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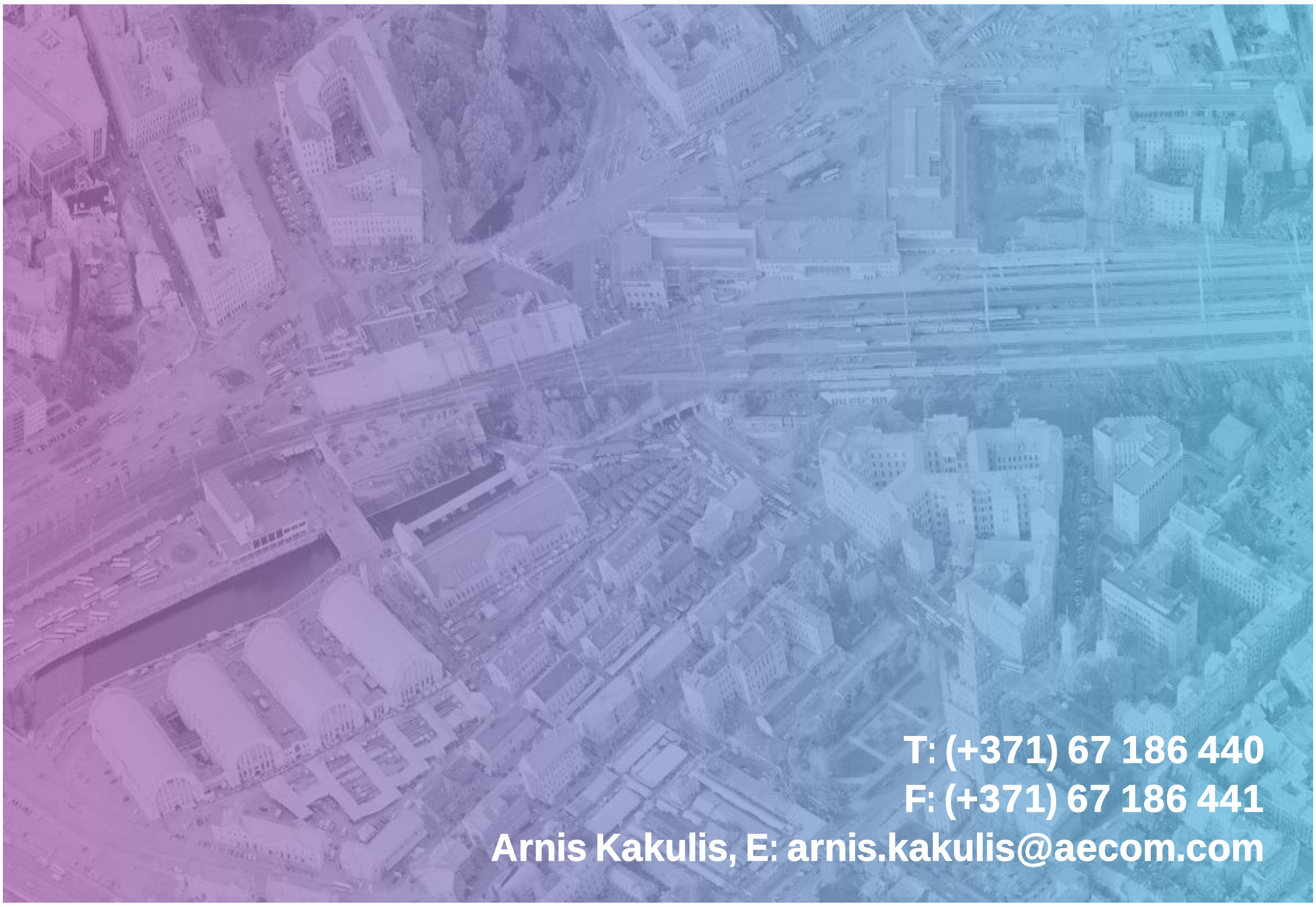
RPTH

Integration of Rail Baltica railway line within the Riga central multimodal public transportation hub - Elaboration of the technical solution No. 2015/01 TEN-T

Final Report

AECOM Rail Baltica Latvia Central Station Joint Venture



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RPTH

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1 Introduction

1 Introduction

1.1 Introduction

AECOM has been appointed to undertake the development of an optimum Riga Central Multimodal Public Transportation Hub engineering and urban building solution by ensuring the mutual integration of two railway systems, public transportation and individual mobility solutions within a single transport hub. The study project is needed to ensure maximum accessible, indivisible passenger mobility between Rail Baltica line countries.

The study commenced in July 2015 and this Final Report is envisaged to be the last submission of this commission, which covers description of tasks undertaken for all work packages outlined in the Technical Specification, and presents their findings in adequate details to demonstrate and form the evidence base for the preferred/ selected option for the Riga Passenger Terminal Hub (henceforth referred as RPTH).

The final report has been structured in seventeen distinct chapters in line with the seventeen work packages identified in the contract. Through these chapters we have described in details the data/ information collation approach, synthesis of the information, analysis and interpretation, forecast and appraisal and assessment of the improvement options.

The table below gives a summary of status on various work-packages and refers to the relevant chapter and sub-chapter numbers within the report where they have been provided.

RPTH Work Package Deliverables

Work Package	Sub-Package	Deliverable	Status	Location in Report
STAGE 1				
1.1	1.1.1	Route and migration pattern analysis for urban, commuter, regional and international public transportation		Chapter 3
1.1	1.1.2	Analysis of the route and schedule analysis for urban and international public transport		Chapter 3
1.1	1.1.3	Description of cycling routes including mapping of cycling infrastructure		Chapter 3
1.1	1.1.4	Analysis of passenger flows to/from Riga Central Station and other related passenger interchanges		Chapter 3
1.1	1.1.5	Analysis of passenger and cyclist migration flows to/from Riga Central station and other related passenger interchanges		Chapter 3
1.1	1.1.6	Peak traffic/passenger migration flows in the vicinity of Central Station		Chapter 3
1.1	1.1.7	Trip duration, frequency, number of interchanges and cost data – to/from Central Station		Chapter 3
1.2	1.2.1	Passenger and cargo train traffic patterns and schedule via Riga Central Station		Chapter 4
1.2	1.2.2	Study of measures in reducing cargo train traffic via Riga Central station		Chapter 4
1.2	1.2.3	Description and location of tracks, points, public utilities, signalling systems and other related infrastructure		Chapter 4
1.2	1.2.4	Description and location of infrastructure serving passengers at Riga Central station		Chapter 4
1.3	-	Location and description of infrastructure objects and public utility networks around Riga Central Station		Chapter 5
1.4	1.4.1	Best practice description of multimodal passenger interchange hubs similar to their scope and profile		Chapter 6
1.4	1.4.2	Description of planned solutions at Kaunas, Parnu and Tallinn interchanges		Chapter 6
1.5	1.5.1	Forecast passenger flow in urban, commuter, region and international public transportation		Chapter 7
1.5	1.5.2	Traffic flow forecast around the Riga Central Multimodal Public Transportation Hub		Chapter 7
1.5	1.5.3	Passenger flow forecast at the Riga		Chapter 7
1.5	1.5.4	Updated forecast passenger flow on the Rail Baltica line until 2050 with corresponding link to the airport terminal		Chapter 7
1.6	-	Forecast pedestrian (including cyclists) flow around the RPTH until at least 2050		Chapter 7
1.7	-	Conclusions and recommendations on initial findings and for next proceedings		Chapter 7

Table 1.1: Work Package Summary Stage 1 (Source: AECOM)

STAGE 2						
2.1	-	Elaboration of transport hub alternatives				Chapter 8
2.2	2.2.1 & 2.2.2	Determination of relevant railway infrastructure, technical and functional parameters				Chapter 9
2.2	2.2.3	Development of incoming, outgoing, and transit train schedules for various development scenarios				Chapter 9
2.2	2.2.4	Modelling of train traffic at RPTH, considering previously elaborated optional train schedules, forecast passenger turnover and train traffic intensity				Chapter 9
2.2	2.2.5	Train traffic modelling carried out considering possible RB railway line passenger transport models, incl. the forecasting and modelling for linkage with RIX				Chapter 9
2.2	2.2.6	Determination of passenger access infrastructure parameters				Chapter 9
2.3	-	Modelling of passenger and pedestrian flows within RPTH				Chapter 10
2.4	-	Modelling of passenger and pedestrian flows around RPTH				Chapter 11
2.5	-	Elaboration of selected alternatives of the transport hub				Chapter 12
2.6	-	Feasibility study of the best solutions and selection of the preferred option				Chapter 13
2.7	2.7.1	Urban building solution for the feasible option of the transport hub				Chapter 14
2.7	2.7.2	Plan of RPTH engineering solutions				Chapter 14
2.7	2.7.3	Passenger flow plan of RPTH				Chapter 14
STAGE 3						
3.1	-	Passenger flow plan of RPTH				Chapter 15
3.2	-	Elaboration of the RPTH implementation plan of the preferred option				Chapter 15
3.3	-	Elaboration of RPTH investment and financing plan				Chapter 15

Table 1.2: Work Package Summary Stage 2 & 3 (Source: AECOM)

2 Policy Context and Stakeholder Engagement

2 Policy Context and Stakeholder Engagement

2.1 Location and Demographics

Situated in north-eastern Europe, Latvia has borders with Estonia, Russia, Belarus, Lithuania and a coastline along the Baltic Sea. Latvia's largest city and capital is Riga (Figure 2.1) which is set on the Baltic Sea at the mouth of the River Daugava. Riga covers an area of approximately 304km^2 with a population of approx. 643,620. The demographics of the city are quite varied and consist of 45.3% Latvians, 38.6% Russians, 4.1% Belarusians, 3.6% Ukrainians, 1.9% Poles and 6.5% from other nations, meaning that native Latvians make up less than half of the population (source: 'Riga 2030', Sustainable Development Strategy of Riga until 2030).

As well as being one of the largest metropolises in Northern Europe, Riga is the largest city in the Baltic States and is a cultural hub with museums and concert halls famous for its wooden buildings, medieval Old Town and art nouveau architecture.

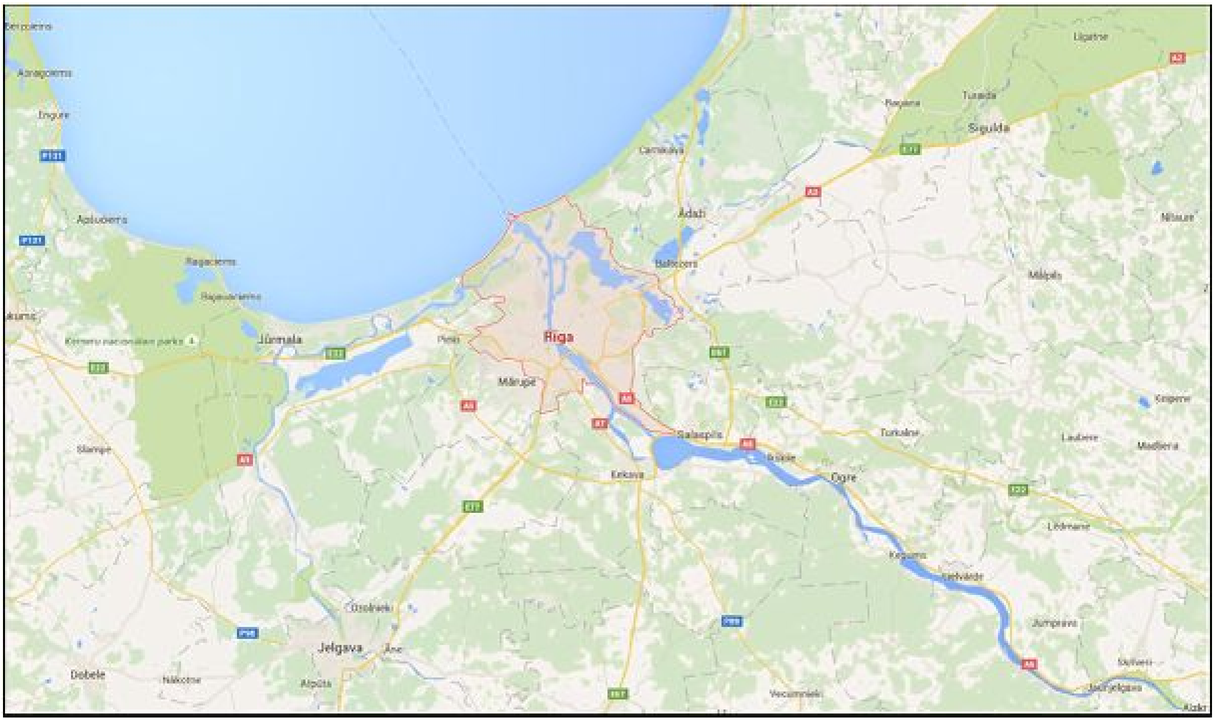


Figure 2.1: Location of Riga Source (Google Maps)

According to Eurostat data, the population of Latvia has declined from 2.28 million in 2004 to 1.99 million in 2015, a decline of approximately 13%. The trend is alarming and if continued, means that Latvia could lose a significant amount of its population in the coming years. Even Riga, being the capital is not unaffected by this trend. In reference to studies conducted by the Academy of Sciences, Riga City Council estimates that even without migration and with measures to improve the demographic situation in the country, the population of Riga could still drop by approx. 10% when compared to current levels.

Much of the drop in population can be attributed to the economic downturn of 2008/2009. With high unemployment rates and the EU's free-movement rules, many Latvian's emigrated to seek work abroad. This combined with low birth and low death rates have resulted in an aging and declining Latvian population.

2.2 History of the Railways

Due to its location in Europe, Latvia has unwillingly been involved in many conflicts and has had its infrastructure destroyed and re-built several times. Modern Latvian history has been dominated by the conflict between two very powerful empires: the Soviet Union and former Nazi Germany. Being a small country, Latvia was unable to defend itself from these powers resulting in cyclical invasion and occupation by its powerful neighbours. This has resulted in the railway networks being destroyed and rebuilt as each power saw fit for their transportation and communication needs.

The railway network in Latvia has imperial Russian origins and was significantly expanded during the period of Latvian independence during the 1920's and 1930's. These railways were then destroyed and re-built during Soviet and German occupation of Latvia during World War II. As a result the rail network in Latvia is a collection of disjointed tracks with different gauges meaning the railway network is not unified.

After many occupations and much hardship, Latvia finally gained independence in 1991. In 2004, along with the other Baltic Countries, Latvia joined the European Union. Membership to the EU has brought forward foreign investment resulting development and prosperity to the nation.

2.3 Current Transportation Links

As stated, the current rail network in Latvia is disjointed and inefficient. This, combined with an efficient bus service has resulted in low rail patronage. Table 2.1below shows the modal split in Latvia between rail, car and bus. From this, it is clear that most people prefer to travel via private car, with rail being the least popular option. In addition to this, the number of people travelling by rail also seems to be declining, with rail mode share decreasing from 5.2% in 2004 to 4.7% in 2013.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Trains (%)	5.2	5.4	5.4	4.9	5.2	4.7	4.7	4.9	4.8	4.7
Cars (%)	73.8	73.5	76.6	79.4	78.7	80.2	78.2	76.2	76.9	77.3
Buses, Trolley Buses and Motor Coaches (%)	21.1	21.1	18	15.7	16.1	15.1	17.1	18.9	18.3	18

Table 2.1: Modal Split of Passenger Transport (Source: EuroStat Data)

Part of this trend can be attributed to the poor quality of the rail network and good quality of bus services that currently operate in Riga. The train station is connected to Origo Shopping Centre and with the current lack of signage and wayfinding, it is difficult to find where to buy a train ticket and how to access the platforms. This combined with the current network inefficiencies makes the railway an unattractive option *for* travellers.

2.4 Rail Baltica Project

In 2011, the European Commission launched the White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system". This paper highlights the need for an integrated railway network: *"The area where bottlenecks are still most* evident *is the internal market for rail services, which must be completed as a priority in order to achieve a Single European Railway Area."*

To meet the vision of the European Commission, new transport patterns must emerge with a move away from the reliance on the private car to more integrated modes of public transport. To achieve this greater integration of the different modes of transport is required. Airports, railway, metro and bus stations should be interconnected and transformed into multi-modal transportation hubs where passengers can interchange between the various modes easily. The current transport policy of Latvia defined in the paper "National Transport Development Guidelines 2014 – 2020" also embraces the vision of the European Commission and aims to have a competitive, sustainable and multi-modal transport system. As such, the Rail Baltica project embraces the objectives of both the European Commission and the local transport policies of Latvia and proposes to introduce a Trans-European railway linking Helsinki – Tallinn –

Riga – Kaunas – Warsaw and continuing on to Berlin as shown in Figure 2.2 below. From this map, it can be seen that Riga will be one of the major stops along the Rail Baltica route.

Figure 2.2: Rail Baltica Route (Source: Google Maps)

2.5 Study Area

Introduction of Rail Baltica will mean that the nature of operation of the railway station, bus station and connections to the airport in Riga will be forever changed. The project will have two major impacts on transportation in Riga. The first impact is that for the first time, Riga will have high speed rail connections to the rest of Europe; currently Riga has

passenger rail connections only with Russia, Lithuania, Estonia and Belarus. This will change the way in which people travel to neighbouring countries and could result in a modal shift from air transport to rail. It could also encourage the use of rail and help to revive the economy.

The second impact of the project will be the connection to the airport. Currently there are three options for travelling to the city centre from the airport: taxi, bus and mini-bus. While the services are frequent and taxis are relatively cheap (€10 - €15), they are constricted by traffic congestion and traffic jams. A rail connection from the airport to the Old Town Centre would ensure an efficient and reliable way for travellers to reach the Old Town from the airport.

These two changes will result in a revival of the Old Town through the design of a new multi-modal transport hub which will allow swift and efficient interchange between the different transport modes and allow people to transit quicker through the city. As such, the study area that has been identified for this work is the train station, adjacent buildings, bus terminal, city bus station, tram stops and immediate roads.

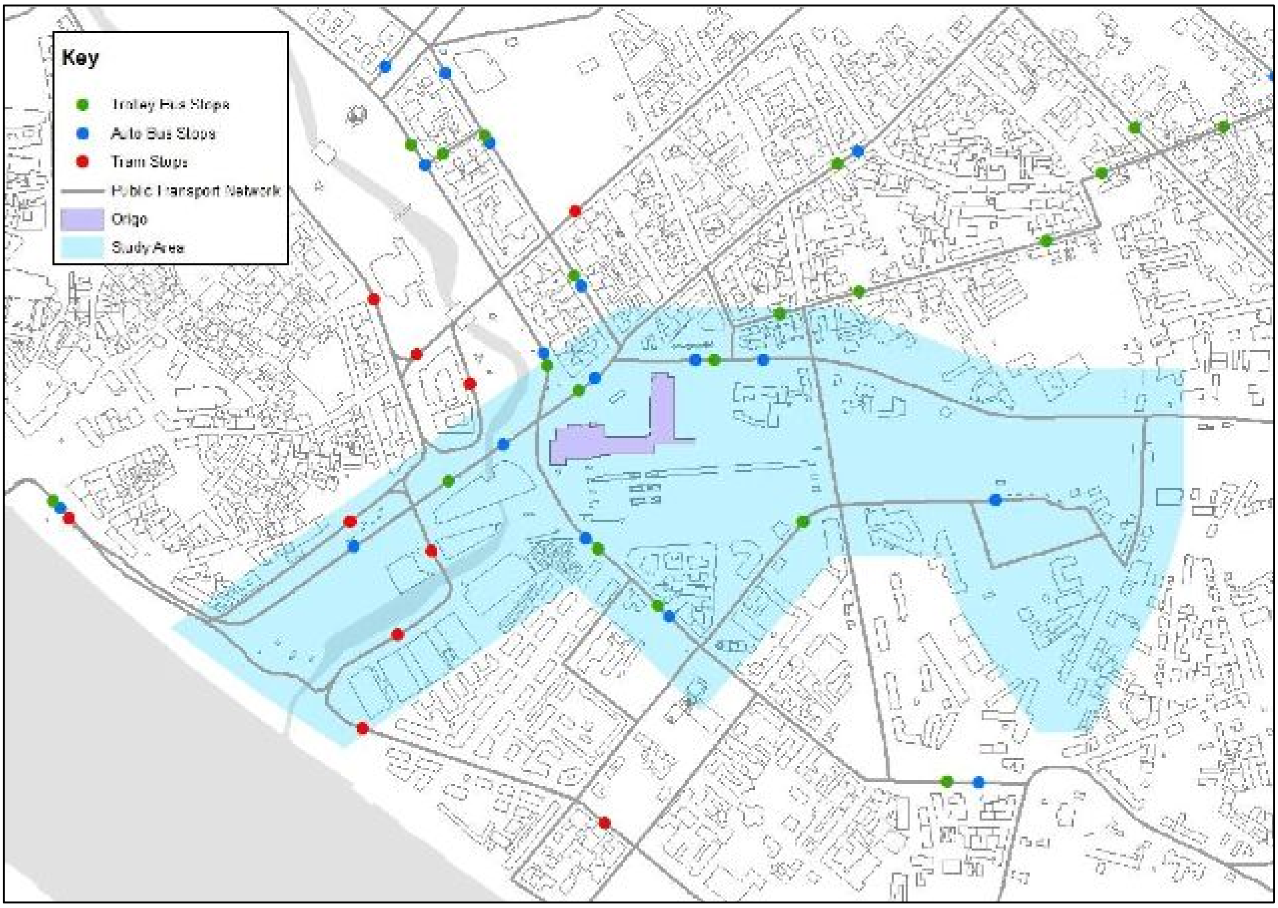


Figure 2.3: Study Area (Source: OpenStreetMap)

2.6 Stakeholders

A number of stakeholders with varying views, opinions and goals are involved in the Rail Baltica project. One of these is Riga City Council Planning Department who last year published the "Sustainable Development Strategy of Riga until 2030". This document sets out overall sustainable development vision of Riga and sets out the goals that Riga should strive to achieve by 2030. One of these goals, to become more "pedestrian – cyclist -, and public transport friendly" aligns perfectly with the goals and vision of the Rail Baltica project.

Another important document is the Passenger Train's "Activity Strategy 2015 – 2020", which was published in June 2015. This document sets out the goal of Passenger Trains as "to become the best passenger carrier in Latvia" and

sets out the measures by which they believe these goals can be achieved. The document also recognises that "An important factor of establishment of an attractive train system is establishment of faster regional transport connections and regular traffic intervals with easily memorisable departure times". To this end, the Rail Baltica project will be fundamental in helping to provide a faster and more efficient train service, which will hopefully encourage a shift in modal share and more train usage.

After discussions with bus operators such as VSIA Autotransporta direkcija and Riga International Coach Station, the common consensus is that the bus station and bus operation must form part of the new transport hub so that connections between the different modes can be streamlined. Riga International Airport also envisions potential in the RPTH as the connection to the airport could result in development opportunities and an increase in passenger numbers.

Linstow, the owners and developers of Origo retail centre, are one of the most active players and interested parties in the content of this project; and are hugely supportive towards the initiative of improving the RPTH, which is going to be beneficial for their own success too. A major part of this assignment will be to align our ideas with Origo's vision on the improvements of this area, and come up with recommendations which can bring in collaborations and collective benefits.

Overall stakeholder opinions/feedback regarding the project have been positive, with many opportunities identified. Ensuring that all stakeholders gain maximum benefits from the implementation of the new transport hub is one of this project's greatest challenges and opportunities.

3 WP 1.1 - Pedestrian, Passenger and Traffic Flow Study on Macro Level (Outside the Hub Area)

3 WP 1.1 - Pedestrian, Passenger, and Traffic Flow Study on Macro Level (Outside the Hub Area)

3.1 Identification of Origin – Destinations

In accordance with the study Technical Specification, this report chapter considers existing pedestrian, passenger and traffic flows and the associated Origin to Destination routing to, from and within the study area.

Figure 3.1: A diagram showing the various methods used to identify origin-destinations and the relationship between each (Source: AECOM)

3.1.1 CUBE Model Origin – Destinations

The CUBE model provides an estimate on Origin – Destination matrices for the study area, specifically the base 2007 CUBE model of Riga was originally used to inform the 2010 Riga and Pieriga Mobility Plan (RPMP) to try and obtain Origin-Destination (OD) data for our study area. Locations included in the CUBE model are the Old Town, market, Riga Central Station and International Bus Station, with migration flow outputs that show the most frequented routes. However, due to the strategic nature of the CUBE model, it lacked detail when considering localised OD's on a micro scale.

The CUBE model Origin – Destination matrices estimated the flows on key routes in Central Riga. However, due to the sparse nature of the network surrounding the railway station and, outdated flow data inputs, the CUBE model was not considered fit for purpose to be used for the current study. Despite this, the output data of the CUBE model assisted in the calibration and helped guide the initial 'Base' 2015 OD matrix development.

3.1.2 International Bus Terminal Origin – Destinations

Passenger data provided by the Riga International Bus Terminal provided a range of statistics on annual passenger numbers since 2010 in addition to the number of services catered for on an annual basis. In 2015, the coach terminal has a daily average of 337 services, with hourly service frequencies also provided over a daily timetable including AM and PM peak hour service numbers. This data will be adapted for the merger of the International Bus station and Riga Central station and will assist in quantifying the destinations from the bus station, consequently forming part of the future O.D. matrix in the RPTH.

3.1.3 2011 Rail Baltica Feasibility Study

The study identified key passenger routes within Riga for multiple transport modes including rail, car and coach on a regional level. Multiple assessment criteria were considered; including trip duration, service frequency, two-way daily passenger flows, average speed and costs from trip origin for each transport mode to central Riga, International coach station or Central station. The results from the research were then graded through quality metrics to produce route scoring for the specific mode of transport on the identified route.

Additional results from the study were also used to identify growth factors for future demand matrices and mode attractiveness, which acted as a guideline for the trip duration, distance and routing information to Riga Central station.

3.1.4 Trip Duration, distance and routes to Riga Central Station

Using the Latvian 2011 Census data, a list of settlements over 5,000 inhabitants were identified and recorded detailing the population sizes and the straight-line distance between the settlement and Riga Central station. From this, using the international journey planner Rome2Rio and Latvian journey planner 1188.lv, the estimated journey times, cost per journey and frequency were noted for cars, coach/bus and rail transport. These journeys were from origin to either Riga Central Station or International Bus Station depending on the mode of transport used. Personal transit was routed to Riga Central Station to stipulate kiss and ride operations.

The results of the research were compared against the 2011 Feasibility study and were found to be in line with previous data. Once this was confirmed, analysis was conducted on the results allowing identification of shortest/longest journey times, cheapest journey by mode, distance from destination and gravity weighting with percentage distribution.

3.1.5 Gravity Model Origin – Destinations

A gravity model was developed to calculate trip duration to/from Riga Central station using the ArcMap GIS mapping software, utilising micro-level (1ha) population density data from the Latvian 2011 census in addition to passenger figures from RIX. The data was then applied to neighbourhood data zones within the Riga city boundary to produce a heat map demonstrating population density. The centroid of the model was established as Riga Station, and a gravity weight was derived to determine a percentage weighting for each residential area, assuming the fastest route from origin to destination using major roads within the city boundary. These outputs were also the primary input to the OD matrix for both strategic traffic and pedestrian models.

3.1.6 RIX Existing PAX

The Riga International Airport Strategy document details the primary function of the airport as an origin/destination based airport, with a suggested catchment area of 6.5 million people covering 300km of the Baltic States. This radius equates to a 3-4 hour drive using major road networks with suggested accessibility from the Baltic capital cities of Tallinn, Riga and Vilnius using this mode of transport. Passenger flows are also provided per year since 2004, with a breakdown of passenger types such as airport OD and transit passenger numbers. The report suggests Rail Baltica could increase PAX by approximately 500,000 annually from 2023 by improving accessibility to/from Riga Central station and Riga International. This data formed part of the inputs to the gravity model to quantify passenger movements within the Riga RPTH OD matrix and, provided the forecast growth factor specific to passenger demand associated with the airport.

3.2 Main Attractors

- Riga Central railway station and the international bus station provide non-local transport connections in this area.
- The Origo shopping centre itself is a major draw, as is the Central Market (opening hours 9am – 7pm in the summer, 10am – 6pm in the winter, Monday to Sunday) and the Stockmann building.
- Historic buildings and museums dotted in and around the historic centre attract tourists, although this is unlikely to attract many people during commuter peak times.

An analysis of the origin-destination data from the CUBE model (Base 2007) indicates that the highest proportion of trips in central Riga actually begin or end slightly north of our study area. More specifically, the CUBE data indicates that 13.7% of all vehicle trips originating within our study area begin at Riga Central station/Origo shopping centre. This is also the most popular destination zone within the study area, with 18.3% of vehicle trips heading to destinations within the study area modelled to end their journey at Riga Central rail station / Origo shopping centre.

The central market area south of the railway is another busy zone, as 15.0% of vehicle trips begin in the study area, and 15.7% of vehicle trips ending in the study area, are modelled to start and finish their journey in the Central Market area south of the railway. Figure 3.2 is a sample of the AM 2007 network showing the proportion of trips to and from key zones within the city . The model shows similar proportions in the Inter-peak and PM peaks.

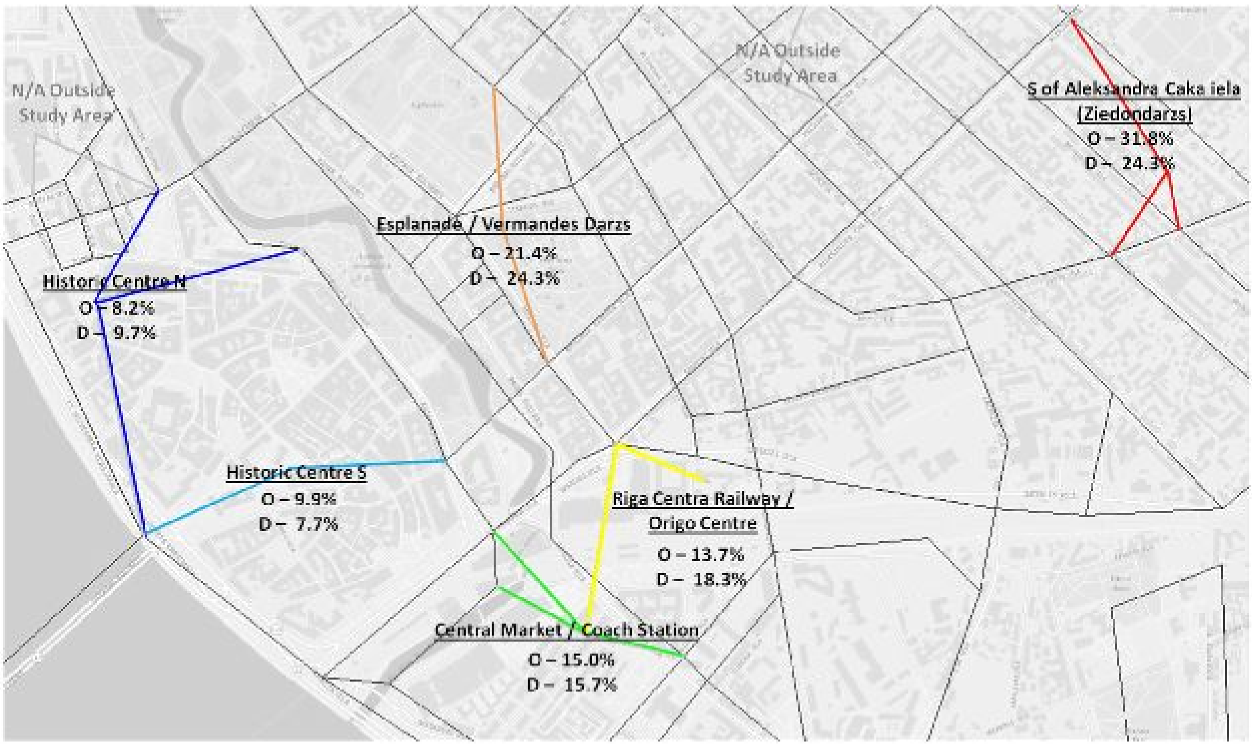


Figure 3.2 – AM 2007 CUBE Data – Study Area Origins & Destinations (%) Source (AECOM)

Please note that this data is from 2007 and, since the CUBE model is strategic in nature, lacks detail in the study area.

Therefore, in addition an in-house GIS based analysis based on gravity modelling principles has been undertaken. The preliminary description and findings of which are outlined below.

The process of calculating development traffic distributions has been undertaken based on gravity modelling principles, supported by the use of ArcMap GIS mapping software. For the purposes of this study the gravity model has been based on population density derived from the Latvian 2011 census. Data was obtained at micro-level land-parcels (measuring 1ha) for all of Latvia's populated areas.

Using the spatial calculation tools within ArcMap, a buffer representing the Riga city boundary was created, allowing the team to select and isolate the relevant datazones within the city itself. Distance between each datazone and the Origo Building/Central Station (the model centroid) was then calculated in order to apply the standard gravity model calculation (see Figure 3.3 below). The assumption that the main distributor road network would be used has been made for this model.

$$\text{Gravity Weighting} = \frac{\text{Population}}{(\textit{Distance between attraction and site})^2}$$

Figure 3.3 - Gravity Model Formula

This calculation is undertaken to determine the Gravity percentage weighting for each datazone within the Riga City municipality. However, with Riga comprising over 7,000 datazones, a further buffer was added allowing these to be grouped into higher-level administrative zones.

All traffic is assumed to take the fastest route, using higher-ranking roads within the city-wide street hierarchy where possible.

Figure 3.4 – Gravity Model Overview (Source:AECOM)

3.3 SATURN Tool

We have used the SATME2 process in SATURN to estimate the origins/destinations of pedestrians, cyclists and vehicles that best adhere to input link count data. Since this tool has been used only to inform how altering the existing network connections causes demand to change routing around the network, no growth has been applied to any of the matrices. Therefore only matrices for 2015 (AM, PM & Saturday) have been produced.

We have also created SATURN buffer networks for the current Base 2015, Do Minimum 2050 and Preferred Option 2050 scenarios.

We have then used SATURN to model the matrix trips using an all-or-nothing assignment to the shortest route between origins and destinations. In total, 18 scenarios have been modelled as per Table 3.1 below.

SCENARIO	Non-Traffic (pedestrians & cyclists)			Traffic (public transport & other vehicles)		
	AM	PM	SAT	AM	PM	SAT
Base 2015	✓	✓	✓	✓	✓	✓
Do Minimum 2015	✓	✓	✓	✓	✓	✓
Preferred Option 2015	✓	✓	✓	✓	✓	✓

Table 3.1: Scenarios modelled in SATURN Tool *(Source: AECOM)*

The inputs used in SATME2 to produce the origin-destination matrices are based on 2015 Solvers survey count data (supplemented in some instances with 2013 historic pedestrian link count data), and Gravity Model outputs.

As mentioned, the SATURN modelling has been used to inform rerouting as a result of changes to the network between the Base and Do Minimum, and between the Do Minimum and Preferred Option scenarios.

3.4 Pedestrian & Cycle Links

3.4.1 Pedestrian Network

Figure 3.5 overleaf shows the detailed pedestrian network for Riga in and around our study area.

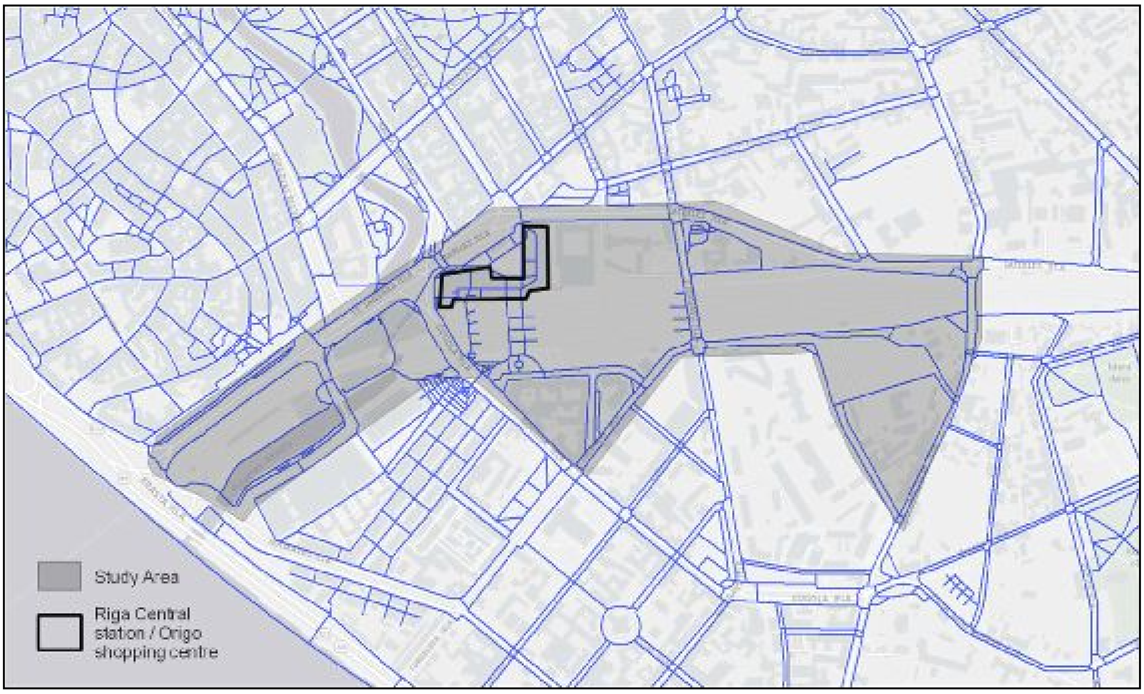


Figure 3.5: Riga Pedestrain Network (Source: AECOM

Figure 3.6 below shows the main pedestrian connections across the railway and road directly around Riga Central station.

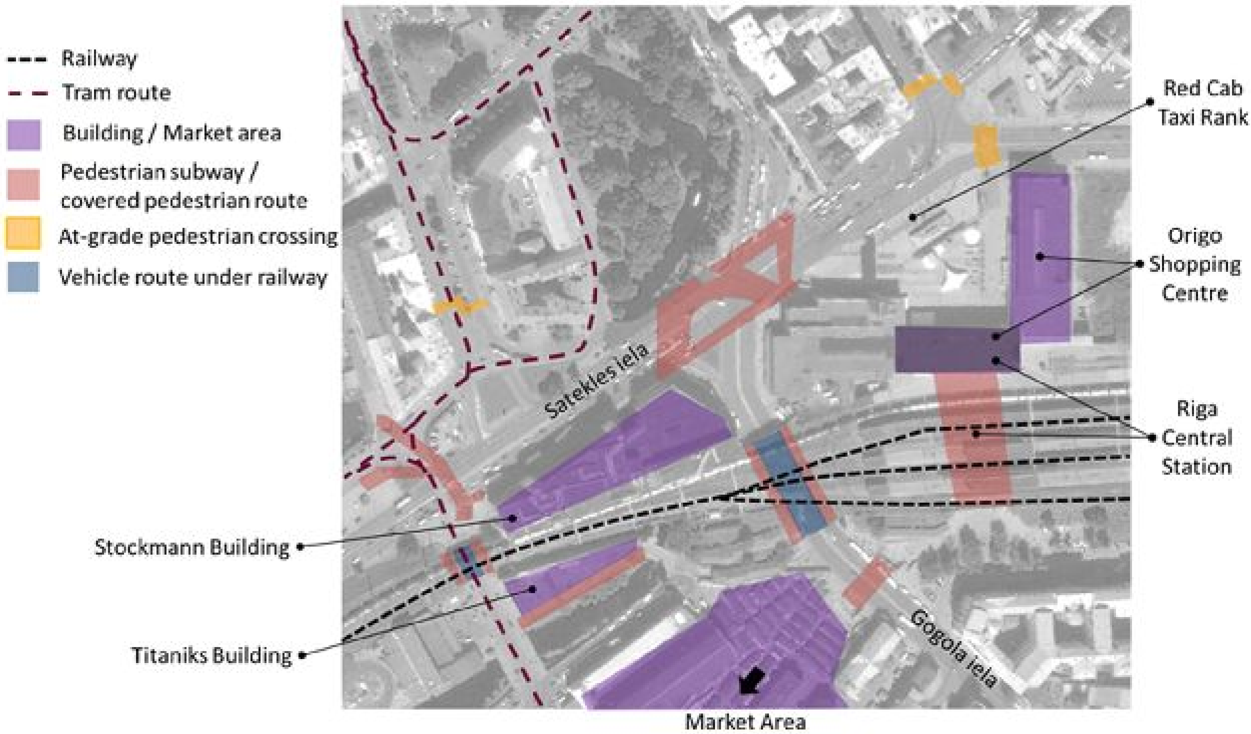


Figure 3.6 – Pedestrian Underpasses, Crossings & Bridges around Riga Central Station (Source: AECOM)

There is a large and complex underpass network around Riga Central station which allows pedestrians to cross the railway line and the major roads north, south and west of the station.

The underpasses are currently not well lit and are in poor condition at present with poor maintenance,, as captured in Chapter 7 of this report. The wayfinding and signage in the underpass system is difficult to use for people unfamiliar with the area.

Only one at-grade crossing is provided in this area, over Satekles iela directly north of the station building / Origo.

The pedestrian routes to the international bus and coach station south-west of the rail station are more than 500m from the main rail station entrance. This is longer than ideal for those with walking difficulties or heavy luggage, and requires use of an underpass without a lift or ramp through a busy retail area. Upon reaching the station, the pedestrian area within Central station has limited space and accessibility for those passengers with restricted movement, equating to a difficult journey when interchanging between the two transport hubs.

North and east of the railway line there is also some evidence of graffiti and poor maintenance. Some websites mention visitors experiencing scams and pickpocketing, particularly targeting tourists in the old historic centre.

3.4.2 Cycling

The cycling infrastructure in Riga has evolved significantly over the past 5 years. The City of Riga has issued a Cycling Infrastructure concept for 2015-2030. This document outlines the cycling primary structure for the entire region and their connections to the city centre. The main cycling alignments parallel the primary automobile alignments, yet have been defined for roads with more minimal traffic.

In many cases, the cycling alignments have been developed in historic tramway alignments and on roadways in which public transportation has been placed. This combination of transporation modes, provide a more robust transportation mobility solution within the City of Riga. The segregation of cycling paths and automobile traffic provides a more safe and reliable cycling infrastructure.

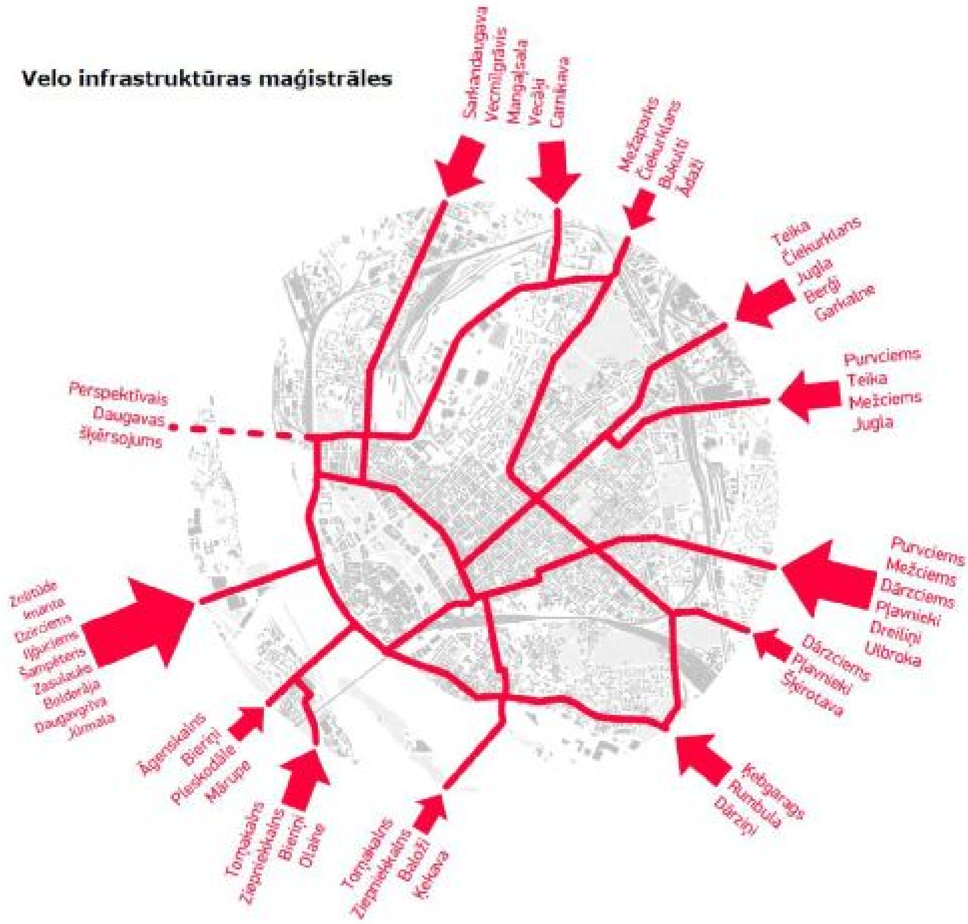


Figure 3.7 – Main Cycle Routes in and around Riga (Source: City of Riga – Velokoncepcija 2015-2030)

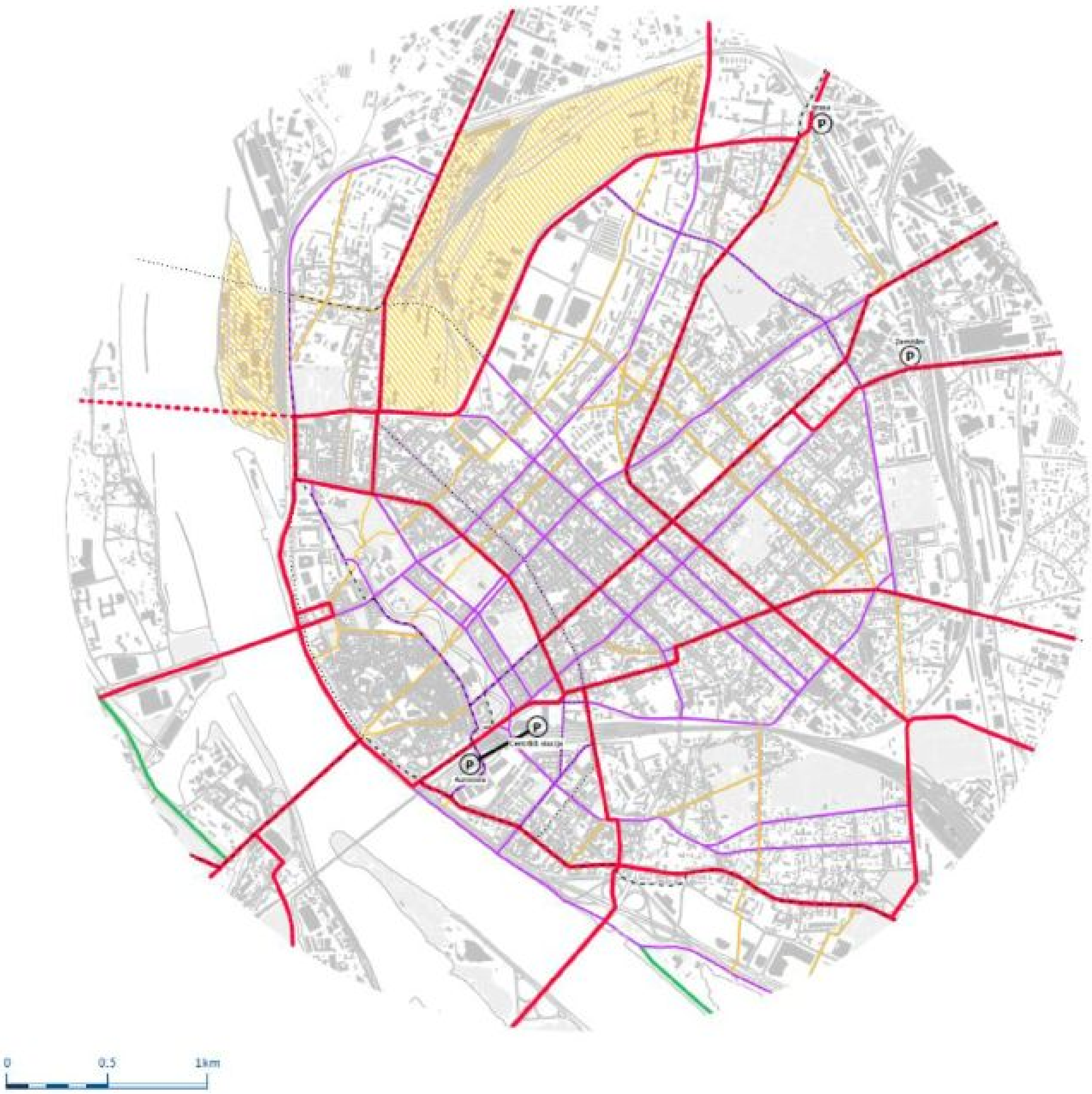


Figure 3.8 – Riga City Centre Cycle Routes (Source: City of Riga – Velokoncepcija 2015-2030)

In the west of the study area there is a lack of pedestrian links to and along the eastern riverbank. Depending on plans for any future bridges between the eastern and western riverbanks, access to and across the river from the station could be improved. However, due to the distances involved a cycle link may be more appropriate than a pedestrian-only link. Since there is very little dedicated cycle infrastructure in central Riga (and none in our study area), this will likely need to be established before links between the railway station, eastern riverbank and western riverbank can be developed.

3.4.3 Accessibility Analysis

We have used AECOM's in-house strategic pedestrian modelling tool to undertake strategic pedestrian flow and route analysis with a view to assess how easy it is to access Riga Central railway station as pedestrians and cyclists from the surrounding area.

This tool reads in a network from ArcGIS or Open Space Map (OSM) and then performs calculations on the network to assess the distance from specified locations which attract or produce high pedestrian flows (such as the Central station / Origo shopping centre). This can help indicate where the heaviest pedestrian flows are expected on a network, and be used to indicate how far in people can walk or cycle from a specific location in a given time (isochrones).

The average walk speed assumed is 4.8kph (kilometres per hour), following the Transport for London (TfL) assumption of an average walking speed of 400m in 5 minutes, which translates to 4.8kph. The average cycling speed is in line with the Transport for London (TfL) assumption of 15kph. Cyclists are assumed able to use both the roads and the sidewalks, and pedestrians are assumed to use only the sidewalks.

Figure 3.9 shows how far a pedestrian can travel from Riga Central station using the surrounding pedestrian network. Figure 3.10 shows how far a cyclist can travel from Riga Central station using the surrounding cycle network. These figures indicate that people can access most of central Riga within a 15 minute walk or a 5 minute cycle.

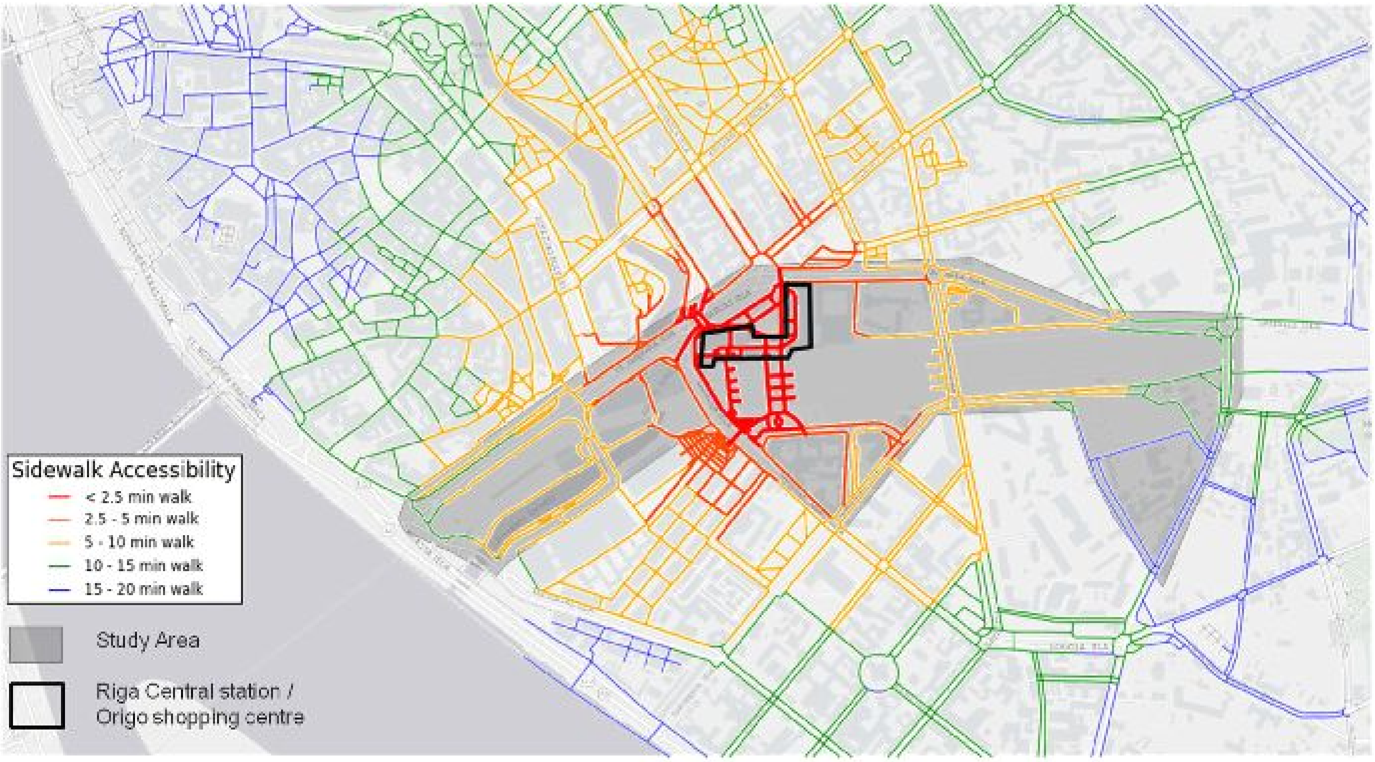


Figure 3.9: Base 2015 Pedestrian Accessibility of Riga Central station, walk time isochrones (Source: AECOM)

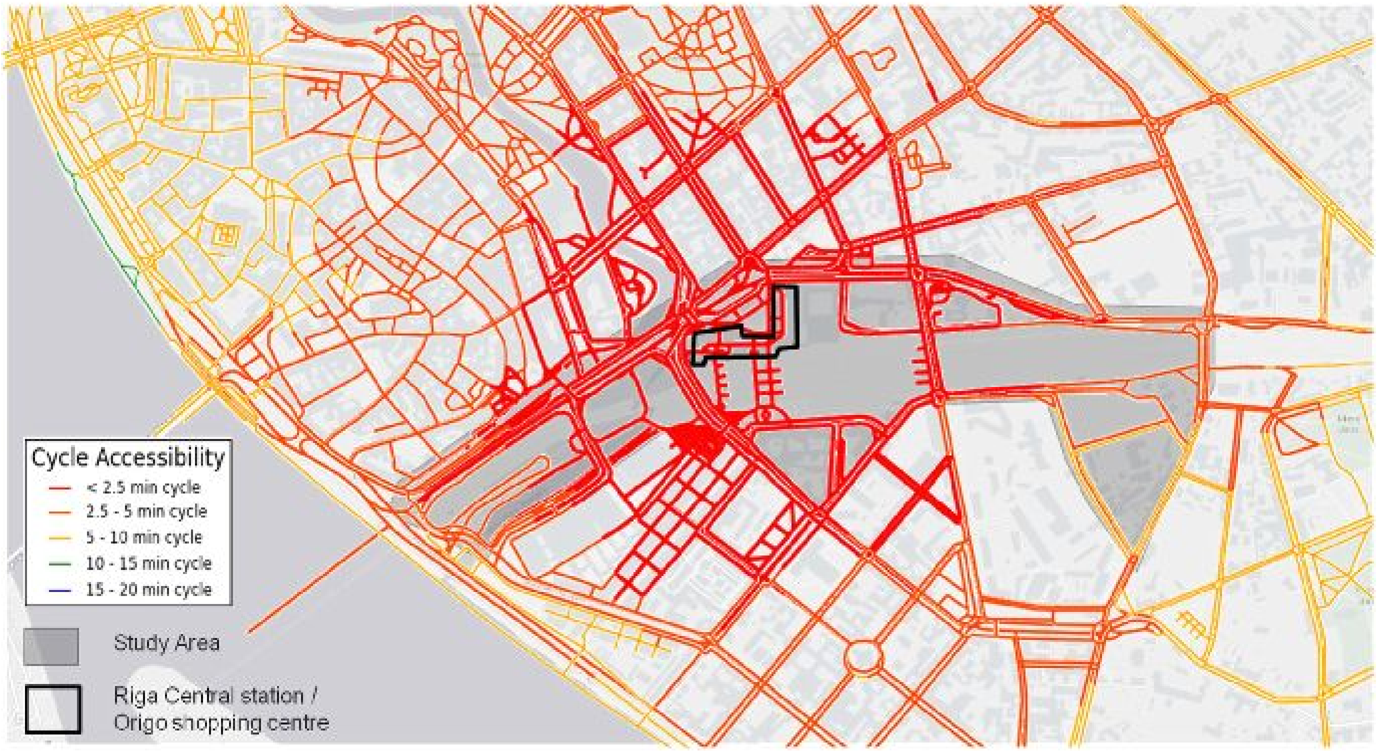


Figure 3.10: Base 2015 Cycle Accessibility of Riga Central station, cycle time isochrones (Source: AECOM)

3.4.4 Pedestrian Connectivity Analysis

AECOM's in house urban space tool was also used to undertake pedestrian connectivity analysis.

Connectivity is a measure of the number of 'direction changes' a link has for all routes through that link, up to 400m away, in line with TfL's assumption that, on average, people are able to walk 400m in 5 minutes. In theory, routes which have fewer direction changes, and which intersect with many other paths, will have a high connectivity. Routes with many direction changes, and few intersections with other routes, will have a low connectivity. Pedestrians tend to favour routes with high connectivity (assuming other route characteristics are equal).

Connectivity plots for both the road network and the pedestrian network have been produced to highlight areas of severance for vehicles in and around the study area. This information has been used to inform the design process by identifying accessibility / connectivity opportunities and constraints to / from the station area.

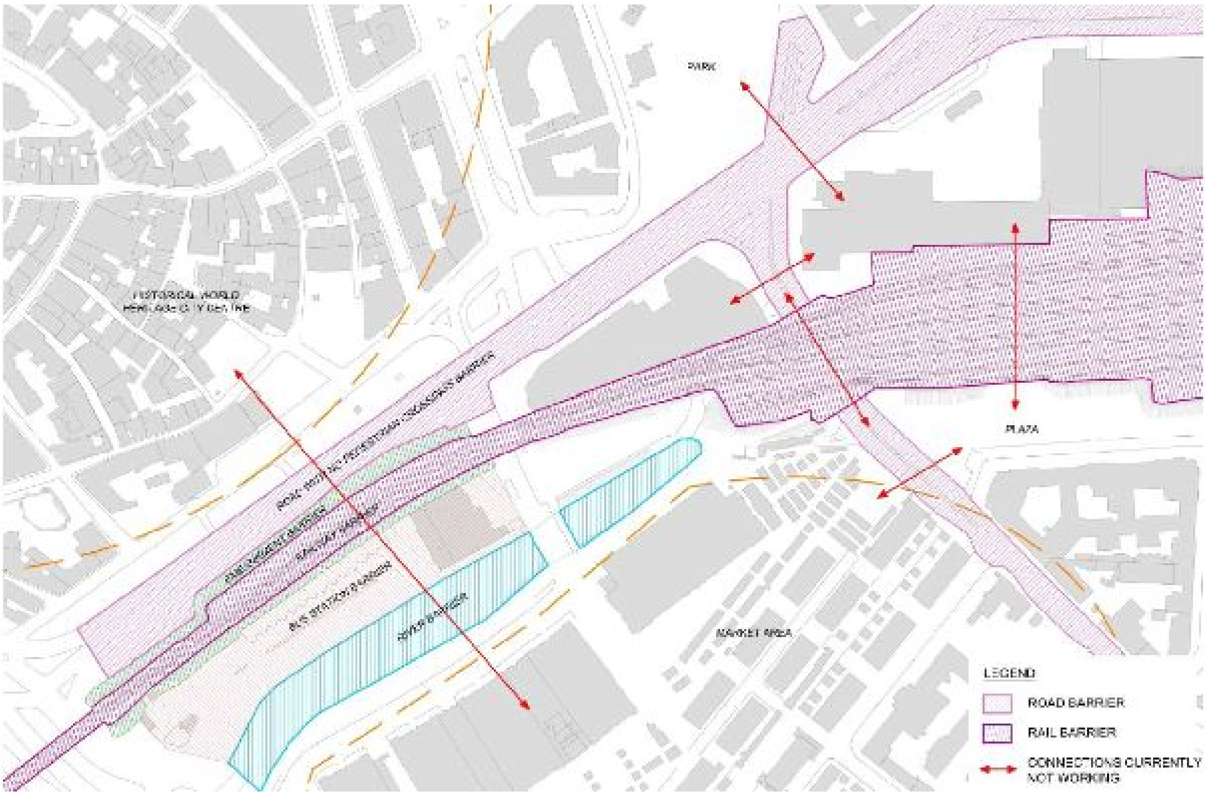


Figure 3.11: Urban Barriers Analysis *(Source: AECOM)*

Figure 3.12 to Figure 3.15 below illustrate the connectivity of central Riga as a whole and of just the study area network. Figure 3.11 above additionally indicates some of the poorer quality underpass connections across the road and rail barriers in the area.

The southeast-northwest route along the eastern bank of the river and the southwest-northeast route from Akmens tilts bridge along 13. janvāra iela and Satekles iela are well-connected routes.

The historic centre is less well-connected for vehicles, which helps discourage traffic in this area and preserve the heritage site. However it can also push traffic onto the surrounding roads, such as 13. janvāra iela in our study area, which makes them harder for pedestrians to cross.

The east side of our study area has lower connectivity than the west side. This is mainly caused by severance due to the railway line.

Accessibility and connectivity are generally better north and west of the railway than they are south and east of the railway. Retail and commercial land use also tends to be more intense to the north and west of the railway, suggesting that these areas are likely to be more heavily used by pedestrians.

Accessibility from the railway to the main market area is reasonable but could benefit from a more direct route. In the 2050 Preferred Option, the pedestrian connection between the market area and the station changes from an underpass to a signalised crossing. This may help improve use of this crossing point in the evenings by reducing perceived security issues in this area, but cause delays to pedestrians trying to cross this link when traffic is busy.

Severance to north-south pedestrian routes caused by the railway and busy roads in the study area is still prevalent in 2050. The new at-grade crossings over Satekles iela north of the station / Origo shopping centre are likely to help pedestrians with mobility impairment and heavy luggage, but may increase delays to pedestrians crossing the roads when traffic levels are high.

Overall, connections between the parks and historic centre north / west of the railway, and the area south of the railway (including the market) could ideally be improved to ensure more interactions on both sides of the station.

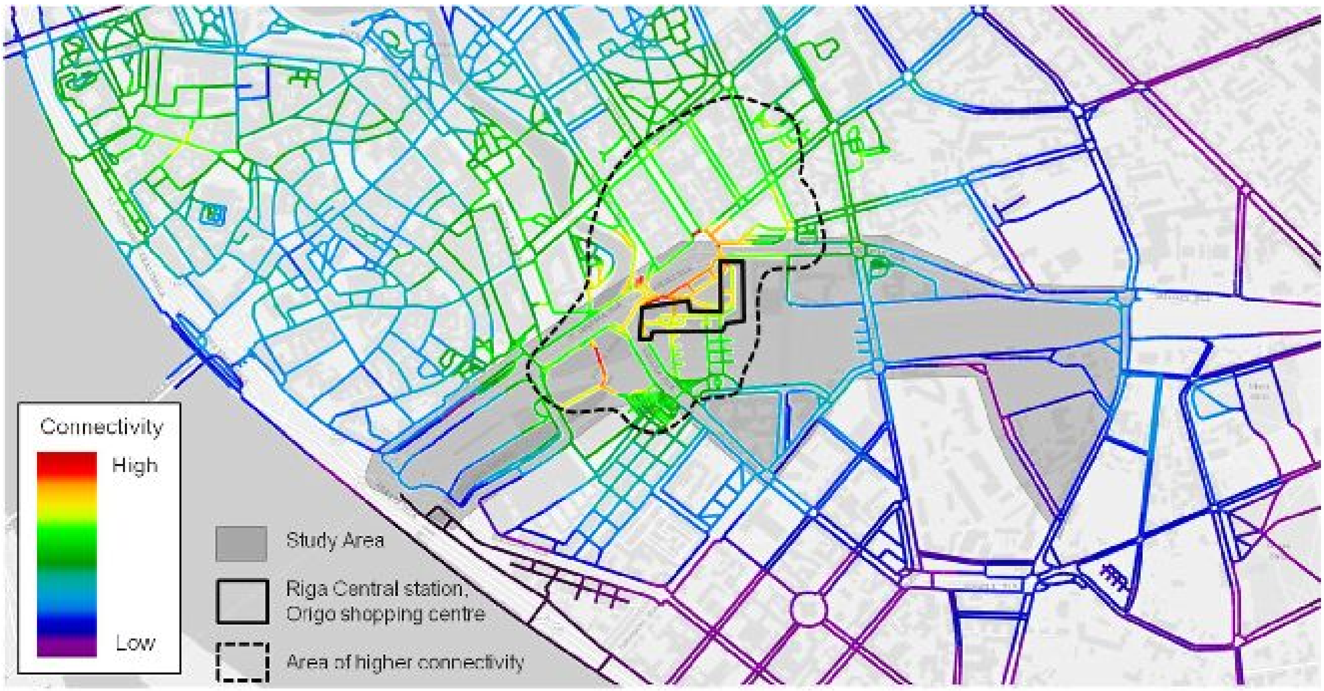


Figure 3.12: Base 2015 Pedestrian Network Connectivity for central Riga (Source: AECOM)

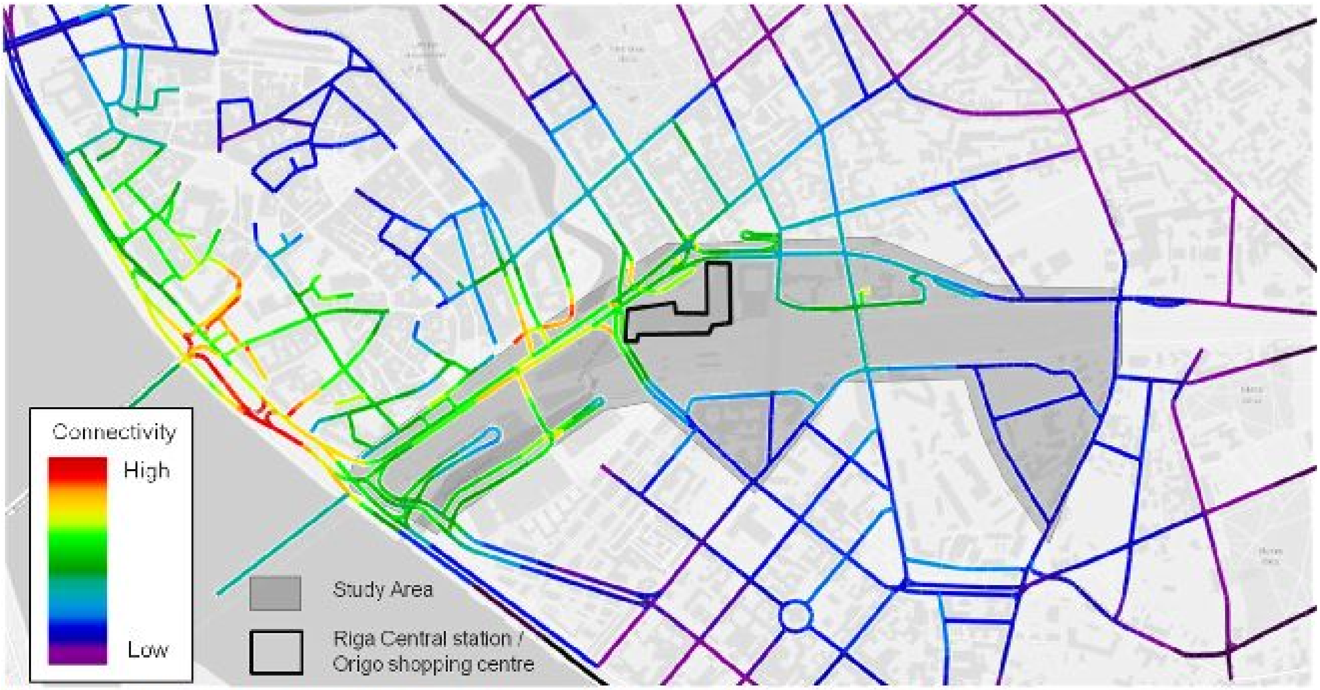


Figure 3.13: Base 2015 Traffic Network Connectivity for central Riga (Source: AECOM)

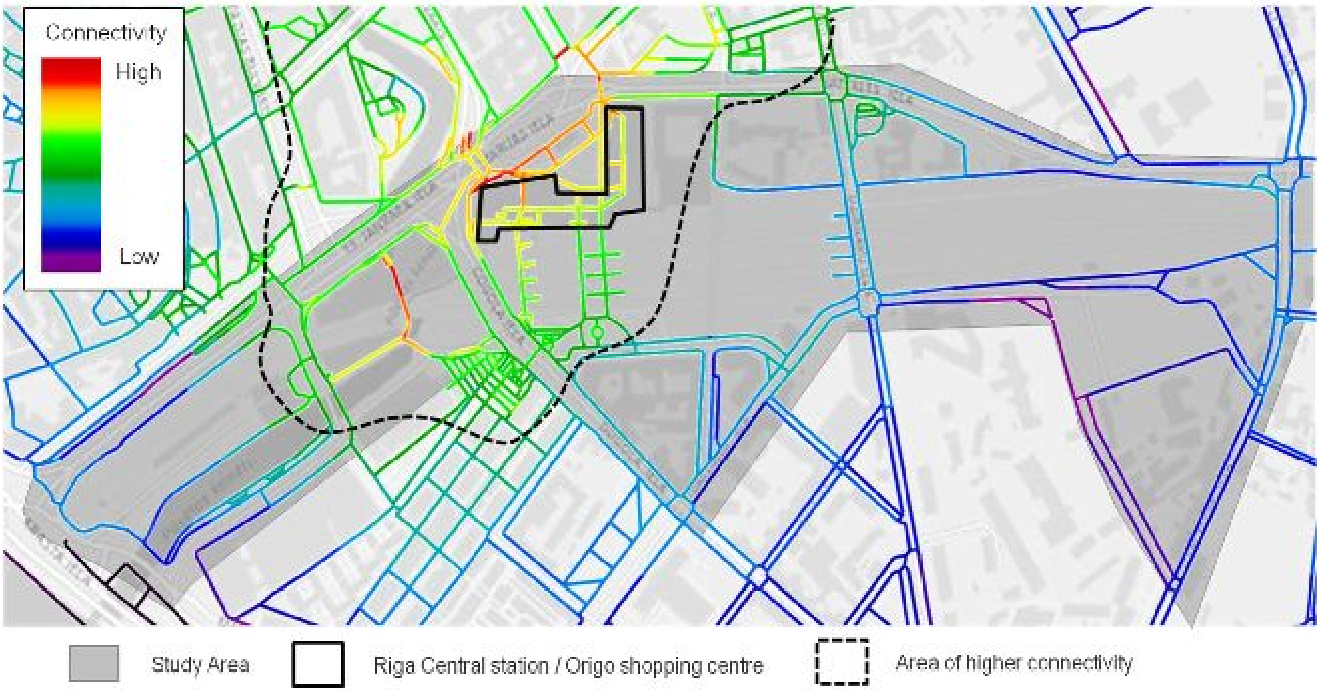


Figure 3.14: Base 2015 Pedestrian Network Connectivity for the Study Area (Source: AECOM)

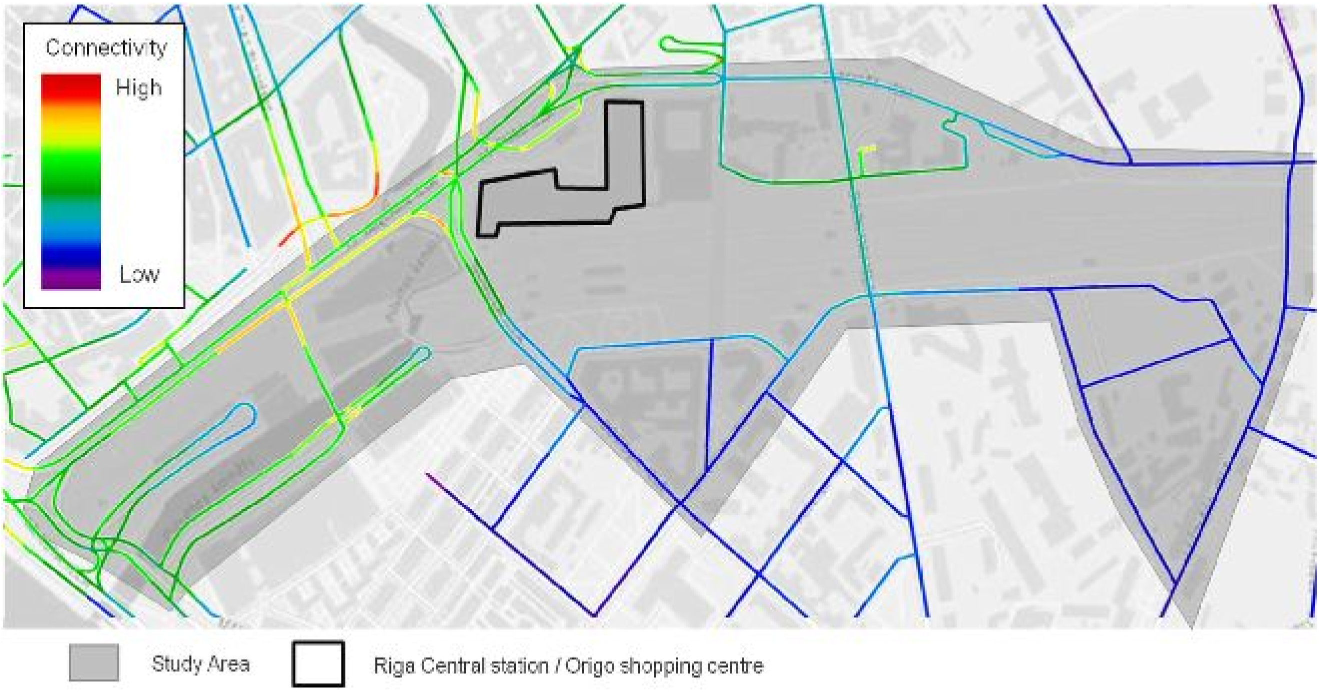


Figure 3.15: Base 2015 Traffic Network Connectivity for the Study Area (Source: AECOM)

3.5 Traffic &Transportation Characteristics of the Study Area

3.5.1 Network

Figure 3.16 overleaf shows the detailed road network for Riga in and around our study area. Figure 3.17 ranks the routes in Riga to both Open Street Map data[1] identifying strategic importance of the route and the expected level of traffic flow on these routes.

The rankings range from the roads with the highest traffic flows and the greatest strategic importance to the area (such as Krasta iela to the south west of the study area, which comprises part of the roads ringing Riga city centre) down to small and lightly-travelled roads (such as Prāgas iela) which are unranked, as they are not thought to be of strategic importance to the area.

[1] OpenStreetMap http://owl.apis.dev.openstreetmap.org

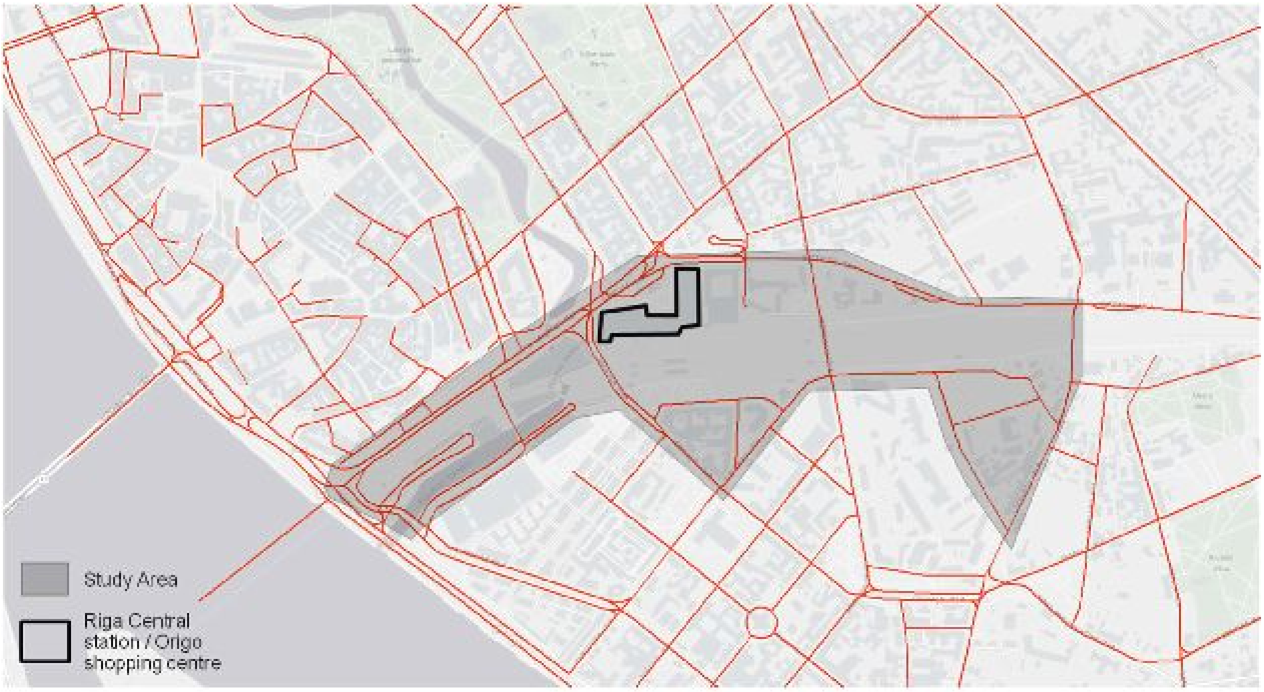


Figure 3.16 – Riga Road Network (Source: OSM data) (Source: AECOM)

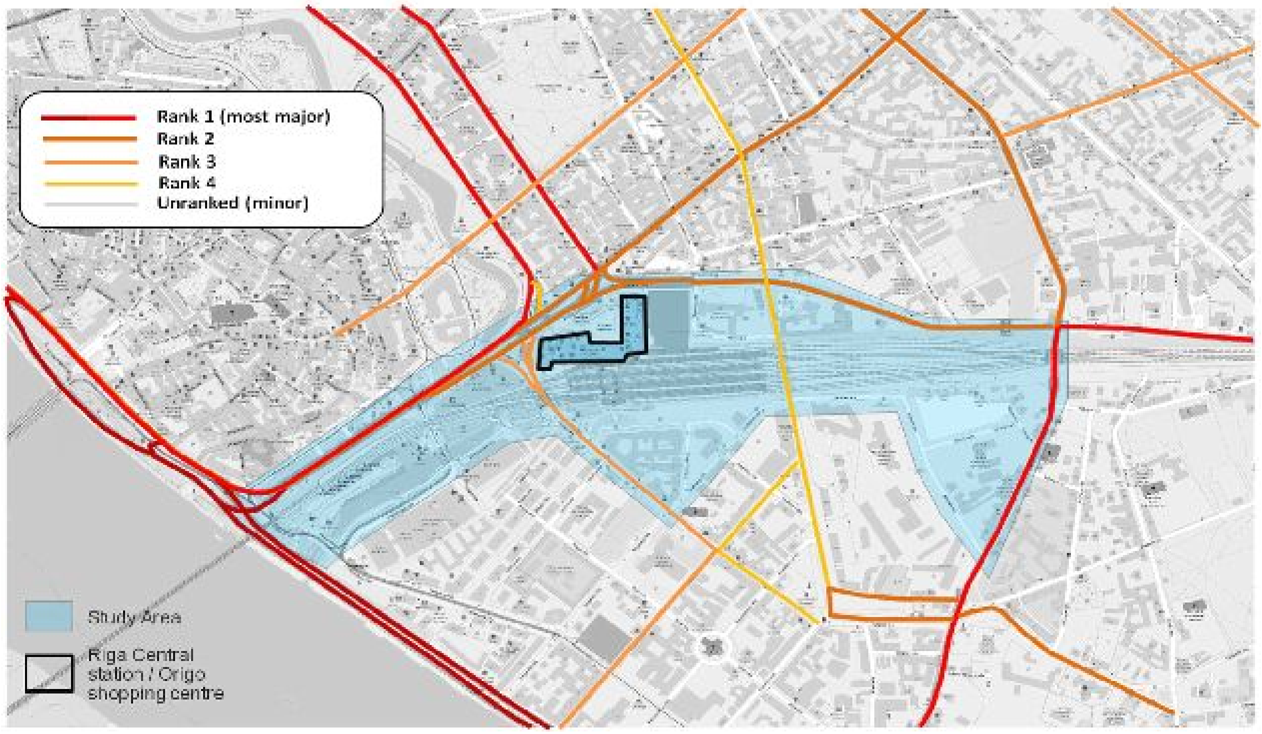


Figure 3.17 – Indicative Riga Vehicle Route Hierarchy (Source: AECOM)

3.5.2 General Public Transport Provision

In addition to hosting the city's principal Railway station, the immediate area surrounding the Origo Building is well-provisioned in terms of public transport – strong links exist at an international, regional, and local scale. Riga's

International coach terminal is located directly to the south-west (approx. 500m), the main minibus terminal immediately to the north (less than 100m), and Rigas satiksme bus terminal (at Abrenes iela) to the south-east (approx. 600m). One of the principal terminuses on the tram network is also situated immediately to the south-west, adjacent to the market area at Centraltirgus.

The study area is well served by each of Riga's three primary public transport services: auto-buses, trolley-buses, and trams. A plan showing the respective networks and location of stops/stances relative to the study area is shown in Figure 3.18 below.

Five auto-bus stops and three trolley-bus stops are located within 200m of the Origo building. The majority of Riga's bus routes pass through this portion of the network and alight at one or more of these stops (see Figure 3.20 and Figure 3.21 below for further detail). Additionally, four tram stops are located within 400m of the Origo building. As such, a significant part of Riga's public transport network is accessible within a five minute walk from the Origo building/Central Station.

The network for each major public transport mode, including number of services alighting at each stop, has been plotted individually and made available in Figure 3.19, Figure 3.20 & Figure 3.21 below. It should be noted that the 'number of services' refers to the number of different service routes (e.g. A11, E16, T4) that serve each stop/stance[2].

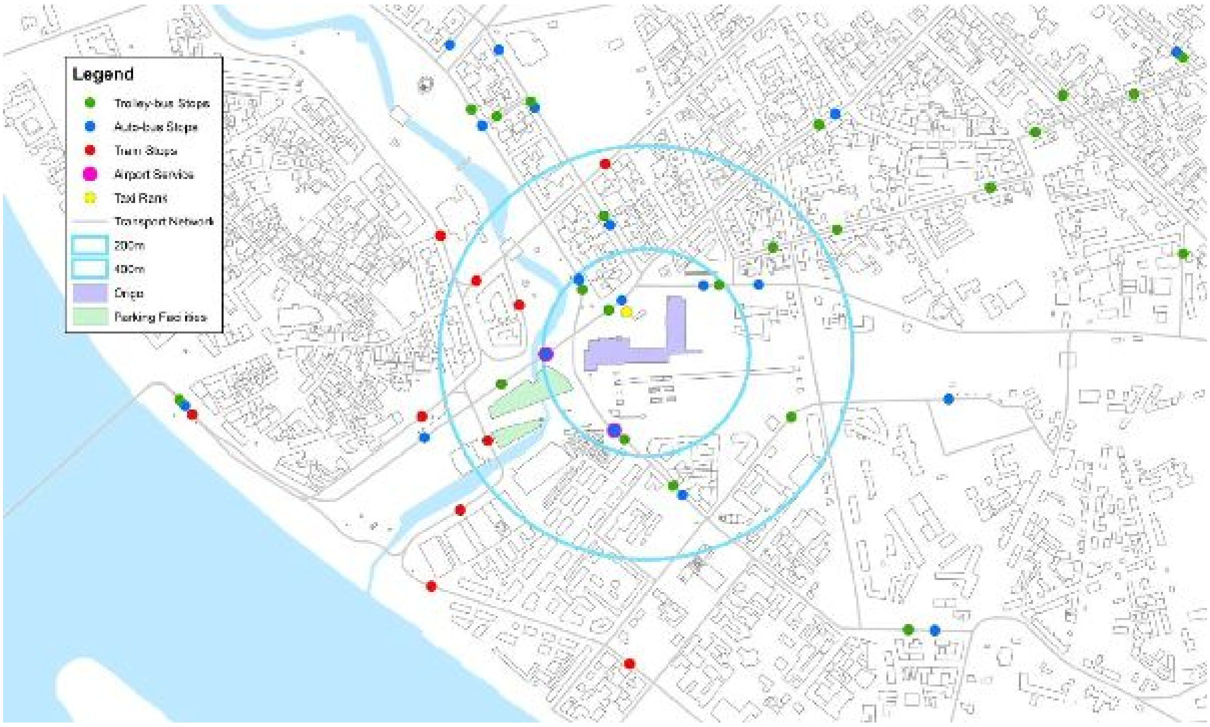


Figure 3.18 – Public Transport map of study area (Source: OpenStreetMap/Riga Public Transport)

[2] Timetables and other public transport information provided in maps produced by Riga Public Transport (included in the report as Appendix WP 1.1

3.5.3 Tram Network

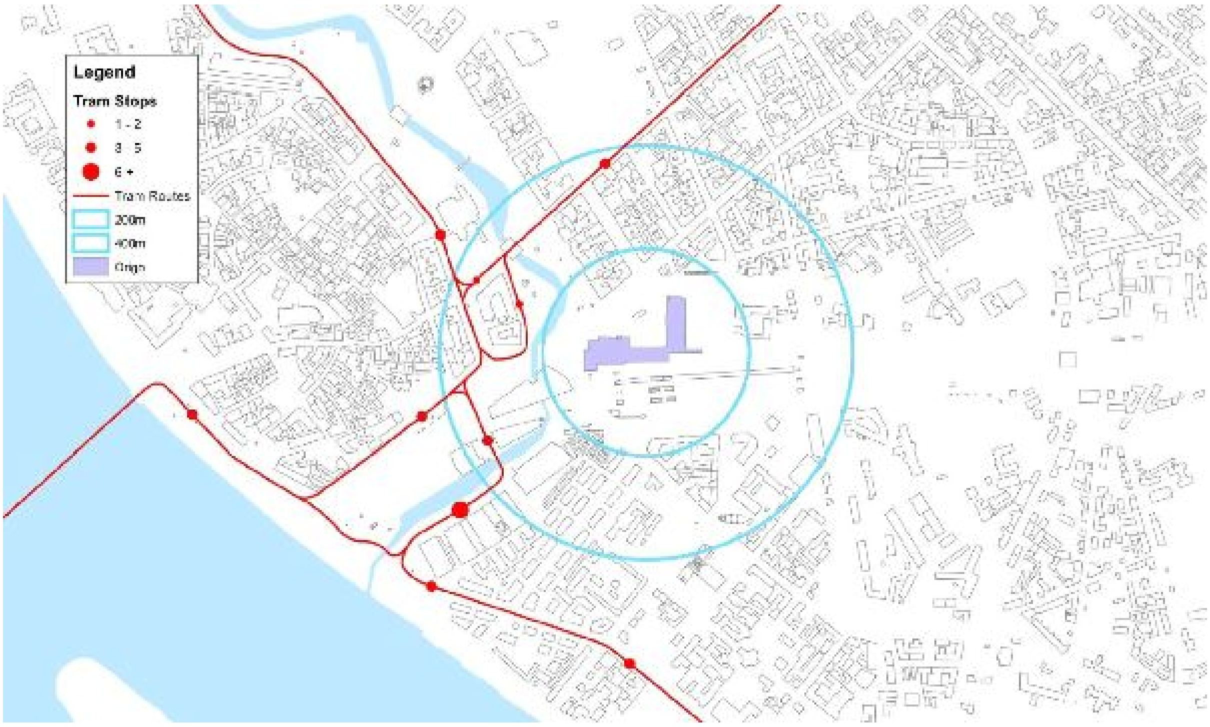


Figure 3.19 – Tram network showing number of services at local stops (Source: OpenStreetMap/Riga Public Transport)

The tram network shown primarily serves the western half of the study area with major stops located at 13 janvara iela (four services), Prāgas iela (three services), and Centraltirgus (six services). This largely reflects the city's wider tram network, with routes extending to the north, west, and south towards the city boundaries. Each of these is accessible within an approximate five minute walk from the Origo Building via the multiple pedestrian routes that run along 13. janvāra iela or via the underpass and footpaths leading towards the marketspace at Centraltirgus.

3.5.4 Trolley-bus Network

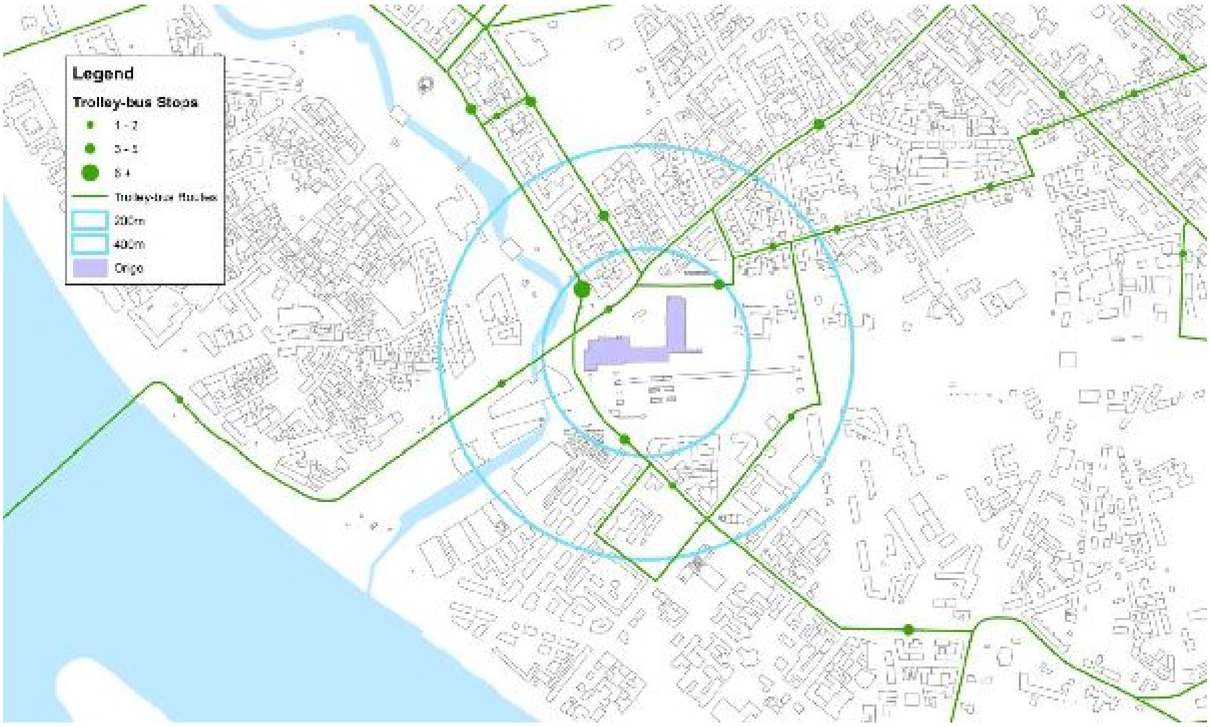


Figure 3.20 – Trolley-bus network showing number of services at local stops (Source: OpenStreetMap/Riga Public Transport)

The trolley-bus network intersects the study area at multiple points and provides passengers with access to over two-thirds of Riga's wider trolley-bus network. As is indicated in Figure 3.20, the size of the filled dots indicate the number of services which stop there, with four trolley-bus stops situated within 200m of the Origo Building, three of which are served by four or more services. Crucially, the aforementioned stops are served by principal north-south and east-west routes, extending outwards towards the city boundaries in every direction.

3.5.5 Auto-Bus Network

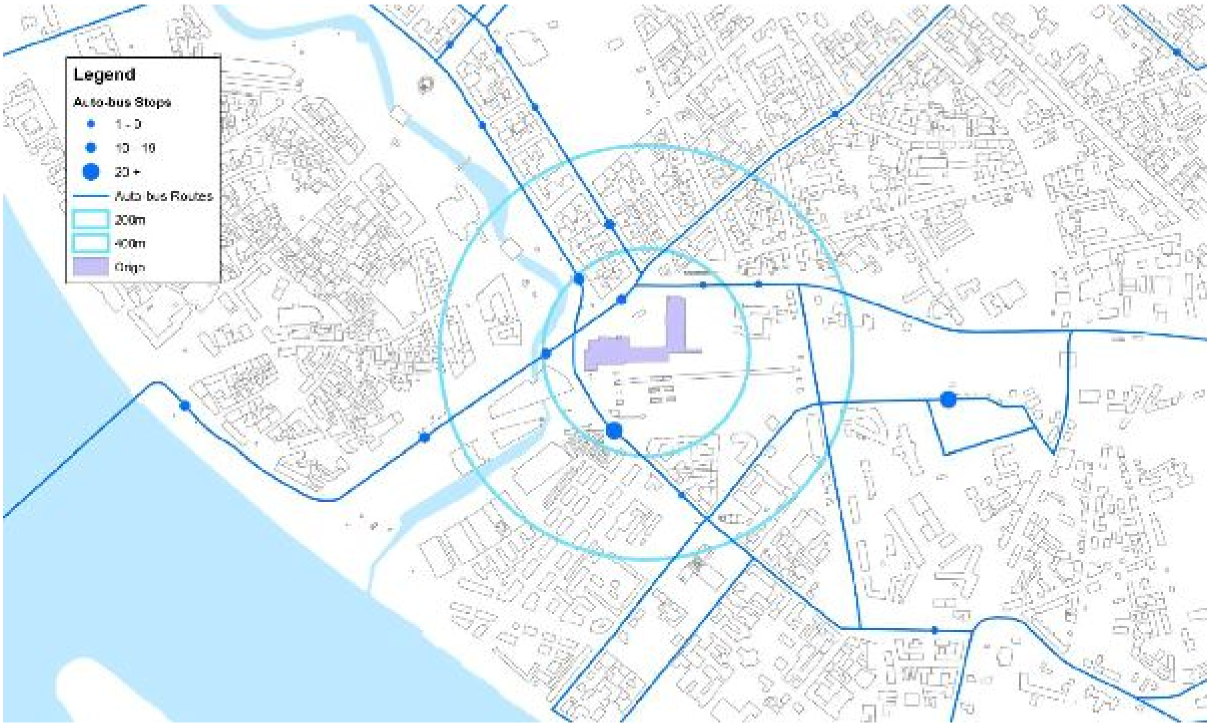


Figure 3.21 – Auto-bus network showing number of services at local stops (Source: OpenStreetMap/Riga Public Transport)

The auto-bus network is particularly well provisioned relative to the study area; in part due to the close proximity of Riga's primary bus terminal at Abrenes iela (located a short distance away to the south-east of the Origo Building – approx. 600m). Riga's auto-bus network is the most extensive of all modes of public transportation, with over 50 routes serving the entire city. The study area, and in particular the area immediately surrounding the Central Station, contains four major bus stops/stances within 200m of the Origo Building itself, with multiple service numbers calling at these stops denoted by its size. The best-served, Centrala stacija, sees 29 separate services alight regularly on standard week-day operations. The other stops; at Stockmann centrs, Stacijas laukums, and Centrala stacija (north), see 18, 15, and 10 services operating respectively.

3.5.6 Airport

It is also worth noting the extent to which Riga International Airport is accessible via public transport relative to the study area. The airport itself is located approximately 10km away to the west of the city by car, and 13km by rail. Although taxis are generally available (and accessible given the location of major taxi ranks immediately in front of the Origo Building), access to the airport is also served by buses and minibuses; specifically, the no.22 auto-bus service and the no.222 minibus service. Both bus and minibus services depart frequently (times range from every 10-30 minutes) and take 30 minutes to reach the airport. Crucially, both services alight at Centrala stacija and Stockmann centrs; both within a five minute walk for passengers travelling to and from Central Station. Locations have been marked in the public transport map in Figure 3.18.

3.5.7 Car Parking

The Titaniks building and the large underground car park in the Stockmann building represent the main opportunities for car parking within the study area. These buildings are adjacent to each other; located north and south of the railway line respectively. The Stockmann building parking is accessed by its eastern side (via Gogoļa iela north of the railway), and the Titaniks via Gogoļa iela (south of the railway). These have been identified in Figure 3.18.

3.5.8 Taxis

There are two main (metered) taxi services available for use in Riga; the green 'Baltic Taxi' (initially started to transport people to and from Riga International airport) and the 'Red Cab' (offering wheel-chair friendly options).

Informal on-street parking is available for taxis on 13. janvāra iela, with an official Red Cab taxi rank adjacent to the station plaza itself – this has also been identified in Figure 3.18.

3.6 Traffic and Pedestrian Surveys

Traffic and pedestrian surveys were undertaken (based on sample counts/observations) during the week beginning Sunday 6th September by the modellers of the project team, with a view to validate and supplement all the data that has been collected from primary and secondary sources. The flows and signal timing data gathered has essentially been used as input data to the microsimulation modelling of the station and Origo Shopping Centre (specifically the signalised pedestrian crossing adjacent to the Station/Origo building)

3.7 Work Package Summary

As the delayed commencement of the study was followed by the summer holiday months, the data collection program had to be pushed back significantly, which was likely to impact the study program. However, with an innovative and customised approach of collation of secondary data and some fast track data collection in the first three weeks of September helped the study team to collect a wealth of data for the base year 2015. Thereafter the study team went ahead to develop a range of modelling suites using a range of relevant software and established transport modelling techniques, which were used to assess the base year traffic and pedestrian flow conditions and also undertake the horizon year assessments for "with" and "without" the proposed scheme options.

4 WP 1.2 - Railway Transport Patterns and Supporting Infrastructure at Riga Central Station

4 WP 1.2 - Railway Transport Patterns and Supporting Infrastructure at Riga Central Station

4.1 Preamble

This section of the report considers work done to assess the current situation at the Riga station. The focus of activity in this work package was to determine the factors that would influence the parameters of a future train service. Developing such a service, which in turn allows the future requirements for platform and connecting tracks to be established, is covered in Chapter 9. Passenger demand forecasts and rolling stock considerations to develop options for a future year service specification are also discussed in Chapter 9.

Information in this section is based on observation of the station, discussions with Latvian Railways and documents provided to the study team.

4.2 Existing Track Layout and Capability

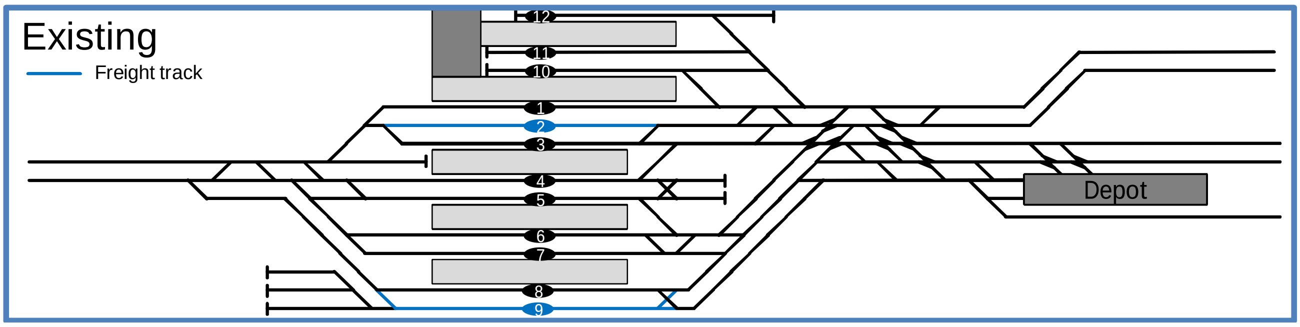


Figure 4.1: Existing track layout schematic *(Source: Latvian Railways)*

Riga station is provided with seven through platform tracks (numbered 1, 3, 4, 5, 6, 7 and 8), two through non-platform tracks (2 and 9) and three east-facing terminating platform tracks (10, 11 and 12). The shortest platform track is number 3 at 375m and the longest is track 1 at 676m, although these figures are between signals so the actual platform and longest train that can use it will be somewhat less.

All tracks are of 1520mm gauge, electrified on the 3kV direct current system. They are signalled for use in either direction, under the control of a relatively modern processor-based interlocking. However the predominant usage is right hand running on each of the three routes entering the station:

- The two-track western route over the Daugava bridge to Tornakalns, where it splits towards Jelgava and Tukums.
- The two-track north-eastern route to Zemitani, splitting for Skulte and Sigulda.
- The three-track south-eastern route to Šķirotava and onwards to Aizkraukle and beyond.

There is also a rolling stock depot east of the station as shown.

Mid-platform signals are not provided and occupation of each platform is generally limited to one train at a time. Permitted speed is 35km/h on all routes except the two non-platform tracks where a 25km/h limit applies. Although the track appears modern the platforms are very low and many are in poor condition.

4.3 Existing Train Service

4.3.1 Passenger

All domestic passenger trains are operated by Pasažieru vilciens ("Passenger Train" or PV) on the infrastructure of Latvian Railway (LDZ). Services are currently irregular, ranging from more than one per hour on the shorter routes at peak times to a few per day on most of the long-distance routes.

Electrification extends from Riga to Skulte, Aizkraukle, Jelgava and Tukums. Passenger service within these limits are generally provided by electric multiple unit stock, with diesel multiple units on those services that run beyond the electrified area. The only locomotive-hauled services are the two sleeper workings each night, one to and from Moscow and the other a splitting service for St Petersburg and Minsk. The sleepers can be up to about 400m long but other passenger trains do not exceed 160m.

Usage of tracks is generally as follows:

1, 10: Longer-distance and international services

2: Non-platform track for westbound freight

3, 4: Jurmala/Tukums

5: Skulte

6: Aizkraukle

7: Jelgava

8: Jelgava, Daugvapils

9: Non-platform track for eastbound freight

11: Sigulda

Trains are sometimes scheduled to work through from one line to another but for passenger purposes all trains are advertised as finishing and starting in Riga. Arrivals on any line are routed to the appropriate platform for their next departure. Minimum passenger train dwell/turnaround times are as follows:

- Departing in same direction: 5min
- Departing in reverse direction (summer): 8min
- Departing in reverse direction (winter): 12min
- International trains: 30min

The same times apply to trains going to and from the depot. The longer turnaround time in winter is due to extra safety checks on the trains, and the increased train utilisation. This implies the operation during winter months is managed by reducing the service on the routes serving coastal resorts during the winter timetable. Some train paths are operated only when good weather is forecast.

95% of passenger trains approach Riga within 1min of right time.

4.3.2 Freight

All freight trains are timetabled but late running is possible. 85-86% of freight trains approach Riga within 1min of right time.

Freight in the Riga area all runs to and from Šķirotava yards. The following train pairs are scheduled through Riga per day:

- **27 Jelgava**
- **5 Bolderāja, using Tukums route from Tornakalns**
- **6 Tukums**
- **3-4 from northern routes to Šķirotava, not passing through Riga station.**

Maximum freight train length is 850m. This is longer than the through tracks at Riga, so freight trains must be run through non-stop to avoid blocking the junctions (but it was noted later in the study that an 850m train can be stopped on track 9 with relatively little impact on other operations).

There is considered to be no potential to divert freight trains away from Riga station on the existing network. However there is some attempt to time freight trains to avoid the daytime passenger traffic through the station.

4.4 Future Developments

The proposals described below are considered to be part of the baseline for the study, except where noted otherwise.

4.4.1 1435mm Services

The Rail Baltica project provides an international 1435mm gauge route linking Poland with Estonia. While predominantly intended for freight use, an international passenger service is expected to be provided.

In the Riga area Rail Baltica is expected to diverge into two routes. All Rail Baltica freight will use a route east of Riga and not pass near the passenger station, so is not relevant to this study. However passenger trains will serve a Riga airport station and then the existing Riga station site. This will require an additional two-track bridge over the Daugava, which must be to the south of the existing bridge to avoid affecting the view from the historic city centre. East of the station the Rail Baltica passenger route continues, probably as a single line but double is possible. Work to date by the Rail Baltica project favours the option of running the new tracks through Riga on the south side of the 1520mm gauge tracks.

It is also proposed to run a shuttle service westwards from Riga on the 1435mm gauge tracks, to provide a frequent link to the airport station.

4.4.2 1520mm Passenger Services

PV's forward strategy is to procure a new fleet of electric trains that will allow increased frequency of service running at regular intervals on the key electrified routes serving the Pieriga region. This step change in quality is expected to generate a significant increase in ridership by 2020. No longer-term passenger service strategy has been defined.

Electrification is expected to be extended from Aizkraukle towards Daugavpils. Conversion from 3kV to 25kV is also being considered. Platforms will be raised to 550mm above rail for the new trains, but short platforms at numerous stations mean that lengthening of domestic trains is not foreseen.

4.4.3 1520mm Freight Services

The following additional freight trains per day are forecast:

- **+2 Jelgava**
- **+10 Bolderāja, using Tukums route from Tornakalns**
- **+1 from northern routes to Šķirotava, not passing through Riga station.**

There has been discussion of a project to create a new 1520mm gauge east-west freight route through Riga, which if completed would probably remove all freight traffic from the existing station. However there is no certainty about whether this will go ahead. Since the purpose of the study is to develop a layout for the station that is compatible with all foreseen scenarios, it is appropriate to test the scenario with no freight bypass and therefore more freight traffic passing through the station. This issue was discussed with LDZ early in the study, and their view was that there was no scope to divert freight away from Riga station unless a new rail route was constructed.

4.5 Work Package Summary

4.5.1 Current situation

Riga station is provided with seven through platform tracks, two through non-platform tracks and three east-facing terminating platform tracks for freight and passenger services, with platform lengths ranging between 375 and 675 metres. All tracks are 1520 mm wide and electrified to 3kV. Three routes enter the station, W from Tornakalns, NE from Zimitani and SE from Šķirotava. Permitted speed is 35km/h on all routes except the two non-platform tracks where a 25km/h limit applies, whist the track is relatively modern the platforms are very low and many are in poor condition.

Irregular domestic passenger services are run by Pasažieru vilciens ("Passenger Train" or PV) with EMU and DMU units. Two international locomotive-hauled passenger services and up to over 40 freight trains per day also use the station. Trains are advertised as finishing and starting in Riga, with dwell/turnaround times of 5 minutes for departures in the same direction and 8 to 12 minutes for reversing trains. Reliability is generally good, with over 95% of passenger trains approaching Riga within 1min of their scheduled time. Maximum freight train length is 850m, which in practice means that they are operated non-stop.

4.5.2 Future developments

Rail Baltica trains running on 1435mm gauge tracks are expected to call at the station once the new multi-national line is completed. No dual track infrastructure is being considered, thus in practice it will not interfere with the existing station. Additionally, PV's intends to deploy new rolling stock units by 2020 that will allow increased frequency of service running at regular intervals on the key electrified routes serving the Pieriga region. This is forecast to generate significant demand at the station. Freight traffic is expected to increase going forward with up to 13 additional circulations per day.

5 WP 1.3 - Infrastructure within Riga Central Station Neighbourhood

5 WP 1.3 - Infrastructure within Riga Central Station Neighbourhood

5.1 Location/Evolution/History (with excerpts from Urban Movement Systems Inform Civic Architecture – A New Intermodal Transportation Hub in Riga, Latvia; Jill Kimberly Browning; 2009)

The Riga Central Train Station is located at the junction of Marijas iela and Satekles iela, flanked by Gogoļa and Dzirnavu iela to the east and west. The train tracks are located directly south of the station. The station lies within the primary zone of the city structure along the southeast periphery of the Old Town and Maskavas District. The main entrance is accessible from the plaza off Marijas iela and Satekles iela, while a secondary entrance is from Gogoļa iela located on the western end of the site, adjacent to Stockmann department store.

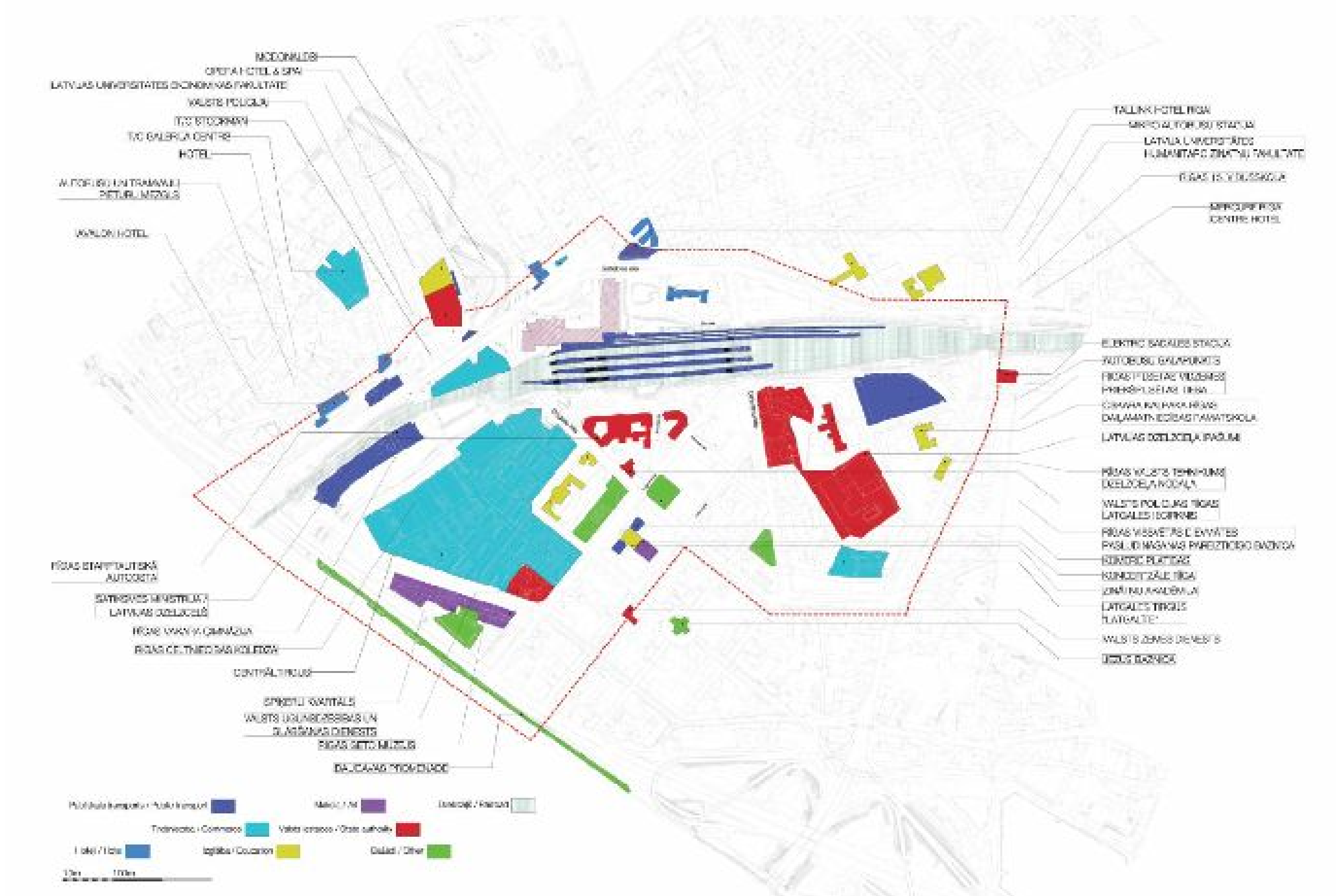


Figure 5.1 – Central Station Location and Adjacent Functions (Source: AECOM)

The site is surrounded by UNESCO's boundaries on three sides, but the site of the train station is not protected under the historic ordinances. The site does however fall within UNESCO's buffer zone, which places restrictions on buildings adjacent to the historic district in order to preserve quality and character of the designated area. These restrictions are related to building heights, facades and scale.

5.1.1 Brief History and Evolution

Riga's first railway station was built in 1861 and was renovated and expanded in 1884-1885 by architect H. Scheel. Riga was experiencing unprecedented growth and out grew its facility. In response a proposal was presented in 1902 to rebuild the station. Although designs were presented, the project was never realized. It was not until 1910-1914 when the new terminal was designed and built by A. Werhowskoy.

Figure 5.2 - Riga Central Station location 1910 (Source: Internet)

The original train station remained in its location fronting Gogoļa iela serving four ground level tracks. The embankment that survives today and the first Akmens tilts was designed in 1914. The elevated embankment reaching 8.53 meters was the result of having to connect to the railway trestle spanning the Daugava River.

The terminus station was demolished in the 1960's and relocated from the corner of Gogoļa iela to its present location fronting Marijas iela. The large public square that exists today was formerly a parking lot servicing the station.

5.2 Description of the Station

The current train station is a mixed-use facility that has both central train station functions and an integrated shopping/retail element (Origo). All ancillary/support functions including connections to other transportation modes occurs external to the station and in most cases not directly adjacent to the station. This created very problematic wayfinding for residents and visitors of Riga.

5.2.1 Characteristics of the Train Station

The station itself has two adjacent passenger halls, ticketing booths in each passenger hall, three parallel tunnels to access the international and regional platforms and two plazas (main plaza toward the center of Riga on Marijas iela and one on Gogoļa iela facing the Riga Central Market and the Maskavas District.

When a traveller enters the station from the main plaza it is unclear with the maze of kiosks and retail stores where to buy a train ticket. There is a small information booth that is rarely serviced by an employee. After trial and error the traveller continues down a corridor to the right leading to a multistory atrium providing access to the shopping mall and ticketing windows. Several kiosks placed in the center of a two-story atrium diminishes the grand scale of this public space and visually blocks the ticketing booths. Only after passing the kiosks the traveller then sees the ticketing window on the southern wall. The combination of the lack of adequate wayfinding and interior circulation accounts for this confusion.

5.2.2 Characteristics of the Train Station Plaza

For all the benefits of the plaza's grand scale, frequent pedestrian traffic and ideal location as a gateway into the city, the atmosphere lacks energy and interest. People only cross the plaza to access the train station, retail centers, bus station, and central market or to get to the city center from the south.

5.2.3 Accessibility/Urban Tunnels

Existing accessibility outside and inside the train station are via pedestrian tunnels and series of stairs. This is problematic for several reasons. Firstly, the pedestrian tunnels are dark and security is minimal. Petty crime such as pick pocketing is very common. Secondly, within the train station there is no visibility of arriving or departing trains. Thirdly, the stairs are problematic for the elderly, disabled, people with children, strollers, baggage or bicycles. At present, only a modified ramp located on the left side of the stairs is available for use by travellers with strollers or luggage. Additionally inclement weather increases the risk of accidents when stairs become slippery with melting snow and ice.

5.3 Description of the Public Utility Networks

The existing network of public utilities in most cases has developed based on the street grid of the City of Riga which was established after the initial planning and development of the location of the train station. The primary infrastructure of the railway was set at the beginning of the 20th century and as such has not been significantly impacted by the utility networks were developed or updated at a later date.

5.3.1 Water Supply

The water supply network was build on using a loop principle, which provides optimal network loads, distributes pressure differences and avoids any delays in damage resolution in emergency situations. Figure 5.3 below depicts the existing D500 and D400 main water supply networks, which can be used in future water supply connections considering existing network capacity.

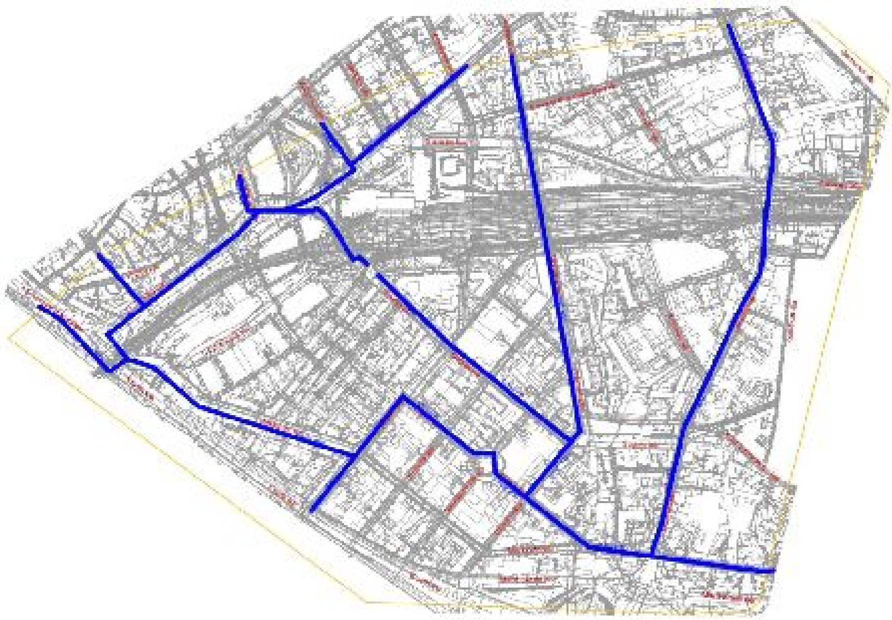


Figure 5.3 - Water Supply Network (Source: AECOM/ A.Abeles Biroj)

5.3.2 Sewer

The main sewage and rain water drain collectors are old, tapered, brick build collectors in size 800x1200 etc. In surrounding area are existing technically suitable collectors. These are shown in Figure 5.4 below.

Figure 5.4 Sewer Network (Source: AECOM/ A.Abeles Biroj)

5.3.3 Gas Supply

Figure 5.5 overleaf represents the medium pressure gas supply network, which is suitable and can supply future building area with necessary gas demand. Existing medium pressure gas pipeline D426 in Krasta iela near river Daugava can be considered as main gas supply for future building area.

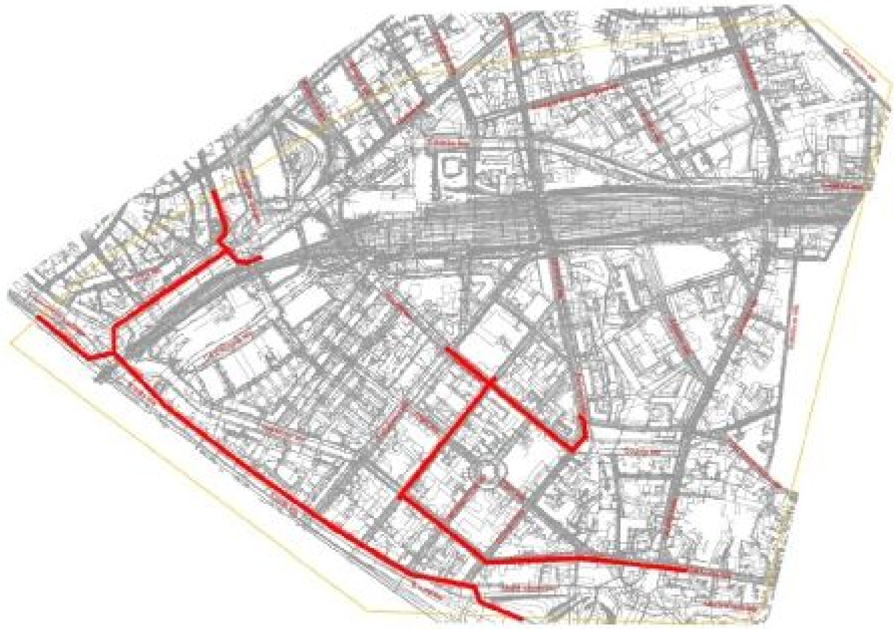


Figure 5.5 Gas Network (Source: AECOM/ A.Abeles Biroj)

5.3.4 Railway (LDZ) Low Voltage Network

The LDz (Latvian railway) low voltage network is located in near railway tracks and is connected with LDz buildings in area of Gogoļa street. Existing low voltage network and as well as other engineering networks in area of LDz tracks surrounding area are build chaotically and adjustments need to be made according to new building area requirements which should be detailed in sketch design.

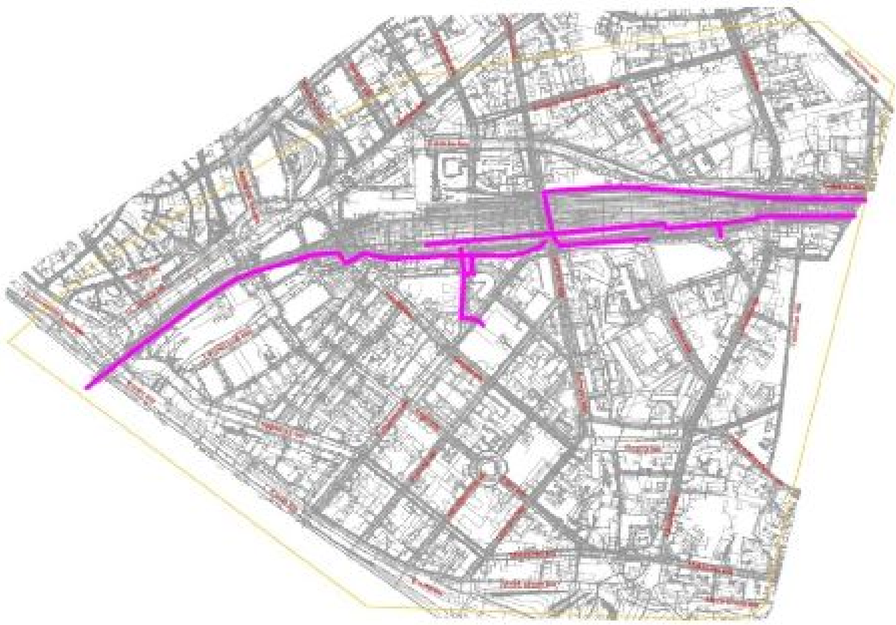


Figure 5.6 LDz Low Voltage Network (Source: AECOM/ A.Abeles Biroj)

5.3.5 Public Low Voltage Network

The existing public low voltage networks are well developed and are recommended to use for future building required use.

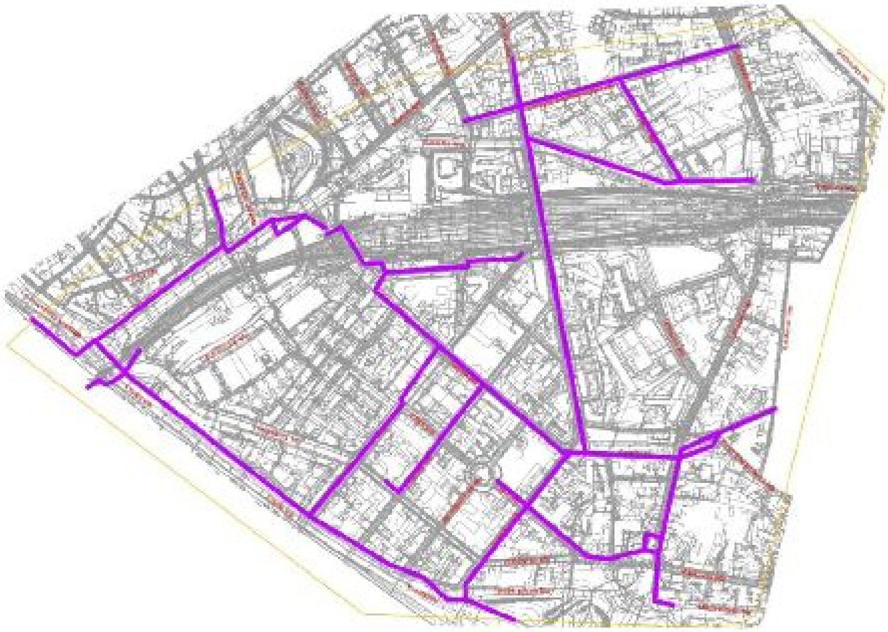


Figure 5.7 Public Low Voltage Network (Source: AECOM/ A.Abeles Biroj)

5.3.6 110kV Power Network and 110/10kV Substations

The 110/10kV substation "Cetrālā" is located on crossing between Lāčplēša street and Satekles street. At this moment substation provide existing supply for 10kV power network. In future it is recommended to provide power redundancy from substation "Bastejkalns" to increase network safety. Existing 110kV cables should be preserved and taken into account in future building area development.

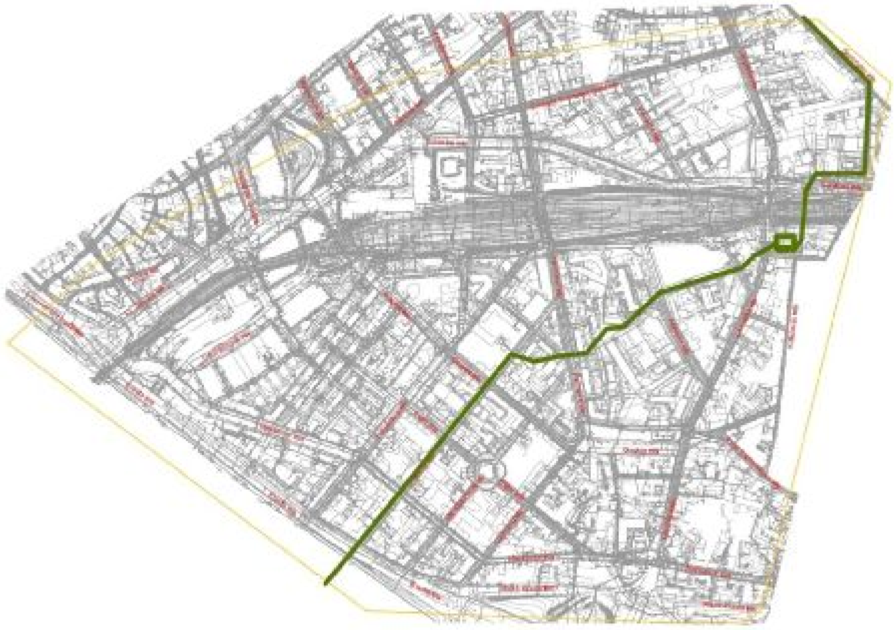


Figure 5.8 110kV Electrical Power (Source: AECOM/ A.Abeles Biroj)

5.3.7 10kV power network and 10/0,4kV substations

The 10kV power network and 10/0,4kV substations are designed in loop principle to provide redundancy in emergency situations. Main part of existing 10/0,4kV substations are more than 30 years old and are considered as technically outdated. Some part of substations are renovated with equipment replacement. In distribution network substations are used transformers up to 1000kVA. Future building area development power supply can be connected to existing substations only in case if required power is not increased. Any increase in load can be executed from substation "Centrālā" and redundant from substation "Bastejkalns".

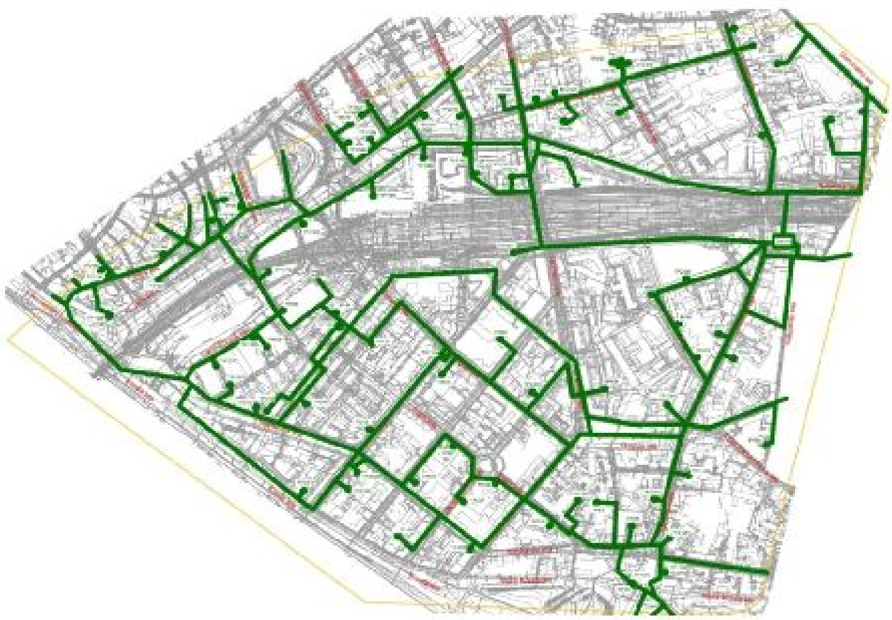


Figure 5.9 - 10kV Electrical Power (Source: AECOM/ A.Abeles Biroj)

5.4 Description of the Surrounding Transportation Infrastructure

The expanded study area considered for overall urban design and transportation infrastructure issues is bounded by 13. janvāra street, Satekles street, Lāčplēša street, Gogoļa street, Puškina street un Krasta street (this is an enlarged area compared to the study are defined in the Technical Specification for this project. This territory as a whole creates central mobility core of Riga city including Riga central station and Riga International coach terminal.

Here there are a relatively small number of residences (about 2750 residents), quite concentrated number of workplaces (about 9860 workers), but the greatest number of people makes public transport passengers, tourists and visitors.

5.4.1 Road Infrastructure

The city street network structure is being developed as a two arterial circle system with a radial connections to the national road network.

The street network was structured taking into account the development patterns of the population in the urban core of Riga.

The street network was built under the railway connections for crossing streets - Lāčplēša street, Dzirnavu street, Gogoļa street, Prāgas street, Kungu street and Maskavas street. Dzelzcela (Railway) bridge over the Daugava River was next to the Zemgales Bridge. In a period during a wars was loss of Zemgales Bridge as well as the carriageway under the railway in Kungu street. In 20th Century (circa 1980s) a new connection was built under the railway on Krasta street. Still unrealized are Elizabetes street and Riepnieku street connection concepts, which is fixed in Riga city development plan and has already reserved in the identified red line corridors.

Figure 5.10 – Railway Line Crossings with Streets (Above Grade and at-Grade) (Source: AECOM/E. Danisevskis Birojs)

Relatively large areas of research territory are with limited traffic access, which increases the concentration of traffic in surrounding street network.

The existing road network serves the urban areas, although the following negative aspects hinder the effectiveness of vehicular movement:

- **Disharmony of workplaces and population in city centre;**
- **Extensive urban development in recent decades and as a result, the need to increase the use of transport;**
- **Fragmentary character of arterial streets around the centre;**
- **Uneven and insufficient number of railway crossings in the city;**
- **Demand of traffic flows exceeds the street network capacity in city centre;**
- **Significant passage transport in city centre;**
- **poorly developed organization of traffic management system;**
- **Weak public transport priority over other transport;**
- **Weak cycling infrastructure.**

5.4.2 Traffic Organization

Road transport and public transport organization in the City of Riga is designed as adjustable and in one level. Pedestrian flows are primarily designed as single-level sidewalks, paths and pedestrian crossings. In some places (13. janvāra street to Prāgas and Gogoļa streets, Gogoļa street to the Central Market and the Krasta street at Spīķeri) pedestrian tunnels have been constructed.

5.4.3 Public Transportation

In the study area, a significant amount of international, national, suburban as well as urban public transport exists . Suburban and international passenger trains arrive at the Central railway station. In 2014, the total number of passengers travelling through the Central Station study area was 19.2 million.

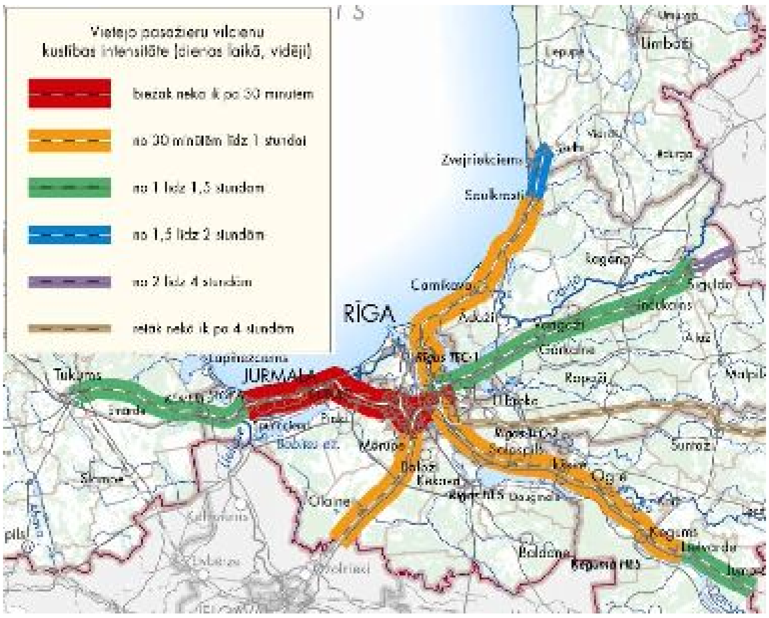


Figure 5.11 – Passenger Train Traffic Intensity (Riga Region) (Source: AECOM/E. Danisevskis Birojs)

Overall, the Riga central railway station placement is assessed as good in relation to public transport stops of city buses, trolleybuses and minibuses. The coach station is better served with tram and urban bus stops.

Transport mode O-D data was received from Autoosta and the information used to help determine the bus to rail and bus to bus passenger interchange percentages within the pedestrian modelling undertaken of the RPTH (see sub-section 10.5.2).

On-site spot surveys/observations of public transport frequency, by AECOM staff on 8th, 9th and 10th of September 2015, during peak weekday peak hours was undertaken to check that the timetable information used to produce the public transport maps in Section 3.5 is correct and up to date.

Passenger boarding and alighting spot surveys/observations was undertaken by AECOM staff on 8th, 9th and 10th of September 2015, during peak weekday peak hours to help inform the number of passengers modelled to and from adjacent bus stops and taxi rank.

5.4.4 Cycling Infrastructure

Bicycle infrastructure development of the city center is relatively weak. Currently in the study area bicycle paths are implemented along the bank of the Daugava in Krasta street opposite Spīķeri and separated bicycle lanes exist on Dzirnavu street.

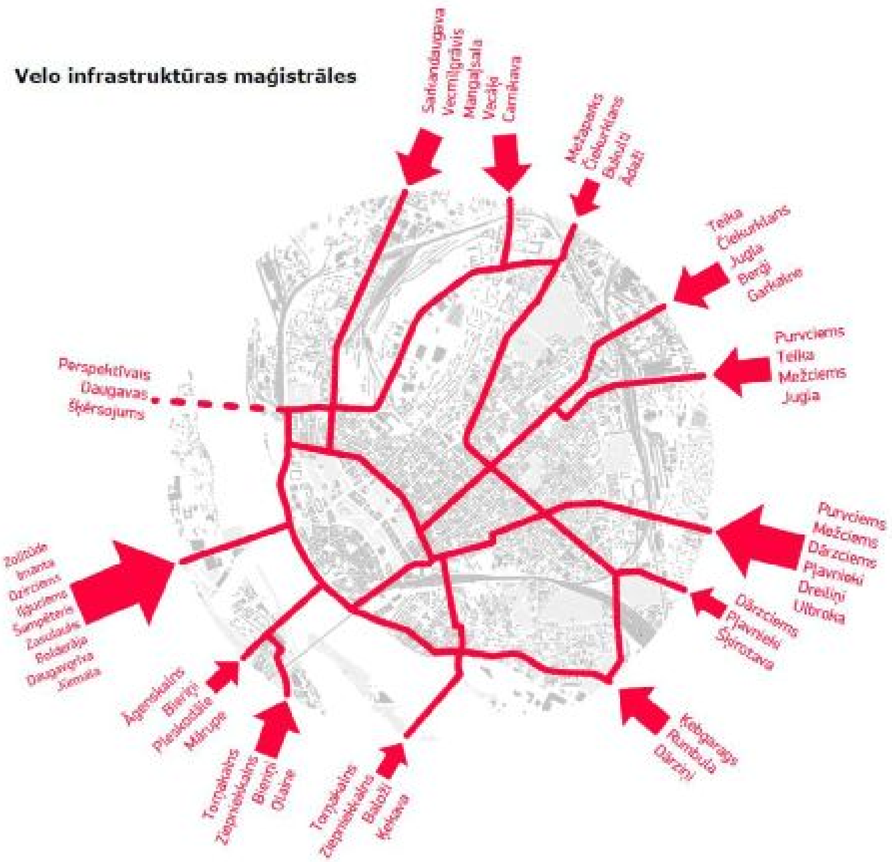


Figure 5.12 – Existing primary bike network in study area (Source: E. Danisevskis Birojs/City of Riga – Velokoncepcija 2015-2030)

In the future, bicycle paths are contemplated on Maskavas street, on 13. janvāra street, on Satekles street, on Lāčpēša street as well as on Gaiziņa street and on Centrāltirgus street and on Turgeņeva street.

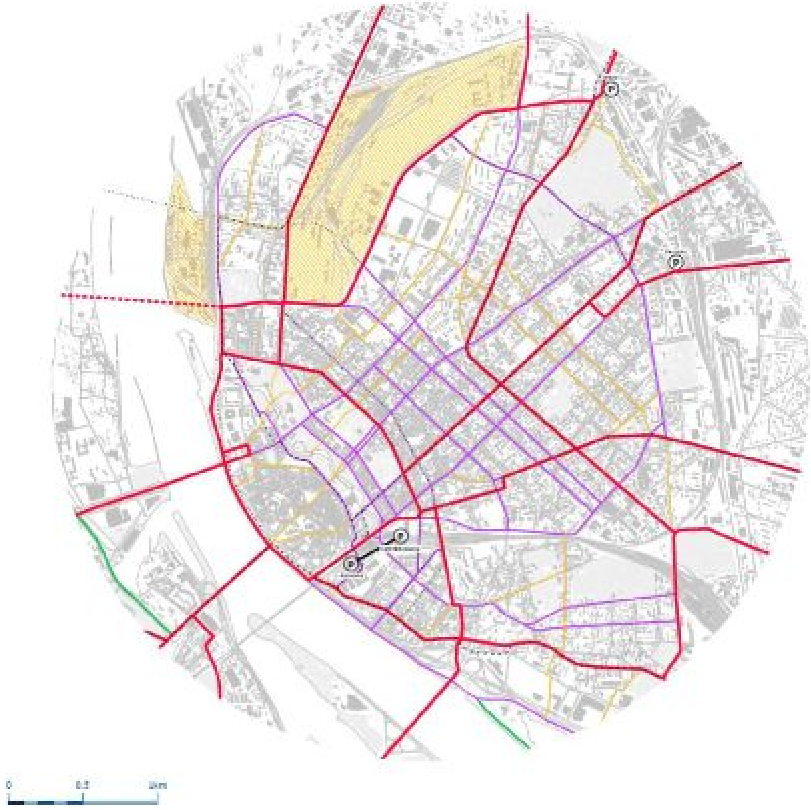


Figure 5.13 – Proposed bike network projects in study area (Source: E. Danisevskis Birojs/City of Riga – Velokoncepcija 2015-2030)

5.4.5 Pedestrian Traffic Infrastructure

Pedestrian traffic organization in the territory is designed as adjustable and on one level. In some places pedestrian tunnels exist, which include retail functions - under 13. janvāra street (at the Praga streets and at Raina blvd.), under Gogoļa street (at Riepnieku street and at 13. janvāra street) and under Krasta street (against Spīķeri). The balance of the territory is served by typical sidewalk configurations at the perimeter of city blocks.

5.5 Future Traffic Networks

5.5.1 Riga City Parking Policy (2015)

The Riga City Parking policy of 2015 has been established to inventory the existing parking situation and to provide furture guidance to the development of parking within the historic center and the urban areas of Riga. Within a 500m radius from the central station 1,470 parking spaces exist.

Within a 500m radius of the coach station 1,583 parking spaces exist.

Within the vicinity of the study area the Parking policy defines various locations that are being considered for additional parking in Riga. Some of these parking structures area contemplated below grade, some are identified under existing city streets and the balance are considered structured parking areas.

In the area around the Central Railway Station and the International Bus Station sufficient parking provisions exist taking into account the surrounding public paid parking – although most parking spaces are expensive and cannot be used for long-term parking for travellers. In the area around the Central Railway Station and the International Bus Station planned future parking is to be publicly available and increased counts will assist in serving the demand of the area.

In addition, in close proximity to the entrances of Central Railway Station and the International Bus Station it is the intent to create future short-term use car parks.

5.5.2 Trade and business building design in Satekles street and Marijas street (2007)

As part of the proposed trade and business building projects along Marijas and Satekles streets underground parking and minibus platform placement has been considered. The project included Satekles and Elizabeth Street intersection reconstruction and installation of traffic lights.

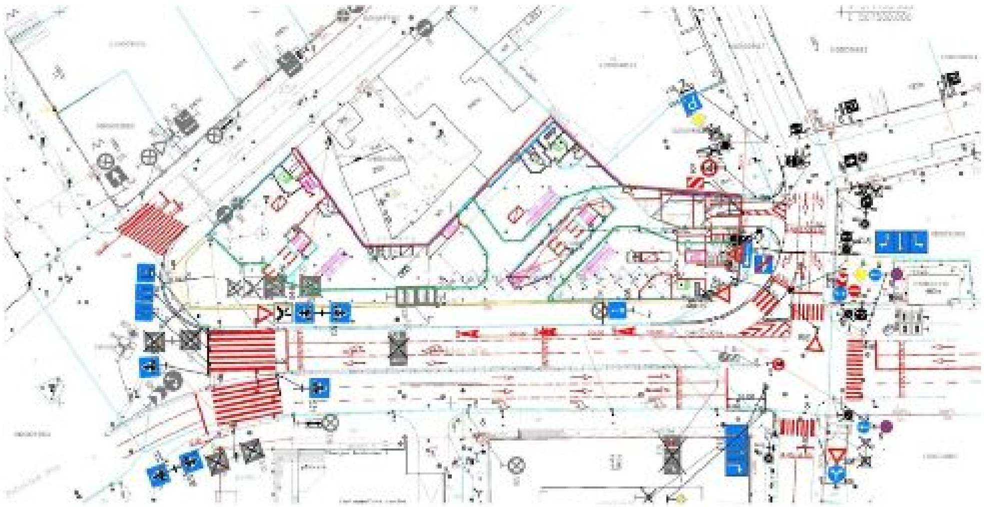


Figure 5.14 - Perspective traffic organization Satekles, Marijas and Elizabetes street (Source: AECOM/ E. Danisevskis Birojs)

5.5.3 Development of traffic system and street infrastructure in 13. janvāra, Marijas and Satekles streets (2005)

This development plan includes various street improvements that relate to the development of a new Daugava crossing. The proposed Zemgale bridge would be located opposite 13 January Street. The bridge is intended as a low bridge with a connection to the Krasta street at ground level. In addition, other street improvements include, but are not limited to:

- **Tram line to move at other side of 13. janvāra street and to place along the railway embankment;**
- **Reconstruction of intersection of Puškina street and Krasta street, allowing the left turn from the Krasta street;**
- **Construction of tunnel under the railway Elizabetes-Timoteja street-track;**
- **Fitting with synchronized traffic lights intelligent management system of bows Elizabetes-Turgeņeva and Puškina-Dzirnavu street; and**
- **Construction of underground parking under the 13. janvāra street.**

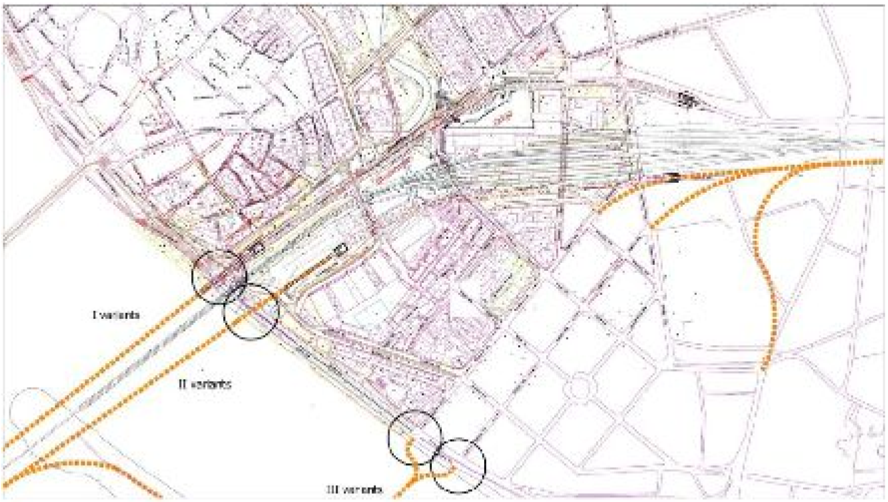


Figure 5.15- Perspective traffic organization in 13. janvāra, Satekles and Marijas str. (Source: AECOM/ E. Danisevskis Birojs)

5.5.4 Transport flow research and forecast project for quarter between Lāčplēša, Satekles and Visvalža streets (2008)

A new multifunctional mixed-use complex is proposed in the area between Lāčplēša, E.Birznieka-Upīša, Satekles and Visvalža Streets. This may impact the east end of the Central Station study area and needs to be taken into consideration in future central station development plans.

Figure 5.16- Traffic organization scheme 2018 (Source: AECOM/ E. Danisevskis Birojs)

5.5.5 Underground multi-story car parking in 13. janvāra street near retail centre "Stockmann". Traffic flow research, sketch design (2008).

Underground parking (2 levels), is proposed under 13. janvāra street - between Aspazijas blvd. and the canal. Entrance is planned from Aspazijas Boulevard. The underground parking structure is planned to be connected to the shopping centre Stockmann underground parking. This type of development has significant impacts to the existing traffic network and as such the traffic organization in the surrounding area would be modified. The development project is not yet under development.

Figure 5.17- Perspective traffic organization scheme (Source: AECOM/E. Danisevskis Birojs)

Figure 5.18- Perspective traffic organization - Underground multi-storey car parking in 13. janvāra street. (Source: AECOM/E. Danisevskis Birojs)

5.5.6 Transport flow research and forecast project for territory among Dzirnavu, Abrenes, Lāčplēša and F. Sadovņikova streets (2008)

The project is designed to assess the necessary traffic infrastructure changes after the multifunctional building development in the area between Dzirnavu, Abrenes, Lāčplēša and F. Sadovņikova Streets. The project includes reconstruction of surrounding intersections and installation of traffic lights in the intersection Satekles and Visvalza Streets. The proposed road infrastructure plan also includes the development of a tram line in Pushkina and Dzirnavu streets in accordance with the development plan of Riga.

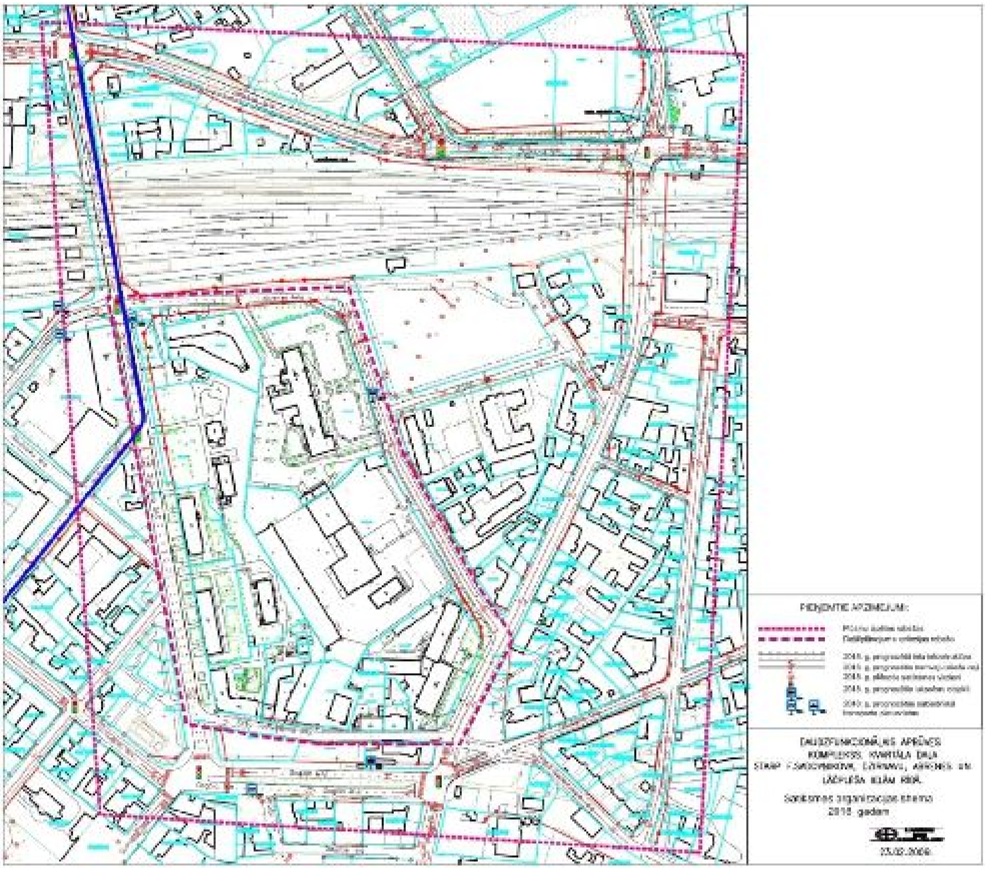


Figure 5.19- Perspective traffic organization 2018 (Source: AECOM/E. Danisevskis Birojs)

5.5.7 Establishment of Intermodal public transport hub in Riga historical centre (territory among Turgeņeva, Maskavas, Gaiziņa and Prāgas streets)

Another future development study was conducted with the intention to relocate the Riga International Coach Station, the city's bus and minibus terminal point in the territory between Turgeņeva, Maskavas, Prāgas and Gaiziņa Streets. The project includes redevelopment of the organization of transport (intersections and streets) to access this site as well as improvements to the pedestrian connections from the newly proposed coach station and the railway station.

Figure 5.20 - Proposals for development of a new multimodal transport hub (20-25 years perspective) (Source: AECOM/E. Danisevskis Birojs)

Although, the project has experienced some changes from the initial development plan and is currently being developed as a mixed-use retail centre with some ancillary public transportation improvements.

The most important and criticalCity of Riga roadnetwork inprovements that need to be prioritized for the RPTH development are:

1) The introduction of the Elizabetes iela/Timoteja iela extension/connection below the railroad tracks;
2) Reconstruction and widening of Klavu iela and the frontage road between the railway station and the Ministry of Transport/Latvian Railways;
3) Upgrading Gogoļa and Prāgas ielas in the areas adjacent to the railroad tracks;
4) Upgrading Dzirnavu iela, Satekles iela and 13.janvara iela to improve traffic/pedestrian flows by traffic lane improvements, turning lane improvments, traffic signalling enhancements/upgrades/re-timing, sidewalk/crossing enhancements, public transit stops and landscaping improvements; and
5) Extending the tramway network along Elizabetes and Dzirnavu ielas to connect to Maskavas iela.

5.6 Taxi Ranks

There is a small taxi rank just in front of the station plaza, which can hold 8 – 10 taxis at one point of time. Lack of drop-off or pick-up facilities in front of the station has been identified as another shortcoming in terms of passengers smooth and efficient access to the station.

5.7 Property Use and Ownership of Lands

The Central Station is located on land that is owned by the Republic of Latvia and operated by the Latvian Railways. The tracks that enter and exit the station to the east and the west are developed on an embankment that is also owned by the State. The other key developments that surround the Central Station include but are not limited to:

1) The Ministry of Transportation

2) **Latvian Railways**

3) **Hotel Mercure**

4) **Riga Taxi Park Microautobus station**

5) **Various retailers and hotels along Satekles iela**

6) **Stockmann Department store**

7) **The City of Riga Canal and Parkway system**

8) **The Riga Coach Station**

9) **The Central Market**

10) **Titaniks – retail and parking center**

A portion of the central station has been leased to Linstow Property Management and has been developed as a multi-tenant retail mall (Origo) that houses an anchor tenant Rimi (grocery store) and many other retailers on three levels. Linstow has also secured and is in the process of developing an adjancent property that will become an extension of the Origo retail center that will also include office and residential areas.

Please see 'Appendix – WP 1.3 Property Ownership' for a detailed listing of the property ownership across the study area with a corresponding map.

The adjacent land-uses complement the functions of the Central Station by providing the operational support required by the Latvian Railways and the Ministry of Transportation.

5.8 Protected Lands

The Central Station is located adjacent to the City of Riga UNESCO world heritage site and the City of Riga historical center. All development improvements must take into consideration the guidelines and policies that these protected zones define.

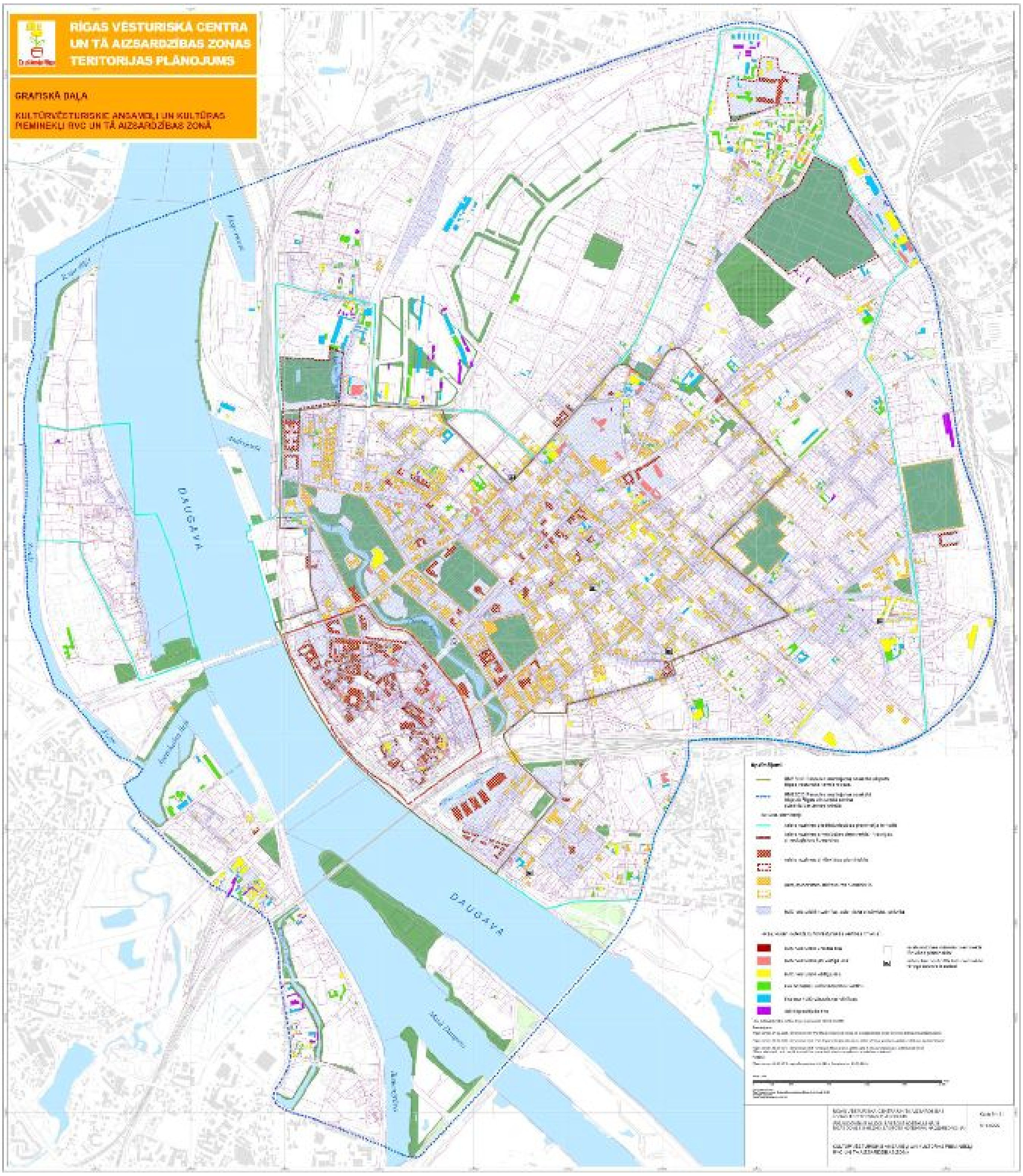


Figure 5.21 – UNESCO World Heritage site boundary map from the City of Riga (Source: Riga City Development Department)

In addition, any improvements that are contemplated within the Central Market and along the edges of the canal need to be carefully reviewed and must align with the historic preservation guidelines for protected buildings and regulations related to urban waterfront protection. These protections will be defined by all associated institutions related to the project, once the Planning and Architecture Brief (PAU) and Technical Requirements (Tehniskie Noteikumi) are requested in the building design process.

5.9 Work Package Summary

This work package has comprehensively addressed the existing and planned improvements of infrastructure within Riga Central Station neighbourhood, which includes:

- **Description and location of lands and buildings**
- **Location and description of public utilities networks**
- **Location and description of protected zones or objects**
- **Planned changes of infrastructure and landuse until 2030**

To develop the RPTH successfully, the Ministry of Transport must develop a strong partnership with the City of Riga and the Latvian Railways to maximize and coordinate the collective development projects that surround the RPTH area. Other key public sector and private sector partners must be integrated into the implementation process and as such will require on-going, pro-active communication about the design and construction processes, so that all stakeholders can coordinate their respective projects during the RPTH implementation process.

6 WP 1.4 - Best Practice Review of Passenger Transportation Hubs

6 WP 1.4 - Best Practice Review of Passenger Transportation Hubs

6.1 Approach

In line with the requirement of Section S4 WP 1.4 (page 19) of the original ITT, we have undertaken a best practice review of passenger transport hubs. The following sections outline our approach and findings from this study.

6.1.1 Assumptions

The case studies have been analysed from an urban planning perspective. The main study has been focused on the integration of the new stations as multimodal hubs within the wider city, keeping in view the main objective of the current study.

A wider consideration about the impact on the city has also been included, focusing on the constraints of the site and the new possibilities and other improvements in the area.

6.1.2 Methodology

Our methodology to fulfil the requirements of sections 54.1 to 54.2 of the Technical Specification is detailed below.

The case studies have been selected taking into consideration similar aspects regarding city context, size of the area, urban challenges, heritage protection and, crucially, lessons learned from each case study that hold relevance for the Riga multimodal hub.

In line with the Technical Specification the we initially provided a list of 10 best practise case studies. Of the 10 cases identified 3 have been analysed in detail. It has been concluded that there is not one example which can be applied to Riga in its totality, but there are examples from which lessons learned and specific urban and design decisions can be taken into consideration.

6.2 Long List of Case Studies

The long list of identified case studies have been distributed in four main catagories

Big scale urban regeneration. The Spanish cases of underground high speed railway and landscape operations:

- **A.1. LA SAGRERA, BARCELONA, SPAIN (AECOM)**
- **A.2. EL CARMEN STATION, MURCIA, SPAIN (AECOM) A.3. LOGROÑO INTERMODAL STATION, SPAIN**
- **Masterplan of mixed use development: B.1. EURALILLE, LILLE, FRANCE**
- **European cases of Bridge-Building Multimodal hubs: C.1. BERLIN HAUPTBAHNHOF, GERMANY**
- **C.2. EAST LISBON STATION, PORTUGAL C.3. TORINO PORTA SUSA, TORINO, ITALY C.4. ORENSE NEW STATION, SPAIN**
- **C.5. OSLO NEW STATION, NORWAY**
- **World Heritage case study:**
- **D.1. SANTIAGO DE COMPOSTELA NEW STATION, SPAIN**

- **Rail Baltica cases:**
- **E.1 PARNU AND TALLINN**

After giving due consideration on size, scale, urban content and operational parameters, the following selected case studies are considered to be most relevant for further analysis in terms of our RPTH improvement objectives:

1. LA SAGRERA, BARCELONA, SPAIN (AECOM): Large urban operation for the maximum integration of the railway in the city centre. A railway corridor is planned with underground accesses and a linear park connects the neighborhoods. It is a very good example that reflects how the city can be changed and improved due to the railway integration.

2. EL CARMEN STATION, MURCIA, SPAIN (AECOM): The integration of the railway in Murcia implies a new urban development for offices and commercial around a new public space that assembles the multimodal hub area.

3. LOGROÑO INTERMODAL STATION, SPAIN: The station building is built underground a new park with round skylights that let the light get into the railway platforms.

4. EURALILLE, LILLE, FRANCE: One of the most important examples of a reconfiguration of a huge area with a mixed-use development related to the high speed railway as a new focus of business and commercial space.

5. BERLIN HAUPTBAHNHOF, GERMANY: Europe´s largest station for long distance, very well solved despite its huge complexity of being in an intersection, the main lesson to learn from this is the way it solves the relationship with the surroundings integrating the mixed-use and all kinds of transportation.

6. EAST LISBON STATION, PORTUGAL: New station over the railway tracks in a very tight connection with a new bus station linked to it.

7. TORINO PORTA SUSA, ITALY: Example for a longitudinal shape station with the flows organization very related to the adjacent streets.

8. ORENSE NEW STATION, SPAIN: Very good example of an innovative understanding of the city, integrating the road connection with the multimodal hub and new public space in a wide bridge interesting structure.

9. OSLO NEW STATION, NORWAY: The Nordic ongoing project will be one of Europe's most advanced public transportation hubs. It frees space after demolishing the old station volume and building new complex including office towers, residential and commercial use in a new covered gallery that links the different city accesses.

10. SANTIAGO DE COMPOSTELA NEW STATION, SPAIN: World Heritage example and at the same time, the most applicable one for Riga New Multimodal Hub for a minimized solution, very functional and with similar spacial constrains.

**** PARNU AND TALLINN: Baltic examples**

6.3 Description of the Shortlisted Case Studies

This is a station representing the example of a big scale urban regeneration type project.

6.3.1 A.1. LA SAGRERA, BARCELONA, SPAIN (AECOM)

Figure 6.1: Location of La Sagrera - GENERAL PLAN (Source: BSAV)

A new green diagonal axis extends into the very heart of XXI century Barcelona. It is a natural path for pedestrians **and** bicycles as protagonists of a new era of a greener and more habitable metropolis, promoting biodiversity and a stronger urban ecological role of the city.

El Camí Comtal will finally connect the Sea and the Mountains, Nature and City in Barcelona. It strengthens the landscape experience for those approaching the sea from the coastal range through the city.

Figure 6.2: GENERAL VIEW (Source: BSAV)

El Parc del Camí Comtal gives a breath to the bustling city of Cerdá, introducing a new green calm ambience as a counterpoint to today's urban frenzy and activity represented by the other Diagonal.

Figure 6.3: GENERAL VIEW (Source: BSAV)

<u>Main challenges:</u> Connect the two sides of the city that were separated by a long barrier of 4,2 km.

<u>Solution</u>: Railway corridor and accesses to the station planned underground as a new station

The Opportunities:

The opportunities highlighted from the LA SEGRA interchange can be outlined as follows:

- **Linear parks, landscape experience, urban ecological role, biodiversity...**
- **Accessible, friendly and safe Stations. Stations are not the centre of neighbourhood life, but are the place which connect home and work**
- **Intermodal hub. Complementary works for other means of transport**
- **Neighborhood engagement. Proper public information during construction stage**
- **Strong governmental and public body support**

The above multi model hub is a large urban operation for the maximum integration of the railway in the city centre. A railway corridor is planned with underground accesses and a linear park connects the neighborhoods. It is a very good example that reflects how the city can be changed and improved due to the railway integration.

The operation includes construction of the UIC standard gauge railway track, a project that requires redesign and realignment of the existing conventional tracks, a new station, execution of the covering slabs on the entire railway corridor, urban integration, construction of several artificial cut-and-cover tunnels and two maintenance buildings.

As well as, the refurbishment and replacement of existing Iberian gauge tracks and related facilities. This terminal could be categorised as an <u>Important Urban Planning Development</u> example.

LESSONS LEARNED FOR RPTH:

The City Development Department fully involved in the huge transformation of the urban planning. Excellent coordination of the works done inside the urban network. All existing facilities and utilities are protected. Complexity of the Stakeholders interface. Complex ground conditions (water table close to existing ground level). Through put type station. Dual gauge/dual track station: Coexistence of the two different track widths (conventional track width 1.668 mm and the UIC international track width 1.435 mm).

6.3.2 A.2. EL CARMEN STATION, MURCIA, SPAIN (AECOM)

<u>Main challenge</u>: Connect both neighbourhoods that are separated by a long barrier

<u>Solution:</u> Railway corridor and accesses to the station planned underground, partially covered tracks Opportunities: New urban configuration in the South of the city: natural landscape, geriatric and playground areas. Hotel, offices and retail next to the new station.

<u>New station</u>: Replacement of the older one. Old station adapted to new tracks is used temporary while the construction of the new one. Old station is protected historical building. Throughput type station.

The railway means a great barrier in the city centre and both neighborhoods at each side find themselves unconnected in a very long section. There are two roads at the end points of this section and only one connection road below the tracks in the midpoint which is not enough for the citizens.

Figure 6.4: CURRENT SITUATION OF THE STATION (Source: Bing Maps)

Figure 6.5: EXISTING RAILW AY BARRIER: El Carmen (Source: Google Maps)

The urban development involves the management of an area of 207,229 sqm in one of the busiest areas of the Murcia city that will become the main hub of the communications after the future Intermodal Station construction. The action plan will integrate the existing railway area with the surrounding urban area and develop a new urban configuration at the south of the city.

Figure 6.6: PARTIALLY UNDERGROUND PLANNED RAILW AY: El Carmen(Source: Murcia Alta Velocidad, S.A.)

The proposed works involve the construction of over 6.3 km of streets including its associated utilities (water supply, sewerage system and drainage, irrigation of green areas; electricity supply, telecommunication, gas supply, street lighting and traffic lights), as well as new public spaces and urban furniture. The project also includes the design of 2 km of cycle paths connected with the existing road network.

The planned phases of construction are as follows:

First Phase (Ongoing): The high speed railway arrives to Murcia over grade. The existing station is planned to be extended and adapted to the new needs with minimum construction for the annex buildings.

Next Phases: The excavation of the railway corridor will take place and the New Multimodal hub will be built underground. Demolition of all temporary constructions will be done. However, the old station is a historical building and is protected by the local authorities. It will be preserved as it is.

LESSONS LEARNED FOR RPTH:

The new configuration of the city implying new urban roads with different widths with all their associated urban services: drinking water, sanitation and drainage supply networks; green areas irrigation; middle and low voltage electric energy supply; telecommunications; gas supply; street lighting and traffic lights, as well as public spaces and urban furniture.

Throughput type station: Case study on constructability where the old station is planned to be adapted and extended while the construction of the new one. The historical building is protected for the cultural interest.

Coexistence of the two different track widths, there are two tracks on multi-purpose sleepers for the conventional track 1.668 mm and the UIC international 1.435 mm, due to circulate high speed new railway and the existing trains, including freight trains.

6.3.3 A.3. LOGROÑO INTERMODAL STATION, SPAIN

<u>Main challenge:</u> Urban planning, Intermodal Station, City, Park and five residential towers

Solution: Railway corridor and accesses to the station planned underground and elevated park Opportunities: City transformation, new topography, green rings and a generous public space for the city New station. A new temporary station is built while the construction of the new one.

This is an end of line type station which includes a bus station fully integrated with the rail station operation.

The railway station design has an important urban role assigned serving as a starting point of a new urban project, restoring connectivity between the Northern and Southern areas of Logroño and rising a large public park as the integral coverage with its geometric and topographic volume.

Figure 6.7: Logrono Intermodal Station: After (Source: Internet)

Main objectives:

- New train station including the bus station
- The park as the key and singular part of the urban regeneration

The multimodal station is an opportunity to rethink the city and transform it. The public space is created in order to recover the continuity in the city and the experience of a social space promoting the pedestrian mobility and cycling. The rail tracks have been built underground and the access to the platforms is from the inside down to the platforms.

There are three distinct phases for implementation of this project:

1. Replacement of the station with a new temporary one and annex buildings.
2. Duplication of the existing track. Excavation and construction of the new station
3. Urban integration with the construction of new streets

The terminal is built below a new park with round skylights that let the light get into the railway platforms. This terminal can be categorised as a integrated bus and rail station with public realm category.

LESSONS LEARNED FOR RPTH:

Case study where a temporary new station is built while the construction of the excavated new one. Excellent fully integration of the bus station in the multimodal hub. They are different buildings covered by the same landscape roof. Bus waiting area and bus platforms are at the same level (street level) as the train station (the railway platforms are one level below them).

6.3.4 B. Masterplan of mixed use development:

B.1. EURALILLE, LILLE, FRANCE

Lille is located centrally within the high-speed train network in Northwest Europe.

The new station at Lille was planned underground, several kilometers outside the inner city, in accordance with the general policy of the SNCF (*Société Nationale des Chemins de fer Français (French Railways)* at the time (Duthilleul, in: Koolhaas et al., 1996:86-87). The objective was to develop it as the anchor of the European Business Centre, a cluster of high-end service industries, commerce and leisure designed to improve the economic position of the city as a whole. Euralille served as a catalyst to economic developments that were already in place.

<u>Main challenge</u>: A complicated junction of various transportation systems: the HST, the two existing railway stations and the ring road, as well as the parking facilities, the metro and the commercial and offices development, as a global masterplan project

<u>Solution</u>: A complex urban re-organization of the infrastructure.

<u>Station</u>: Extension of the two existing stations. International high speed railway.

Figure 6.8: Graphical Presentation of Station Integration (Source: OMA architectural office)

Figure 6.9: Euralille Station Location and Urban Setting (Source: Metalocus)

The masterplan defined several distinct areas:

- **Euralille Centre, a mixed-use precinct, situated between the two stations, comprising a shopping mall named Triangle des Gares designed by Jean Nouvel, offices, apartments, a hotel and various other amenities.**
- **TGV station designed by Jean-Marie Duthilleul with two office towers above by architects Christian de Portzamparc and Claude Vasconi**
- **Park designed by Gilles Clément**
- **Congress centre known as the Grand Palais designed by OMA. Congress and exhibition centre, including meeting rooms, auditoriums, catering facilities and an events hall.**

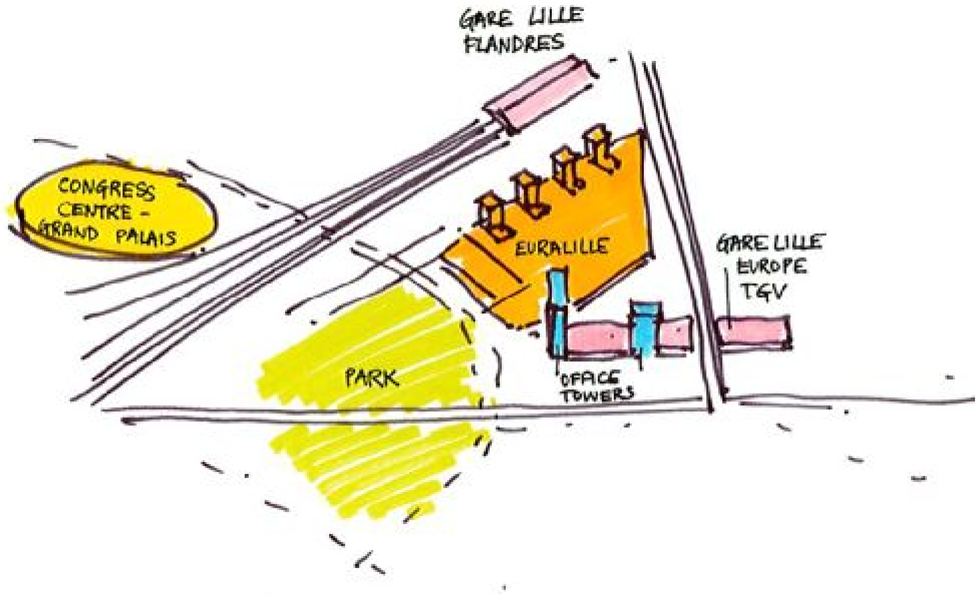


Figure 6.10: USES AND LOCATION (Source: AECOM)

LESSONS LEARNED FOR RPTH:

Zoning of the different uses according to the urban space and services to both stations. Urban planning configuration taking into consideration a long term future huge expansion of a business node.

6.3.5 C. European cases of Bridge-Building Multimodal hubs:

C.1. BERLIN HAUPTBAHNHOF, GERMANY

Large Railway Station and mixed use complex.

<u>Main challenge</u>: Multimodal hub over two intersecting railways at different levels: underground north-south link of the InterCityExpress service connects with the west-east line running on a curved railway track.

<u>Solution:</u> Bridge buildings above the tracks and excavation of the station Opportunities: Shops and gastronomy, office space in the arch buildings and parking. Status: Built in 2006.

Figure 6.11: Berlin Station Interchange: Urban Setting (Source: Bing Maps)

Berlin's new Central Station – Europe's largest train station for long-distance, regional, and local transport – was built on its historical site in the Tiergarten District, west of Humboldthafen. At this station the new underground north- south link of the InterCityExpress service connects with the west-east line running on a curved railway track. Additionally, suburban railway tracks in both directions, as well as an underground line from north to south arrive at this station. The north-south track runs 15 m below ground level in a tunnel, which also passes below the River Spree and the Tiergarten. A train station for long-distance journeys with eight platforms, four platforms for long- distance and regional transport as well as a new train station for the U5 underground line positioned parallel to the eastern platform was realized in this location. The east-west line is elevated 10 m above street level und corresponds to the previous course of the railway tracks. A total of four long-distance railway tracks and two urban train tracks run on four newly constructed urban railway bridges.

The key design principle of Berlin's Central Station is the clear emphasis of the existing course of the railway tracks in the urban environment. Large, lightweight glass roofs as well as two intersecting office buildings.

Berlin is Europe´s largest station for long distance, very well solved despite its huge complexity of being in an intersection of two railway lines.

LESSONS LEARNED FOR RPTH: The main lesson to learn from this is the way it solves the relationship with the surrounding landuse and activities integrating the mixed-use and all kinds of transportation in many different levels. It is a throughput type station. Structural complexity of the bridge buildings in order not to interfere in the use of the railway below them.

The bus station is fully integrated in the architecture, it is at the same level (street level) as the train station having railway tracks at two levels, above and below it. Both stations share a surrounding full of retail and commercial galleries.

6.3.6 C.2. EAST LISBON STATION, PORTUGAL

Multimodal complex linking the transportation with the mixed use area along the coast.

<u>Main challenge</u>: Interchange for high-speed intercity trains, rapid regional transport, tram and metro networks linked with the new Bus Station and the Retail/ Office Area

<u>Solution:</u> Walkways, park and ride and elevated station along the tracks

<u>Opportunities</u>: Connection between previously separated areas of the Olivais District and shopping mall

This is a throughput type new station. Bridge type station. Bus station as separated area directly connected to the terminal by a pedestrian walkway.

Figure 6.12: East Lisbon Station -LOCATION AND USES (Source: AECOM)

Modes of Transport:

- **train: urban, regional, long distance and international/ subway / bus: urban, regional, long distance and international / taxi**

Detected problems: Low integration of the train service with the other public transport services in other station besides Gare do Oriente:

- **Few bus services in the stations and not coordinated with train schedule**
- **No adequate public transport solutions from railway stations to small cities**
- **Passengers need to build there travel chain leg by leg (multimodality)**
- **Passengers forced to go to Gare do Oriente even when are geographically closer to other stations (such as: Vila Franca de Xira), because of the lack of suitable land-based connections.**

The train station is elevated over the tracks which are also elevated and let the two roads (in dashed blue) continue below them. A long walkway (marked in red) connects the bus station with the train station and let the access to all the bus platforms from above. Then the train station is connected at the same level with two pedestrian bridges with the retail complex.

LESSONS LEARNED FOR RPTH:

The full integration of the bus station with the railway station through an elevated walkway and the continuation of this transversal flow until the commercial area through another two pedestrian elevated walkways. The bus station is conceived as a separated area directly connected to the terminal by a pedestrian walkway at the same level as the train station (railway tracks one level below them). Lessons to learn about efficient connectivity.

6.3.7 C.3. TORINO PORTA SUSA, TORINO, ITALY

<u>Main challenge</u>: Railway widened to six tracks and new platforms

<u>Solution</u>: 300-metre long Station Building and cross connections at the street level

<u>Opportunities:</u> Multimodal hub, parking and a 100-metre high office tower

This is a throughput type new station. Adjacent outdoors bus station at street level.

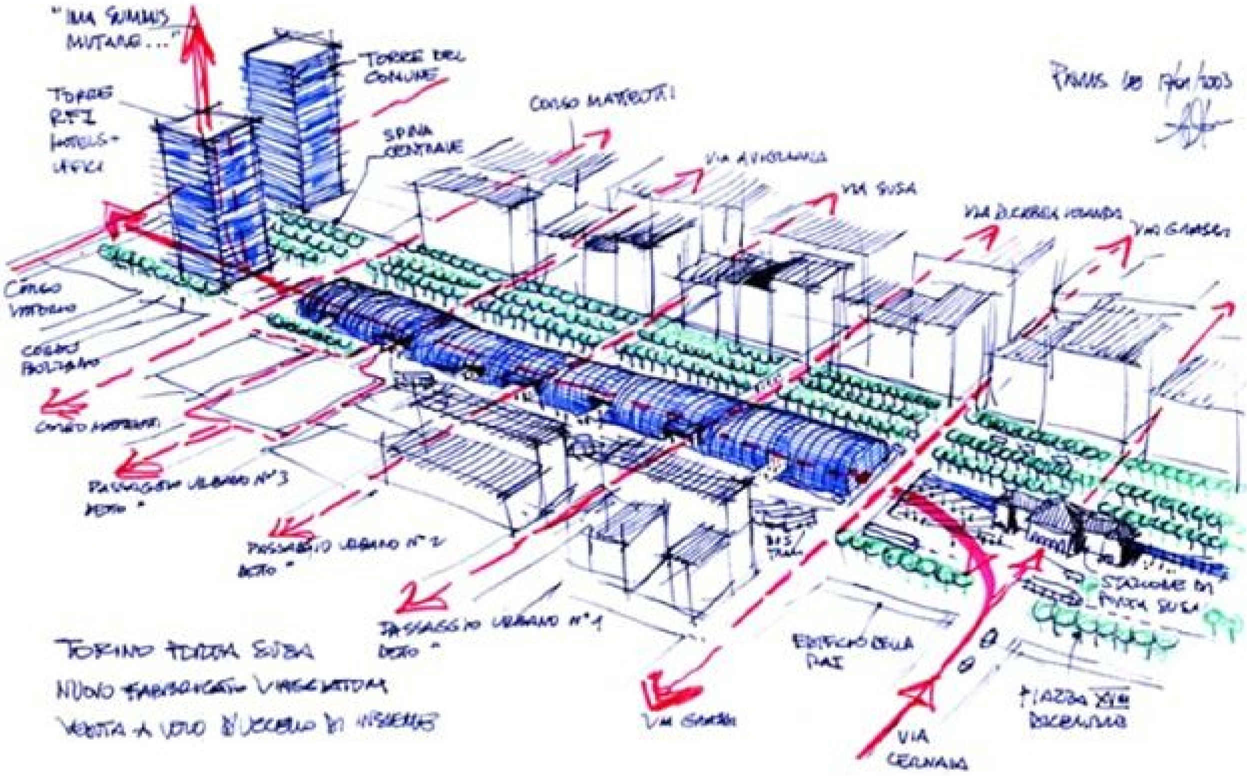


Figure 6.13: TRANSVERSAL AXES SKETCH (Source: Silvio d'Ascia Architecture)

Proposed as a new pedestrian thoroughfare, the gallery is traversed by existing city axes, allowing the station to stitch back together areas of the city previously divided. The station will be connected at the South to a mixed-use tower currently underway. Access is provided by a multitude of circulation elements: ramps, escalators, stairs, elevators which help ensure ease-of-passage amongst the station's various levels, from the metro access at its lowest point (-5), to the main tracks (-3), to the main level (-1).

The railway platforms are excavated below the street and the glazed gallery allows the access to the trains and metro. There is an elevated walkway connecting the building in the longitudinal direction. There is a band of retail in two levels serving the gallery.

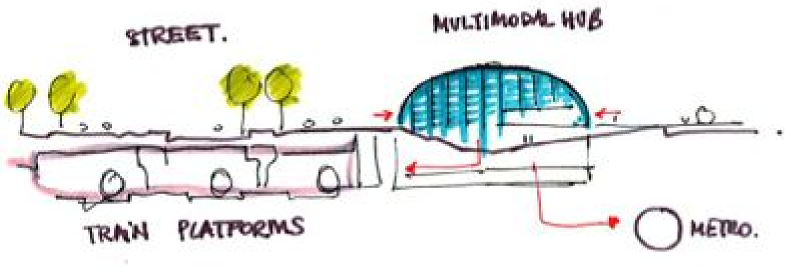


Figure 6.14: SECTION SKETCH (Source: AECOM)

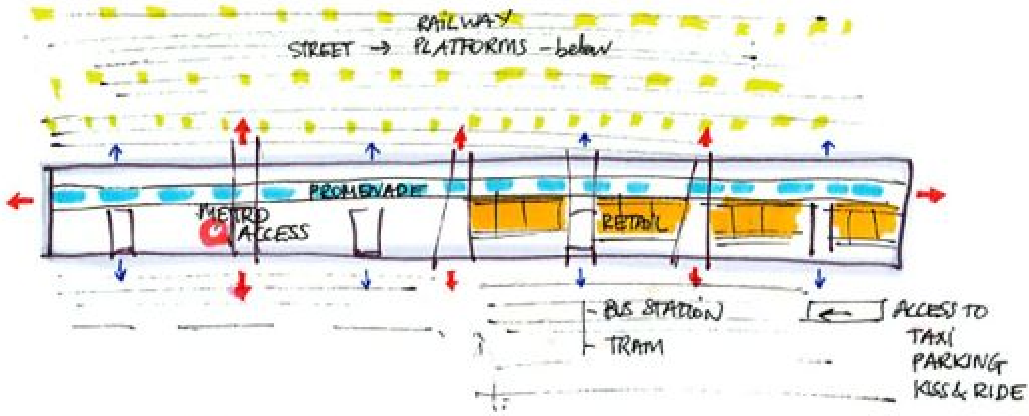


Figure 6.15: FLOOR PLAN SKETCH (Source: AECOM)

The transversal section cuts show the proximity of the new station to the railroad tracks and platforms which were buried underground as part of the urban initiative to rejoin two severed districts of Turin. The grand hall is located below street level.

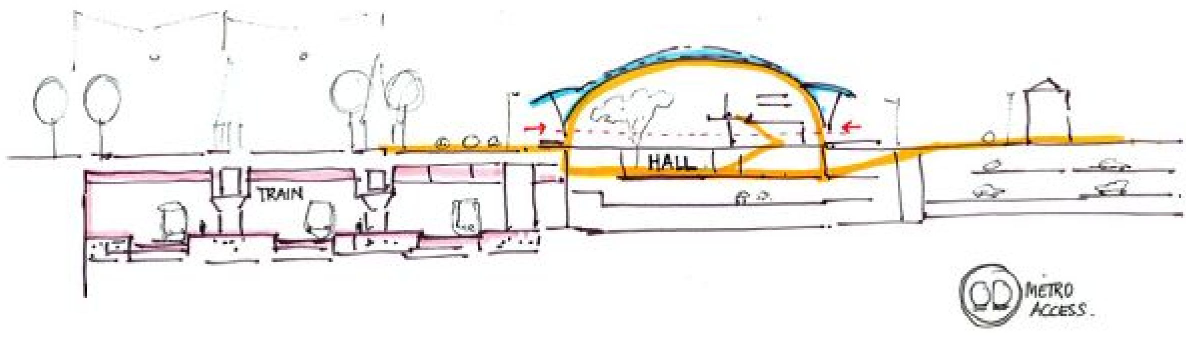


Figure 6.16: SECTION SKETCH (Source: AECOM)

Figure 6.17: GLASS ROOF OPENINGS AND UNDER CONSTRUCTION NEW AVENUE (Source: Plataforma arquitectura)

Linear Gallery Station: Example for a longitudinal shape station with the flows organization very related to the adjacent streets.

LESSONS LEARNED FOR RPTH:

Throughput type new station. Nice indoor space of the commercial gallery for the citizens, very illuminated pleasant to walk specially for winters in Riga. For rethinking longitudinal Riga´s dark passages and underpasses with retail.

6.3.8 C.4. ORENSE NEW STATION, SPAIN

Main challenge: Infrastructure over the rail tracks improving the urban connections.

Solution: An elevated wide bridge including the new station, a park and new road.

Opportunities: New public space, pedestrian links, connection including the bus station.

Station: Replacement of the existing station. End of line type station. Bridge type station. Bus station fully integrated in the architecture.

The design combines transport infrastructure with a new park, which will create a major new public space in the city and open up pedestrian links between the districts on each side of the tracks.

The high-speed AVE train station is located over the existing track level and integrates a bus station and parking area below. Above ground, the station's presence is discreet and transparent, with glazed facades that allow views through to the mountains beyond.

Figure 6.18: PLAN OF THE W INNER PROPOSAL (Source: Foster and partners)

The park extends from the station plaza and is intersected by pools of water and a formal network of pedestrian walkways, which echo the alignment of the tracks and connect the streets of Barrio del Puente to Barrio Veintiuno.

The Orense Station is the end of the line, so the integration of the new park can be planned at the street level.

Lower level: The new development of residential blocks in dark blue, the existing railway platforms in pink.

Upper level: Great structure for an elevated bridge surface with the road connection linked with an area for taxi and Kiss&Ride. The new station and new office buildings. The new park sloping down with water pools and street connections.

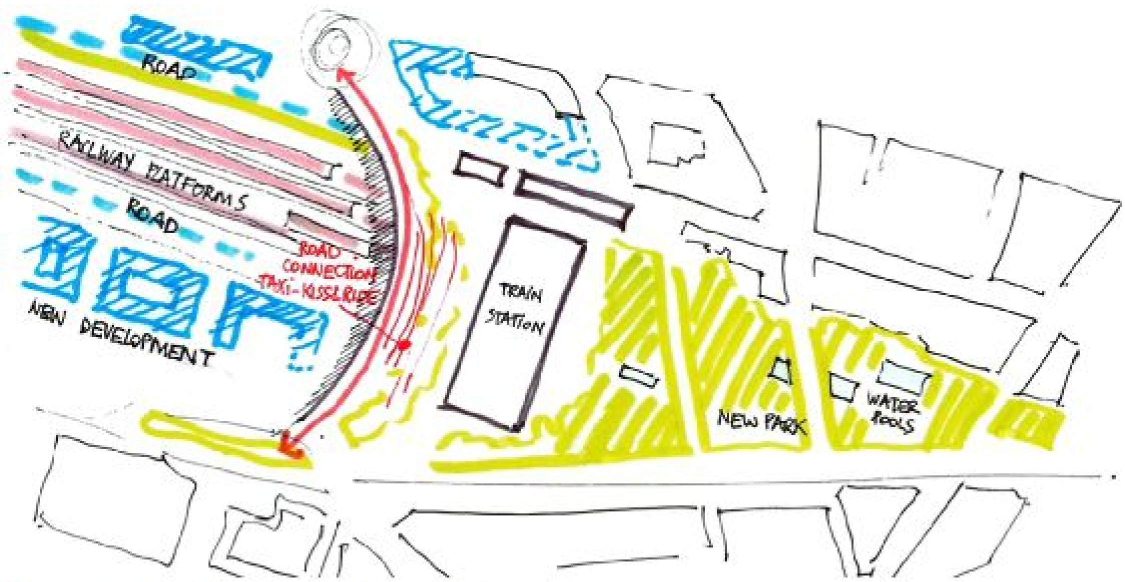


Figure 6.19: GENERAL PLAN (Source: AECOM)

Below the station and the railway platform s there will be the bus station and parking. As it is the end of the line, the park can slope down and reach the street level and allow a better connectivity with the city.

The concourse is sheltered beneath a sequence of lightweight roof canopies, which rise in a sweeping arc over the station and extend to shade the plaza and entrance to the park. The underside of the roof is reflective to bounce daylight down to the platforms, and between each canopy is a glazed, linear opening.

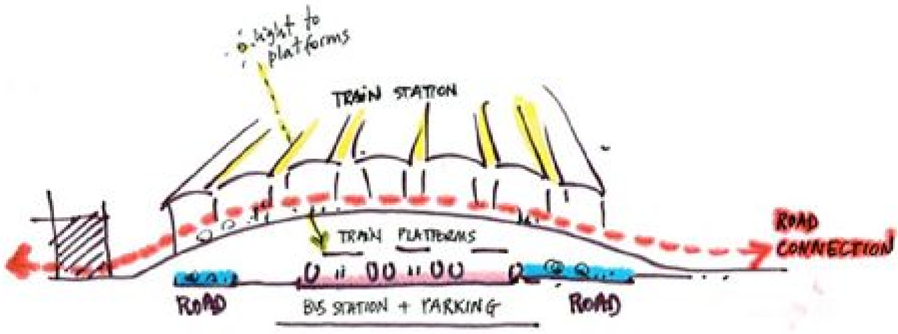


Figure 6.20: CROSS SECTION (Source: AECOM)

Structural challenge for a perfect integration: Very good example of an innovative understanding of the city, integrating the road connection with the multimodal hub and new public space in a wide bridge interesting structure.

LESSONS LEARNED FOR RPTH:

Big piece of the city above the existing rail tracks by complex bridge structure. Integration of the bus platforms and parking area below the structure with a direct link to the waiting area (at the same level as the train station waiting area).

6.3.9 C.5. OSLO NEW STATION, NORWAY

<u>Main challenge</u>: Redesign of the station to create a multimodal hub combined with mixed-use development.

<u>Solution:</u> Demolition of the old station and redesign of the urban space improving the connectivity in the city.

<u>Opportunities</u>: New public space, pedestrian links, great amount of new space for offices, residential, commercial

and the biggest conference centre.

<u>Station:</u> Extension of the existing station. End of line type station.

The project consists on demolishing a big part of the existing station, to build a 4 stories tall structure that will unify the station. It will include 2 floors for offices hanging over the station. Also, an adjacent U-shaped building will be occupied by the biggest conference hotel in Norway.

Currently, the Central Station receive 150,000 travellers every day, number expected to double in the next few years, rendering the current structure obsolete. Space Group´s project will be able to grow in stages. Construction was planned to start on 2013, during 5 to 10 years.

The urban planning idea is based on a continuation of a North-South grid to establish a connection from the Opera area to the city centre.

Today's chaotic situation resulting from decades of just behind time planning, displays an alarming lack of cohesion or flexibility to absorb the evolution of the function or the city it is meant to serve.

The strong East – West axis has outplayed its role - and is replaced by a North-South axis, from the forest to the fjord - from the inner city to explosive urban development in the bay, with the new opera. The new station axis neutralizes the old stigmatized division between East and West and reflects the real shift of public flows as the city expands east. New Oslo Central Station belongs to the whole city.

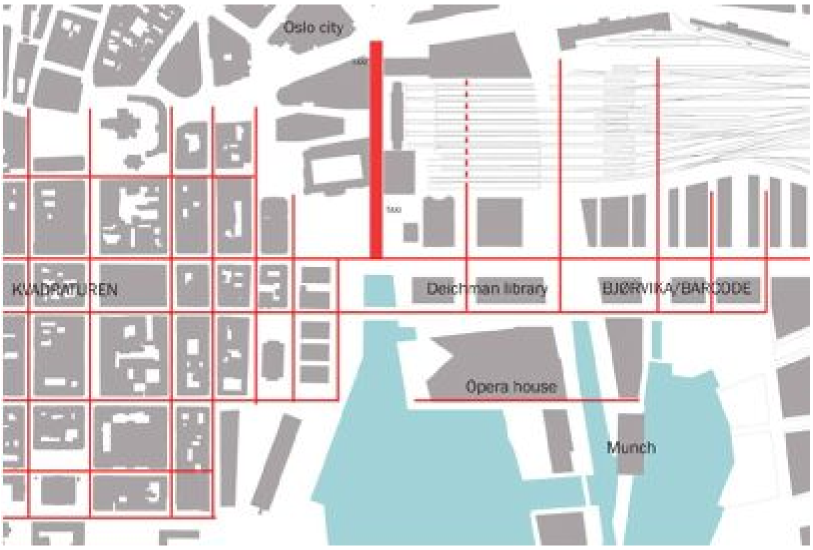


Figure 6.21: DIAGRAM SHOW ING THE MAIN URBAN CONNECTION AXIS (Source: Space Group)

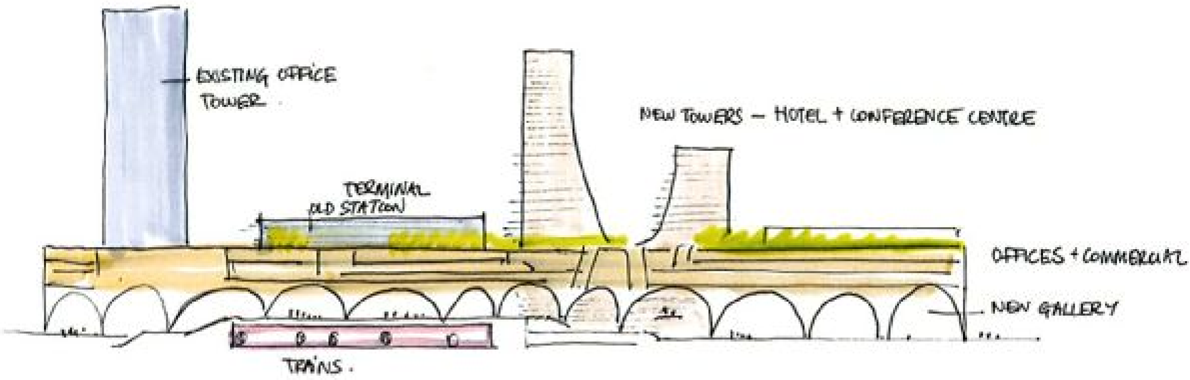


Figure 6.22: SECTION ACROSS THE LONGITUDINAL GALLERY (Source: AECOM)

Reconfiguration based on new street connections: The Nordic ongoing project will be one of Europe's most advanced public transportation hubs. It frees space after demolishing the old station volume and building new complex including office towers, residential and commercial use in a new covered gallery that links the different city accesses.

LESSONS LEARNED FOR RPTH: Demolition of part of the existing station in order to build an extension to it and free space. Reconfiguration of the direction of the main pedestrian flows in the city. Covered public space for citizens.

6.3.10 D. World Heritage case study:

D.1. SANTIAGO DE COMPOSTELA NEW STATION, SPAIN

The Historical old city of Santiago de Compostela is an UNESCO World Heritage Site. Main challenge: New station that connects the city keeping the railway alignment

<u>Solution</u>: Bridge building and topographical new park

<u>Opportunities</u>: Urban regeneration of the area and green public space modifying the urban landscape. Status: Project Competition, 2011

Station: New station replacing the existing one. Throughput type new station. Bridge type station. Bus station fully integrated in the architecture.

The new intermodal station of Santiago de Compostela faces three objectives:

- **Assume the status of the capital city**
- **Regeneration of the degradated area due to the railroad**
- **Assume the role of being a gateway and first image of the city**

The station building is built as a bridge at level +9.00 meters with an entrance by walkways and a new plaza using a topographical solution. At that vestibule level there are the Train Station and the Bus Station, both encapsulated in two volumes lobbies.

At level +3.00 meters there is a "mobility platform" for pedestrian users of public transport networks and cyclists, as well as a taxi area and Kiss & Ride.

The access to the train platforms is by mechanical escalators down from the station and waiting areas, and exactly

the same for the buses. There is a small retail area and offices for the High Speed Railway and a viewpoint cafe on the top of the volume. Two levels of parking at -9.00 m and -12.00 m are placed below the buses area.

The elevated station links the main flows of the city perfectly by elevated walkways and the new plaza.

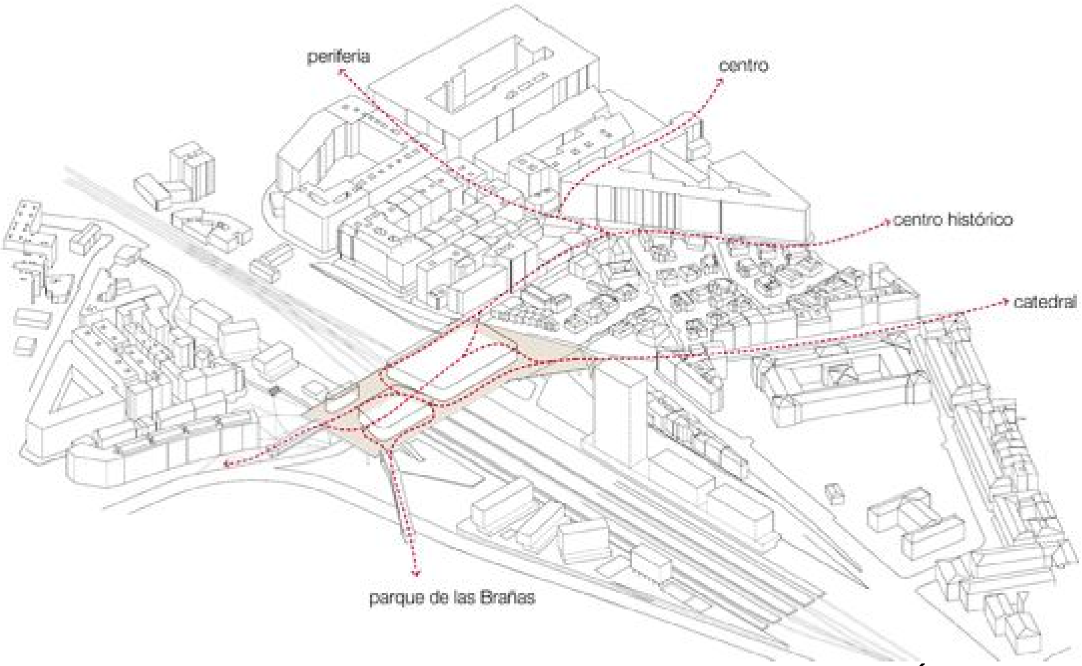


Figure 6.23: URBAN MAIN CONNECTIONS (Source: Herreros Arquitectos, Rubio & Álvarez Sala)

LESSONS LEARNED FOR RPTH: Throughput type new station. Bridge type station. Very similar to RPTH for keeping the existing tracks level and urban constrains on both sides, so the station is elevated above the tracks with the access down to the platforms. The connection with the city is through a public space for the citizens that are coming down to the city level. The integration with the bus station is full and excellent. The station is combined both for trains and buses and the connections down link with the train platforms and the bus platforms below the bridge building.

6.3.11 E. Rail Baltica cases:

E.1 PÄRNU AND TALLINN PÄRNU

<u>Main challenge:</u> Transportation hub

<u>Solution</u>: Bridge terminal above the tracks

<u>Opportunities</u>: Gather different transportation modes

<u>Station</u>: New station. Throughput type new station. Bridge type station. Technical data: Gross area of 1.070 m2

Figure 6.24: SITE PLAN (Source: Voistlused.arhitektuurikeskus)

The site location is conceived as a strategic point of a new gate to Europe and at the same time a daily use network for work or school connections by the locals. The terminal gathers the new High Speed and local trains station and the access to an outdoors bus station and car parking.

Very reduced elevated terminal that uses the maximum outdoor space for the bus platforms and car parking surrounding the area.

The construction cost is a crucial consideration in the project and the cost of the tunnel solution has been analyzed and discarded for its flood risk during construction.

LESSONS LEARNED FOR RPTH:

The formalistic shape of the building appearing an insect could be decided to be recognized and become an iconic image of the gate of Europe, but the indoor space being so reduced and thin makes the walkways very long. So the walking distances are multiplied and some of the pedestrian walkways seem to be too long.

It is a bridge solution, but in the longitudinal direction, that is why the walking distances are multiplied in the other direction. The typical bridge options (crossing the tracks) solve the flows with the architecture and the walking distances are minimized.

6.3.12 TALLINN ÜLEMISTE STATION

4 Proposals for the Ideas Competition in 2014

<u>Main challenge:</u> Transportation Hub integrating a new Railway

Station, Bus station, Parking, Tram and urban improvement of the surroundings

Solution: Two main concepts: Tunnel Terminal / Bridge Terminal

Opportunities: Office and Commercial buildings and new public space for the city

Status: Project Competition, 2014

TUNNEL TERMINALS: Proposals PUHKUS and OOTUS

BRIDGE TERMINALS: Proposals TAGASI and AURUMASSIN

6.3.13 PUHKUS: Tunnel Terminal

This proposal is very attractive for the city due to the integration of the architecture in the cityscape.

A wide roof covers the different uses for the station and opens an outdoor space for the citizens. The accesses to

the railway platforms are planned through a tunnel, so the roof just covers the platforms partially and gives continuity to the terminal building.

The two terminals, railway and bus station, are placed below the triangular roof, one of each side of the court, connecting with the bus platforms on one side and the tunnel to the railway on the other.

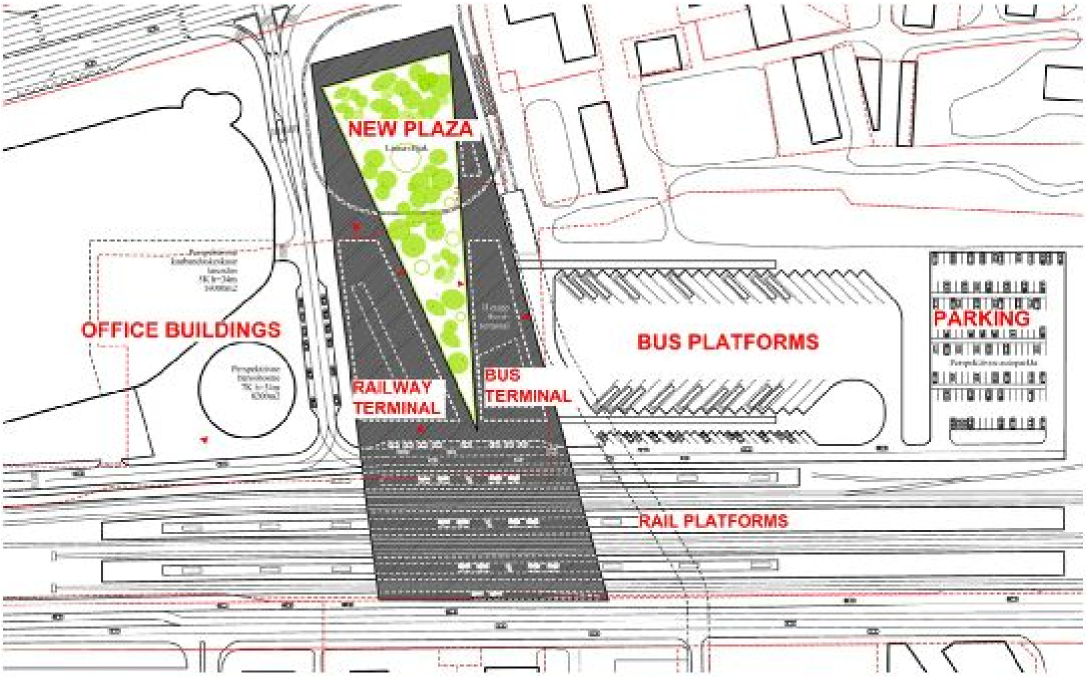


Figure 6.25: PLAN (Source: Internet)

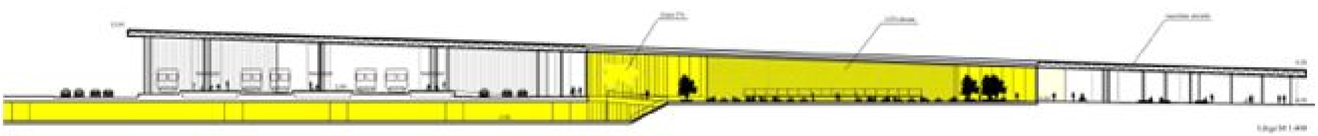


Figure 6.26: SECTION (Source: Internet)

BEST PRACTISE – TALLINN PUHKUS

Efficient layout regarding walking distances and total integration of the bus station into the architecture. Interesting public space for the city.

LESSONS LEARNED FOR RPTH: Minimum impact in the city image, very respectful with the heights due to the horizontal proportion. Efficient layout.

6.3.14 OOTUS: Tunnel Terminal

The terminal building consists of two long and thin pieces that cross each other creating different spaces around them. One side is a new urban space for the citizens, that connects the terminal area with the city. On the other side there is a car parking very well placed serving the terminal. The bus station, in front of the plaza, brings the passengers from the city through the waiting area to the bus platforms. And between the bus station and the railway tracks the tram runs and stops in the multimodal hub.

The longest piece, one storey high, runs over the tracks as a roof covering partially the railway platforms and indicating the underground flow which is beneath it.

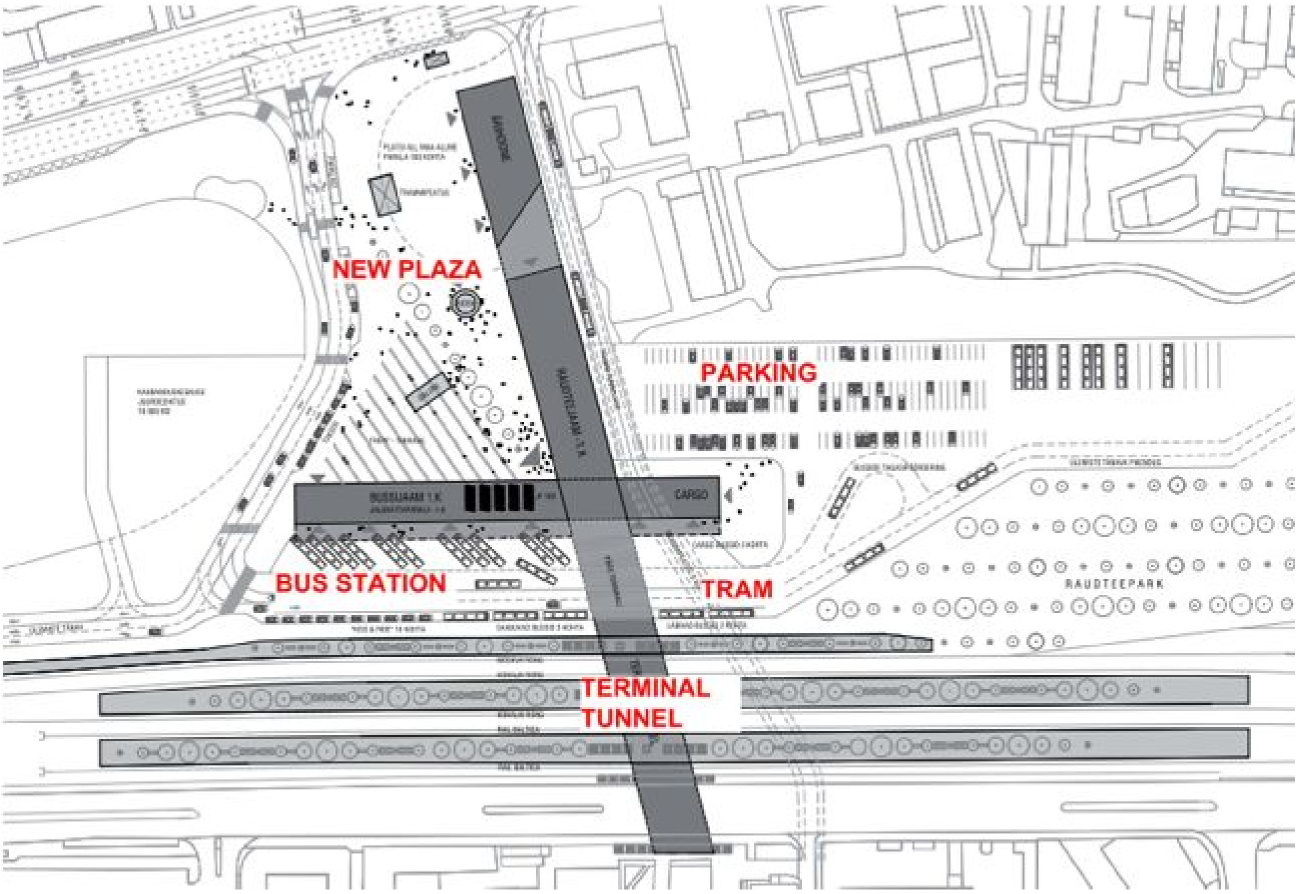


Figure 6.27: PLAN (Source: Internet)

BEST PRACTISE – TALLINN OOTUS

The new public space created articulated by the two wings of the building links and opens the terminal to the city.

LESSONS LEARNED FOR RPTH:

The bus station arrangement along in parallel to the railway tracks multiplies the distance from the tunnel access in the terminal to the railway platforms exits. The terminal and the other uses are very well connected with the city, but ignoring the main connection with the platforms. It functions better as a bus station than a railway terminal.

6.3.15 TAGASI: Bridge Terminal

The reconfiguration of the urban space allows a long view of the terminal from the city. The new office buildings are designed following the existing urban fabric and creating a secondary street giving access to them on both sides and letting the plaza be a regular and pure rectangular shape, a pedestrian corridor that articulates the accesses to the different levels where the bus station is and the tram is running.

For the car parking the proposal integrates it in another building next to the bus station. Both stations are integrated in the city structure.

The elevated terminal building allows the acceses to the railway platforms from above.

The urban planning proposal is very attractive for the city, the long plaza and the office buildings give a wide and open view towards the city from the terminal building and a new public open space for the citizens connected to the multimodal hub.

LESSONS LEARNED FOR RPTH:

The terminal seems to be an independent volume from the masterplanning, even if there is a bridge intention the connection only applies for the platforms, it does not connect with the neighborhood that is on the other side of the tracks.

The formalistic structures that frame the terminal and tracks don´t seem to serve for a canopy roof purpose covering the passengers, and that gesture effort could have been applied in a better connection of the terminal with the plaza, sloping up to the waiting area.

Deeper studies might be done in order to detect if the connection with the other neighborhood would be a consistent upgrade for the city.

6.3.16 AURUMASSIN: Bridge Terminal

The access to the terminal is directly from the new plaza and the bus station is placed along parallel to the railway tracks, so the same building for the terminal access integrates the waiting area for the bus station.

The office buildings and new plaza, placed alike the previous proposal, orders the city very well, keeping the outdoor car paking and bus platforms away from the new public space.

The bridge terminal connects both neighborhoods.

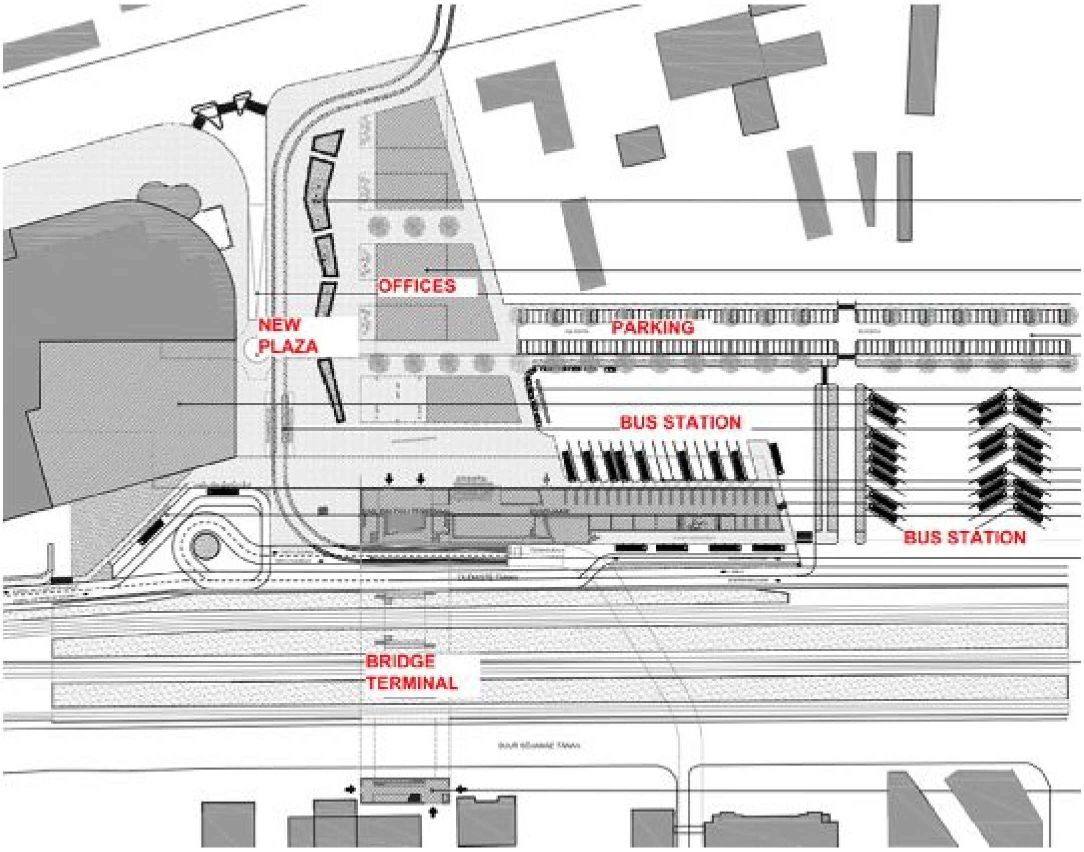


Figure 6.28: GENERAL PLAN (Source: Internet)

The longitudinal car parking is placed efficiently in the road system letting run in parallel with the bus platforms area, in a cheaper solution than planning a building only for integrating the parking, which may be not necessary if there is enough space for the development.

BEST PRACTISE – TALLINN AURUMASSIN

The order of the masterplan is very effective and well organized for the urban development and creation of a new urban space for new building ans new public space in relationship with the new multimodal hub.

LESSONS LEARNED FOR RPTH: Minimize the walking distances, so the access to the terminal is direct from a public space The bridge solution should connect both sides of the tracks, both neighborhoods.

This one is a very good exercise of deciding that the outdoor spaces for the parking and the bus platforms should run in parallel, so they are both linked to the main axis and the walking distances to them are minimized.

6.4 Work Package Summary and Conclusions

6.4.1 General aspects

- **Whatever their scale, high-speed rail station projects always have the opportunities to improve urban development and regeneration.**
- **They are always part of larger development and transport schemes, combining local, regional, even national scales.**
- **The mulit-modal interchange are by definition complex multi-partner and multi-operator projects, involving multiple financing and multiple stakeholders throughout all stages.**
- **Opportunities for mixed-use urban development.**

6.4.2 Urban scale

- **Free space: Replacement of old train warehouses/ workshops/ old buildings/ part of full existing station... need to demolish in order to free space and reorder the urban area. Use of maximum space as possible in order to create a better reconfiguration of the city taking into consideration the new creation of public space at its surroundings.**
- **Integration of the bus station close to the terminals. Either the bus terminal and bus platforms both integrated in the architecture of the multimodal hub. Or both bus station and bus platforms adjacent to the train architecture and a very efficient connection (vertical or horizontal), (outdoors or indoors) even through the landscape in a public space area.**
- **Urban connections with the adjacent streets, improvement of connections between neighbourhoods.**
- **Avoid barriers and make pedestrian flows efficient.**
- **Protected buildings and potential landscape areas to take as priority of respect and strengthen them as an opportunity to improve the space.**

6.4.3 Architectural aspects

- **Improvement of the railway platforms canopy roofs**
- **Accessibility for pedestrians and reduced mobility persons. Platforms at level of the train access levels.**
- **When the level of the existing tracks is maintained and no modification of them is possible: Either the station should be elevated above the tracks (Lisbon, Santiago, Tallinn examples...)**
- **Or excavated and access planned from below the tracks (Tallinn examples) or adjacent to the tracks, for this a considerable amount of land is needed (Torino, Parnu).**

6.4.4 Railway Aspects

- **Coexistence of two gauge track with multipurpose sleepers. The international standard gauge track is used in mostly of the Occidental Europe (UIC, 1.435 mm). In Spain, there is a coexistence of the two gauges: the international UIC and the conventional (1.668 mm), adopted in Spain and Portugal. There are many stations in Spain where due to the new High Speed Railway implantation there is a coexistence of both gauge tracks. The most important ones are in Madrid: Atocha and Chamartin, where the new tracks have been built either occupying extra area or changing the gauge track for all systems of High Speed.**

6.4.5 Phasing and Coordination

- **The possibility to use the old station and existing accesses while construction of the new one.**
- **A planning as detailed as possible, at a level that the study requires, to be able to execute the total of the intervention in phases, being one of the most important inputs, in order to determine the scope of each phase, the needed economic financing, even though is a concession or a public- private collaboration.**
- **Each phase in which the intervention is divided must be functional and operationally feasible (for the previewed modes of transportation in the multimodal hub or surroundings), as well as the flow and accessibility to them.**
- **The coordination and possible agreements with the companies of the affected services is crucial.**
- **It could be the possibility of existing services that determine the engineering solution to adopt. (For example, city water or electricity supplies, the affection could be greater for the citizens than changing the design).**
- **Considerations at defining the phases, trying to minimize the temporary situations until the completion of the construction. (For example, if one of the services is affected in one of the phases and needs to be replaced with a temporary service, then it should be used in the following phases avoiding more temporary situations.**

7 WP 1.5, 1.6 & 1.7 - Passenger and Traffic Flow Forecasts

7 WP 1.5, 1.6 & 1.7 Passenger/Traffic Flow Forecasts and Stage 1 Conclusions

7.1 Forecasts and Network Flow Diagrams

'Appendix – WP 1.5 & 1.6 Demand Forecasting Note' to this report states the demand forecasting uplift percentages which have been applied for the purposes of this study. Client agreement of the note is also included within this appendix.

Within 'Appendix – WP 1.5 & WP 1.6 2 – Flow Diagrams', to this report, are network flow diagrams for the 2015 Base year (as surveyed), 2025 Opening Year (factored flows) and 2050 Future Year (factored flows).

7.2 Current Situation Analysis: Conclusions & Recommendations

The analysis of the existing conditions has been essential in order to establish a clear direction for the following design phases of the project. The 'best practice' review of existing multi-modal hubs has supplemented this analysis, with the study team having identified key principles and design elements which could ideally be applied to the design optioneering for the RPTH.

As an overview, analysis of the current situation suggests that there exists numerous opportunities to improve urban development and regeneration as part of this project. Being a multi-modal transport scheme, this will likely involve development at a combination of scales; local, regional, and even international. The integration of a bus station either within the design or close to the terminals has been identified as a key component, with significant passenger movement having been identified between train and bus (c. 40% of train passengers as per station survey).

The location of the RPTH has been shown to be well connected (both at an urban scale, and with other public transportation modes), and efforts should be made to ensure that connections between neighbourhoods are maintained and where possible, improved.

From a railway engineering perspective, a strong case has been made for the inclusion of a two gauge track with multipurpose sleepers; such as the kind currently used across Europe. Existing examples in Spain have been cited, where high speed rail has been incorporated into existing rail infrastructure in similar circumstances to proposals for the RPTH .

8 WP 2.1 - Elaboration of Transportation Hub Alternatives

8 WP 2.1 - Elaboration of Transportation Hub Alternatives

8.1 Urban Analysis

The study area is shown in Figure 8.1 below. The first step in the analysis was to undertake an in depth urban study of the zone. This has been carried out to identify the urban constrains, understand the potential of the different areas and study the current situation of the area in relation to the future planned changes for Riga city.

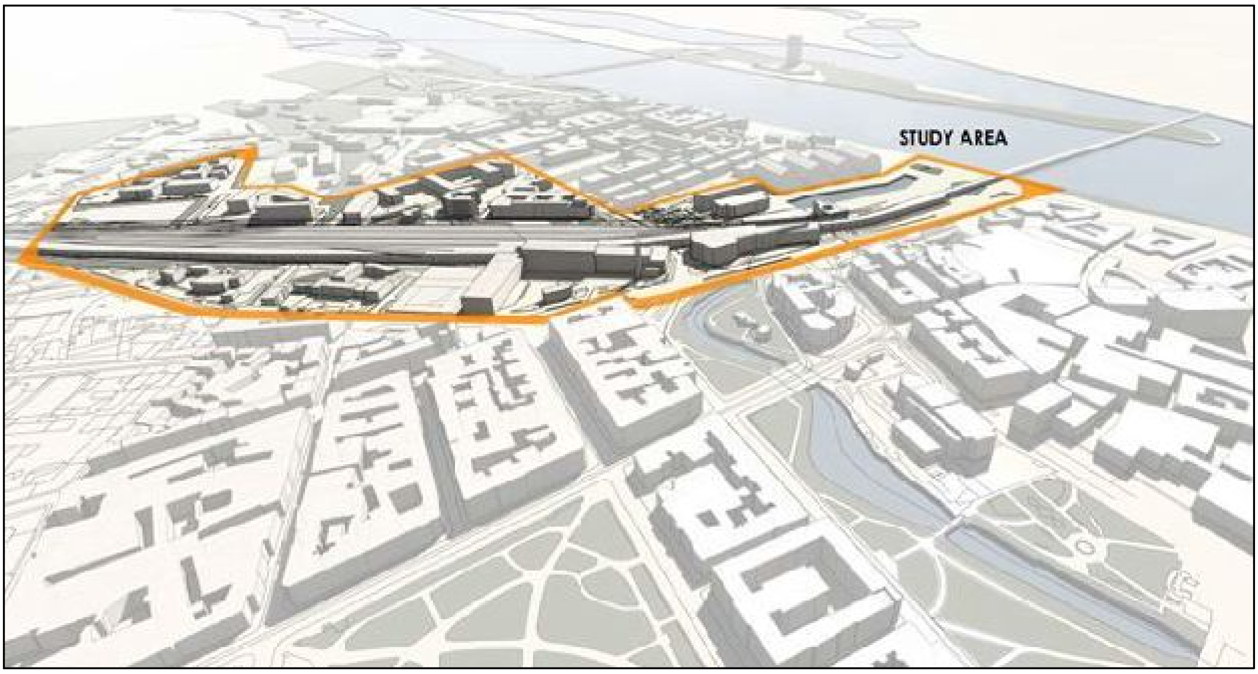


Figure 8.1: Study Area/Zone (Source: AECOM)

13. janvāra iela creates a significant barrier between the Old City and the Market Area and there are almost no at-grade pedestrian crossings. The Road barrier is followed by the Railway barrier and the Coach platforms all the way to the canal. The main aim of the urban proposal will be to provide a clear connection for pedestrians from the city to the canal where a new public space could be created. The access would be through a permeable bridge structure that would replace the current longitudinal embankment.

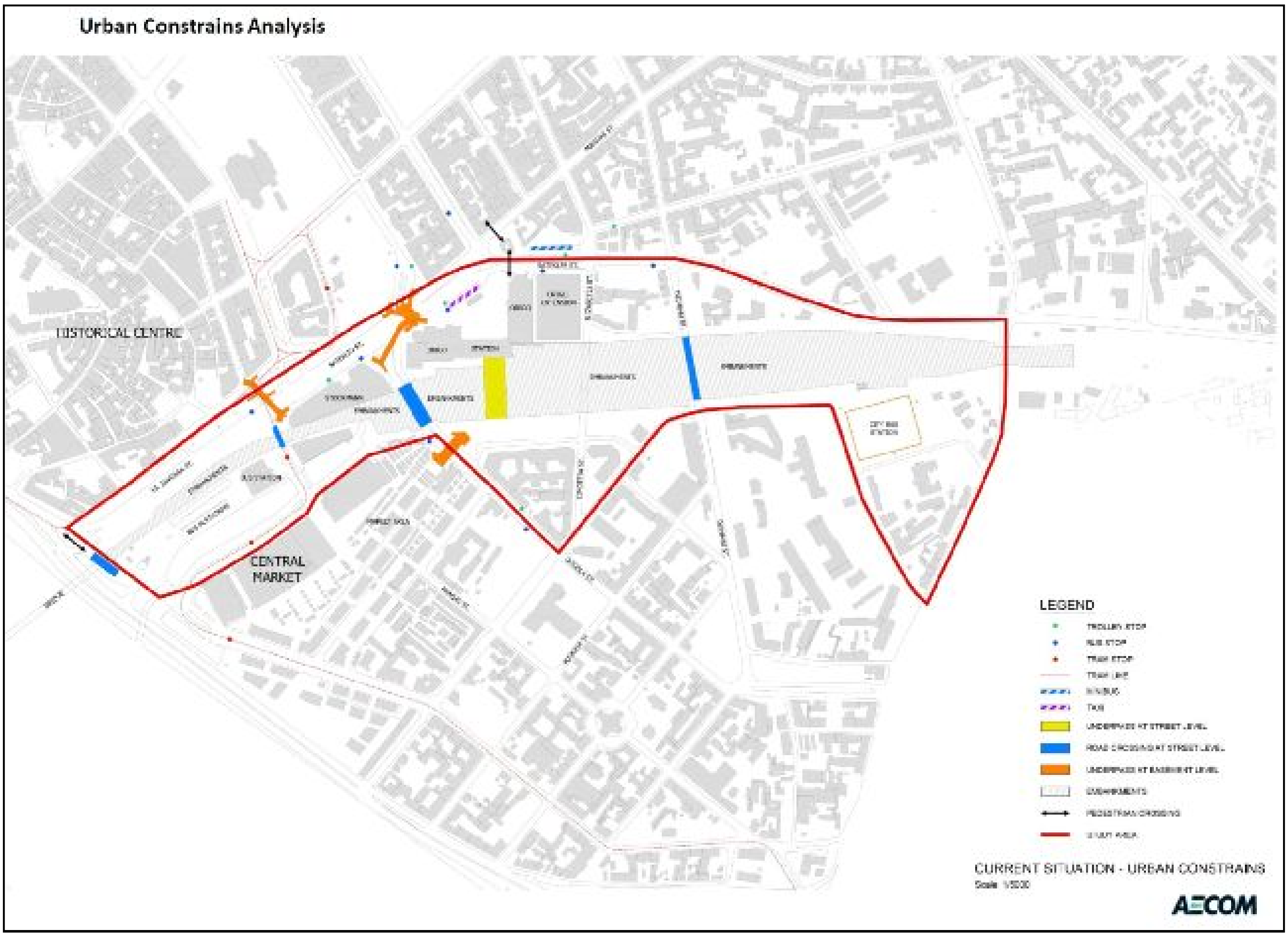


Figure 8.2: Urban Constraints (Source: AECOM)

Currently the canalside is completely abandoned and functions as the back façade of the market area for loading and unloading. The aim here is to recover the water feature towards the city and regenerate the area using the potential of the natural landscape.

Due to the proposed Rail Baltica tracks it has been determined that theTitanik Car Parking will have to be significantly altered or removed. This intervention could free the land next to the water and could provide a wider path for pedestrians, solving the current problem of connectivity at that point.

The Coach platforms and current Coach Station would also be affected by the Rail Baltica tracks and would have to be reconfigured. The proposal for this area is to keep some bus traffic at the end of the land, next to Krasta iela, and maintain the flow of some of the buses. The touristic buses are the type that would remain and they can turn within the proposed Tourist Information point. This Tourist area is related to the new public space, a new attractive area with great views of the Market's historical buildings and at the same time have direct walking access to the Old City.

At this area, a new green promenade would link to the new multimodal hub and a pedestrian bridge would connect with the Market area. The canal would once again be completely integrated in the city and become an important element in Riga. Below the new structure that replaces the embankment, commercial and cultural use for exhibition galleries could be built, as well as a free-standing volume for a possible museum (this can be placed where the coach station is now). As the Rail Baltica project represents a new pan-Baltic transportation infrastructure, the museum could be dedicated to the Baltic Heritage, and could create a place which is an attractive point for cultural events.

There is an immediate possibility of connecting the new green area with Stockmann.

At the Market river bank the existing lower level for loading and unloading would be covered by extending the street level and provide a pedestrian promenade. For loading, only the ramp at the East side would be used, and the one in the west would be closed, in order to provide continuity at the street level.

The flea market would become a new station plaza and the existing market would be relocated, preferably with an integration project providing new safer modular structures below a common roof, for example where Titanik car parking is now. The new market and relocated market will find a place in the urban regeneration of the area. The flea market is highly used by the citizens of Riga and can remain as a traditional space. The flea market would be upgraded, as well as the external areas around the historical buildings. They could all be upgraded as part of an integration plan.

13. janvāra iela is a very wide avenue and according to a traffic and capacity study the lanes can be reduced at some points allowing for narrower pedestrian crossings and the introduction of a green boulevard in the middle of the avenue.

Gogoļa iela is one of the road barriers that divides the market area and the multimodal hub. There is a requirement for a pedestrian crossing at grade.

There are two options of upgrading this specific flow ambience. Either by closing the underpasses altogether and letting the people cross streets only on surface or upgrade the landuse, lighting and other urban design elements within the tunnel to make the pedestrians journeys through them safer and attractive.

The possibility of building a specific Rail Baltica Station has been studied. This option would increase walking distances and services from one station to the other. Please see the diagram of the Railway station options in APPENDIX - WP 2.1 – Multi-Modal Hub Alternatives.

8.2 Multi-Modal Hub Alternatives

The elaboration of the alternatives is based on grouping them into three different categories according to the development strategy:

Group A builds only over the tracks and keeps the embankment as it is, closing or upgrading the existing underpasses. The Railway Station would be an elevated station with good views and the Coach Station would be maintained where it is now, with the reconfigurations needed for the coach platforms affected by the proposed Rail Baltica tracks. The car parking would be limited and the walking distance between modes of transportation would be the maximum of the three proposals.

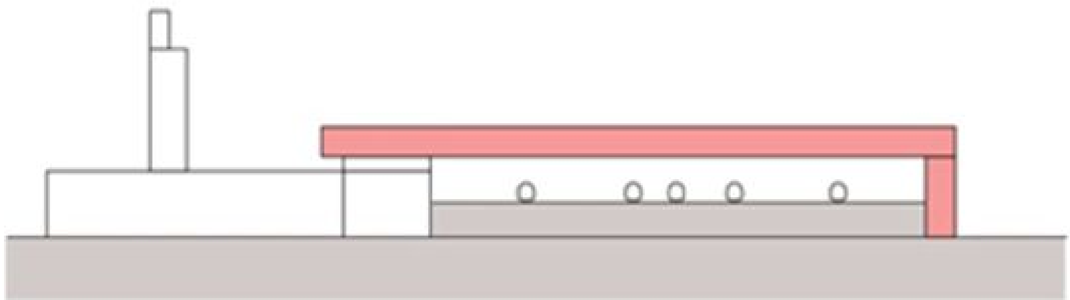


Figure 8.3: Group A (Source: AECOM)

Group B builds the new station below the tracks providing a Railway Station and a new Bus Interchange at street level and the possibility of Car Parking on the basement level, all at the embankment 3. This option is not visible in the city and despite the economic effort and construction complexity of opening the embankment 3 the new hub is hardly a recognizable building from the outside. The new platform canopies would be the most visible elements from the city.

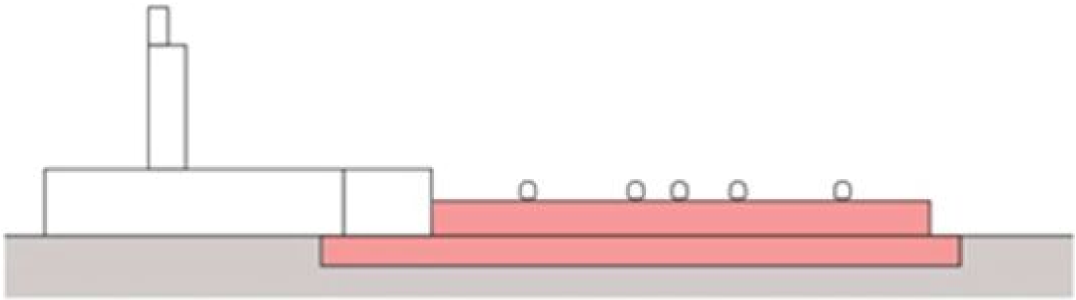


Figure 8.4: Group B (Source: AECOM)

Group C combines the previous solutions. There will be an elevated station for the Railway Station with access from above to the new platforms. A new Bus Interchange is placed at street level, emptying the embankment 3. It also offers also the possibility of having car parking both at street level and basement level. This solution is the most efficient and interesting one, because it gathers all modes of transportation, minimizing the walking distances between all modes of transportation, visible and compact with very direct vertical connections.

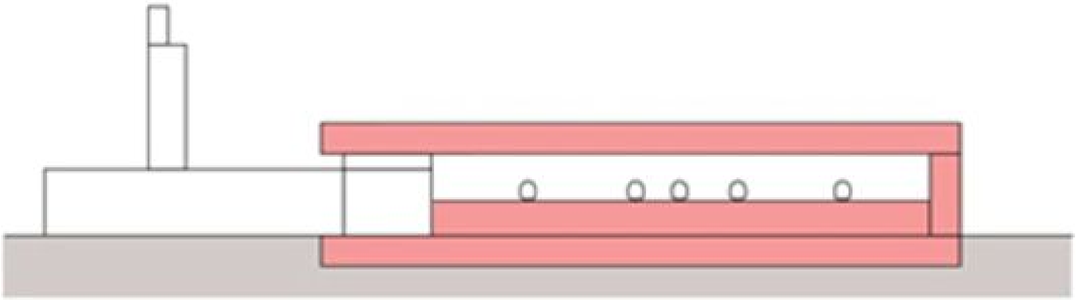


Figure 8.5: Group C (Source: AECOM)

The various options that have been developed and a detailed summary of each of the three groups described in this section can be found in Appendix WP 2.1 – Multi-Modal Hub Alternatives. Please note that Section 2.3.of Appendix WP 2.1 – Multi-Modal Hub Alternatives contains drawings for each alternative that are from a previous stage, so the floor plans do not include the revisions from the workshop in Riga (14th October 2015). The chapter of the best option includes revised floor plans, solving the traffic access issues and others discussed during the workshop.

8.3 Elaboration of the Best Engineering Solution of RPTH

Each of the alternatives has been evaluated through a multi-criteria analysis to determine the preferred option. Within Group C several design proposals have been studied for the elevated station ranging from the box building to the thin bridge building. All of them can work, but in order to use some space for retail and provide views of the city and cultural use as an attraction for the citizens and tourists, the larger solutions can offer more flexibility and area than the smaller ones.

There are different ways of developing the relationship between the multimodal hub and the front plaza. A wide cantilevered roof covering the plaza is one of the proposals, another one is to allow the box building to overhang the plaza.

However the most ambitious proposal and preferred option is to extend the box building over the existing glass façade which would compromise of retail or cultural functions. The extension would provide a wide covered space at the entrance which would form part of the plaza.

The best option allows part of the embankment 3 to remain as it is and frees most of it for a retail connection between the North and South, car parking, and a bus interchange. The desire to establish a strong interchange link by incorporating a bus station into the design itself partially reflects the findings of passenger surveys undertaken at the station, where passenger flows between train and bus were identified as major movements. The new bus Interchange is vertically connected with the Railway Station and the car parking on the basement level. The Interchange combines different bus services: the international coaches, the microbuses, city and intercity buses. The international coaches come from the South, Krasta iela and access the multimodal by Timoteja iela, which will be a New One way street. They would turn right through a new one way street behind the hotel, using some of the embankment land. And then by Turgeņeva iela back to Krasta iela. The main flow of private cars that come from the North would turn down in Gogoļa to Timoteja and access the multimodal station, the same movement would be undertaken by the kiss and ride which would be loacted in front of the Ministry of Transport.

The embankment 1 (at the current coach platforms) and the embankment 3 (where the multimodal station would be placed) can be built in stages with traffic diversions. The connection with Stockmann from the current Titanik building location could be built with a Jacked Box construction methodology.

Detailed drawings of the preferred option can be found in Section 2 of Appendix WP 2.1 – Multi-Modal Hub Alternatives.

Please see Appendix WP 2.4 – MCA Analysis regarding the full Multicriteria Analysis process.

8.4 Work Package Summary

At this stage of the project, the work package outcome establishes the three categories of multi-modal interchanges which could be adopted for Riga Passenger Terminal and Multi-Modal Interchange. And these three groups of design options are successfully taken forward for an initial appraisal through Multi-Criteria Analysis (MCA) technique to determine the best suitable category for Riga.

9 WP 2.2 - Modelling of Train Traffic

9 WP 2.2 - Modelling of Train Traffic

In order to carry out modelling it is necessary to prepare a timetable and an assumed track layout. The modelling then simulates the operation of the timetable and produces a prediction of the amount of delay that will be caused to trains due to the inadequacies of the track layout. These activities were undertaken for different options to develop a track layout for Riga RPTH that accommodates all reasonable predictions of 2050 train service and is therefore likely to be adequate in all future scenarios.

9.1 Train Service Specification

The aim of the train service specification is to define a reasonably optimistic but realistic assessment of the number and type of trains that will be using the station in 2050. This then forms the basis for determining the station layout, and verifying it by defining a timetable and undertaking micro-simulation.

Therefore the specification concentrates on defining service within the immediate vicinity of Riga station. It considers the morning peak period, which is the busiest time of day, and also the transition to the off-peak period which presents some challenges because some trains need to wait for longer periods or move into the depot. During this period the international trains also arrive in Riga. Therefore the morning peak clearly represents the busiest time of day, which the simulation covers.

9.1.1 Rail Baltica Train Service Specification

Rail Baltica trains will be of 1435mm gauge and we assume there is no sharing of tracks with 1520mm gauge trains. Therefore the two stations are operationally separate and because of the simplicity of the Rail Baltica facilities these are not timetabled in detail or micro-simulated.

The Rail Baltica main freight line passes to the south and east of Riga and all freight trains will take this route without passing through Riga station. However it is proposed to build a loop line for passenger trains joining the Rail Baltica route north and south of Riga. All Rail Baltica passenger trains will therefore serve Riga central station and Riga Airport. However Rail Baltica freight trains will not normally pass through Riga station.

The 2011 AECOM study predicted the international services would run at a frequency of one every two hours in each direction and this remains valid for the current study. International trains are assumed to be up to 400m long in accordance with the norms for such services. There is however an aspiration to run a greater frequency of international trains and perhaps also regional trains on the 1435mm gauge.

It is also proposed to run a shuttle service between Riga station and the airport. No demand figures are available for this, but airport users expect a frequent service to minimise waiting time and international experience indicates a maximum interval between trains of 15min for this type of service. This interval is therefore assumed for the airport service. Airport trains are likely to be shorter than other trains and a length of 100m is assumed.

9.1.2 1520mm Domestic Passenger Demand calculations

Pasažieru Vilciens (PV) supplied count data at Riga Central station for 2014. This database was used to define the baseline scenario for each corridor, see table below.

Corridor	Annual traffic	Monthly traffic	Daily traffic
Skulte	1,066,300	88,858	2,929
Sigulda	435,500	36,292	1,196
Aizkraukle	3,503,300	291,942	9,624
Jelgava	2,318,900	193,242	6,371
Tukums	4,198,800	349,900	11,535

Table 9.1: Baseline scenario *(Source: PV 2014 counts)*

In order to estimate how conventional railway demand is likely to evolve to 2050, two growth periods have been defined. Short/Medium term forecasts between 2014 and 2020, and long term forecasts from 2020 to 2050. High level demand calculations presented in this section form the basis for the definition of clockface timetables for each corridor. Given that no specific demand modelling has been undertaken for this study, considerations in this section are based on observed data and existing forecasts available for this study. The number of trains per corridor, rather than estimated ridership per train, is the key factor from a rail operations perspective.

Latvian Railways confirmed for this study plans to deploy new rolling stock units by 2020, improving service frequencies on most corridors. This package of enhancements is expected to reverse the recorded downward trend between 2008 and 2015, rising rail demand to +36.7% by 2020 compared with 2014. The proposed 2020 rail service is expected to regain passengers previously lost by the rail sector to other modes, as well as to generate additional demand new to rail. It has been assumed that patronage will grow proportionally to PV's proposed number of additional trains deployed on each corridor.

Additionally, rail demand on the existing network is expected to grow on average by 1.25% per annum between 2020 and 2030, and by 1.35% between 2030 and 2050[3]. The aforementioned growth rates have been applied to the estimated 2020 demand, and are considered representative of the likely evolution of conventional rail patronage. Although Riga is the main attractor of rail trips in Latvia, Rail Baltica is expected to enhance interchanges driving up conventional demand.

The implied assumption is that long-term uniform growth rates are expected on each commuter rail corridor. In practice this is the best estimate and assumption that could be made due to the lack of corridor-specific data, which is however partially addressed in the proposed 2020 timetable. Detailed demand modelling would be required to assess the impact of different timetable alternatives such as through service running. This exercise is however not expected to substantially alter the proposed service frequencies by corridor given the forecast loading results presented in this section and the role of Riga as main attractor of rail trips in Latvia.

[3] Overall growth rates from a 2011 AECOM study as confirmed by PV

The table below presents the estimated ridership by corridor based on passenger count data and previous demand forecasts.

Corridor	2014 Riga demand ('000s)	2020 Riga demand ('000s)[a]	2030 Riga demand ('000s)	2050 Riga demand ('000s)
Source	*PV, see previous table*	*PV figures increased by PV growth assumption*	*PV figures increased by AECOM growth assumption confirmed by PV*	*PV figures increased by AECOM growth assumption confirmed by PV*
Skulte	1,066	1,947	2,191	2,822
Sigulda	436	753	847	1,091
Aizkraukle	3,503	4,702	5,289	6,814
Jelgava	2,319	3,552	3,996	5,148
Tukums	4,199	4,798	5,398	6,953
Total	**11,523**	**15,752 (+36.7%)**	**17,721**	**22,828**

[a] Overall growth rate 2014-2020 +36.7%, change by corridor proportional to frequency changes proposed by PV

Table 9.2: Ridership by Corridor *(Source: PV and 2011 AECOM demand study)*

In order to forecast the maximum occupancy by corridor, annual traffic has been converted to peak hour patronage using coefficients from the 2013 AC Konsultacijas (ACK) rail study. This calculation returns a high-end estimate of the likely average traffic on each corridor, considering the peak period of the busiest month. The following assumptions form the basis for the calculations:

- October demand is used to calculate the train occupancy by corridor. ACK data shows that October is generally the busiest month with the more restrictive winter timetable in place. Seasonal traffic on the Tukumus and Skulte lines is highest in summer but this spreads the morning peak, and is therefore not representative of the busiest period at the station. Summer-only services on these lines cater for seasonal traffic fluctuations but generally run in the off-peak period.

- Average weekday traffic on each line is used to convert weekly to daily demand.

- Inbound and outbound traffic are roughly similar over the course of an October day on each corridor, when seasonal traffic is generally low. Count data recorded in 2014 evidenced that the average number of boardings and alightings for each corridor sits within the ±5% range.

- Peak occupancy often occurs outside Riga as demonstrated in the ACK report. A demand uplift parameter has been defined to account for this. This factor is calculated as the ratio between demand at Riga Central station and the maximum line demand, generally in the approach to Riga's urban conurbation.

- Finally, ACK coefficients allow the conversion of daily into peak demand.

The table below provides a summary of the inbound AM demand calculations for the 2050 scenario. Other periods have also been examined returning lower number of passengers per hour.

Corridor	Annual to OCT	Av. Weekday demand	AM Peak demand	Outside Riga factor	Inbound hourly Peak demand
Skulte	8.5%	15.0%	15%	1.5	936
Sigulda[a]	9.0%	15.6%	17%	1.25	367
Aizkraukle	9.0%	16.0%	18%	1.1	2,216
Jelgava	9.0%	16.0%	20%	1.1	1,891
Tukums	9.5%	15.5%	15%	1.2	2,103

[a] No data available for the Sigulda corridor, factors worked out as an average of other lines

Table 9.3: 2050 Demand Calculations *(Source: 2013 AC Konsultacijas report and PV 2014 counts)*

ACK data evidences that most passengers accessing Riga by rail travel within the Pieriga area. The figures in this study assume that long-distance services will also carry Pieriga passengers.

PV has confirmed to AECOM the technical parameters of an order of new trains. Line traffic calculations consider therefore the capacity of these trains as the likely characteristics of the 2050 passenger fleet:

- Length: under 162 m
- Seats: 400 to 450 per train (excluding folding seats and wheelchair spaces).
- Standing capacity: at least 450 passengers per train, at four passengers per square metre

Rail demand forecasts and train characteristics are processed to estimate the required number of peak trains on each corridor. Operationally compatible service frequencies reduce potential pathing conflicts. Skulte and Sigulda trains share for instance infrastructure in the approach to Riga station, thus coordination of train times is desirable for these lines. This also applies to Jelgava and Tukums trains.

As noted above, the new trains will be a maximum of 162m long so this should be considered as a minimum length for the platforms used by domestic services. However in accordance with international norms and to provide flexibility, for example to re-platform the international service, a platform length of 400m is recommended where possible. Consideration of platform length must also take account of arrangements for eastern access, which may also be required to provide an alternative exit from the platforms in case of emergency.

9.1.3 1520mm Domestic Passenger Train Service Specification Option 1

The table below shows proposed peak frequency by corridor and the implied peak occupancy for the low train capacity (400 seats) and high train capacity (450 seats) alternatives. In accordance with PV's load factor target[4], a balance between peak capacity and over-provision of seats is desirable. In this context, some standing in the approach to Riga during the peak seems reasonable. This forms train service specification option 1.

		Peak occupancy (train capacity)		Peak occupancy (seats only)	
Corridor	Trains per hour[a]	Low train capacity	High train capacity	Low train capacity	High train capacity
Skulte	3+0	37%	35%	78%	69%
Sigulda	2+1	14.4%	13.6%	31%	27%
Aizkraukle	3+2	52%	49%	111%	98%
Jelgava	3+1	56%	53%	118%	105%
Tukums	3+1	62%	58%	131%	117%
[a] **Pieriga + Long distance**					

Table 9.4: Option 1 peak (0800-0900) train frequency and occupancy *(Source: AECOM)*

The above table demonstrates that loadings would be less for the Skulte and Sigulda corridors, so it would be possible to use shorter trains or reduce the frequency. In contrast, trains from Aizkraukle, Jelgava and Tukums exceed seating capacity in the approach to Riga, which implies that some passengers will be required to stand during the peak period. This level of crowding is acceptable for a peak service, especially since it occurs only for a short section in the busiest winter month. If patronage rises above the discussed range, or the preference is to avoid standing, higher peak frequencies on each corridor could be considered. This option reduces waiting time whilst smoothing passenger distribution, but presents a potential issue linked with an excessive provision of off-peak capacity.

4 PV intends to maintain average load factor above 55% the number of seats. Source: PV activity strategy 2015-2020

The image overleaf compares the capacity of the new trains ordered by PV and the average number of passengers per train during the morning peak. It must be noted that the analysis presented in this note considers the peak hour rather than the busiest train. Higher load factors can be observed on specific trains that may require divergence from the regular interval pattern.

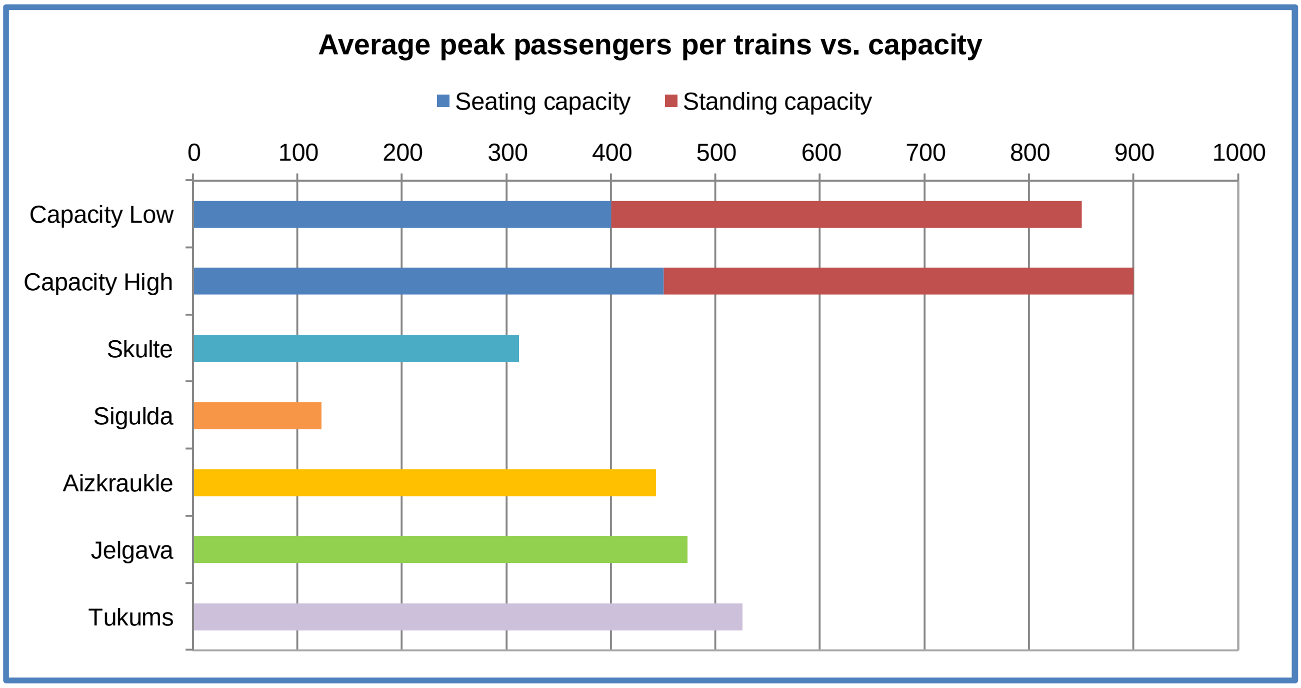


Figure 9.1: Option 1 peak passengers versus capacity *(Source: AECOM)*

In the off-peak period the Pieriga train service is assumed to reduce to two per hour on each route.

9.1.4 1520mm Domestic Passenger Train Service Specification Option 2

After micro-simulation of option 1 commenced, client comments were received indicating that PV was predicting a more intensive train service as follows:

Corridor	Trains per hour[a]
Skulte	3
Sigulda	2+1
Aizkraukle	4+2
Jelgava	4+1
Tukums	4+1
[a] Pieriga + Long distance	

Table 9.5: Option 2 peak train frequency *(Source: PV)*

This train service specification has therefore also been subject to timetabling and micro-simulation.

9.1.5 1520mm International Passenger Train Service Specification

The only international passenger trains serving Riga today are two each night, one connecting with Moscow and the other with Minsk and St Petersburg. Stakeholders do not envisage any significant increase in demand, so the frequency is assumed to be unchanged in 2050. They are assumed to be up to 400m long.

9.1.6 1520mm Domestic Passenger Services: Terminating or Through Options

All passenger trains today are advertised to terminate in Riga, although some are diagrammed to form onward services on other routes in the same direction or with a reversal. There are several benefits for passengers and for the train operator in terminating all trains in Riga:

- The train will probably wait longer so passengers have more time to board and alight
- Staff employed in cleaning/servicing trains can be concentrated in Riga, not out-based at a range of termini
- Timetabled frequency and train length can be optimised for each route individually
- Routes can be electrified in any order without having to consider the impact on through services
- Delay on one route is less likely to affect other routes
- A terminating train can make use of the terminating platform tracks

There are also possible reasons to run advertised through services through Riga:

- Some through passengers will not need to change trains
- Trains not reversing occupy platforms for less time, so platforms and trains might be used more efficiently

Most of these factors are not related to the design of the station and this study cannot therefore determine whether a terminating or a through service pattern is the best option for the operator. It was therefore agreed with the client that the chosen station layout should be broadly compatible with both service options.

This is achieved by testing the worst case option, which is to have each passenger train reversing at Riga and returning to the same origin point, except trains scheduled to go to or from the depot. Compared with a through service this option is worst case because reversing trains must wait for 12min whereas non-reversing trains can only wait for 5min, and because a series of trains entering and leaving a platform at the same end uses more capacity than the same number of trains entering at one end and leaving at the other.

Hence testing a terminating service also gives confidence that the station can handle a through service, or some combination of terminating and through service.

9.1.7 1520mm Freight Train Service Specification

Based on discussions with Latvian Railways, we understand that there is little scope for extra freight services beyond those currently projected (and mentioned below). The study assumes that no alternative 1520mm gauge east-west route through Riga is built (should one be built, there would be more capacity in the station for passenger trains). Latvian Railways has confirmed there is no possibility of re-routeing freight that currently passes through Riga, onto any alternative route that avoids the Riga area. Therefore, for the purposes of this study, there is no scope to re-route freight trains away from Riga station.

All freight trains passing through Riga station run to or from Šķirotava yard in the east of the city. It is not defined which route they take at the junction west of the river bridge. To minimise the likelihood of passenger trains overtaking slower freight trains, where possible each westbound freight train will follow passenger services westbound on both routes out of Riga station, and each eastbound freight train will precede eastbound passenger trains on both routes into Riga station.

In addition to today's traffic, it is understood that 2 freight paths per day are expected to operate to Jelgava, 10 to Bolderāja and 1 via Zemitani (not crossing the Central Station). It has been confirmed that freight trains can be scheduled to avoid the morning peak, reducing any potential interferences with passenger trains. However the timetable does provide at least one freight path per hour during peak times, which would for example allow for freight trains that should run earlier but are delayed. During the 0900-1100 period two freight trains per hour are scheduled in each direction, and if this continued after the end of the developed timetable it would give a total for both directions of

36 freight trains between 0900 and 1700, compared with 22 timetabled at present. More freight trains could operate in the evening and overnight.

Freight trains are assumed to be 800m long, requiring a track length of 850m to wait without blocking junctions.

9.2 Track Layout Options

Having established the approximate number of trains required, it is then possible to develop options for the number and layout of the tracks and platforms. Emerging conclusions from other parts of the study indicated that expansion of the station footprint would cause a number of difficulties. Hence this section has focused on measures that will minimise the space required for the tracks and platforms, subject to meeting essential operating requirements.

9.3 Rail Baltica Layout

An investigation has been undertaken into question of running Rail Baltica through either the north or the south side of the study area (which could be within the existing station footprint or outside it). This is also influenced by the relative difficulty of adding the Rail Baltica tracks to the existing railway outside the study area, but as the Rail Baltica project has developed a southern alignment we assume that this is preferred.

All north side alignments would take up the alignment of the existing 1520mm tracks west of the station, with the 1520mm tracks relocated on a new Daugava bridge just south of the existing one. Several north side alignment options were considered (the text below assumes Rail Baltica is single track east of Riga station, but similar considerations would apply if it was double track):

The only benefit evident of a north side option would be shorter access routes to the Rail Baltica platforms from the north side of the station, but this is offset by longer access routes to the relocated 1520mm tracks and would in any case be mitigated by the improved access in the new station building.

9.3.1 In area of tracks 11-13

Locating the Rail Baltica platforms in the area of existing tracks 11 to 13, with the western ends of the platforms close to the proposed station building (as shown below) would require demolition of the Stockmann building. Therefore this is not considered to be a viable option.

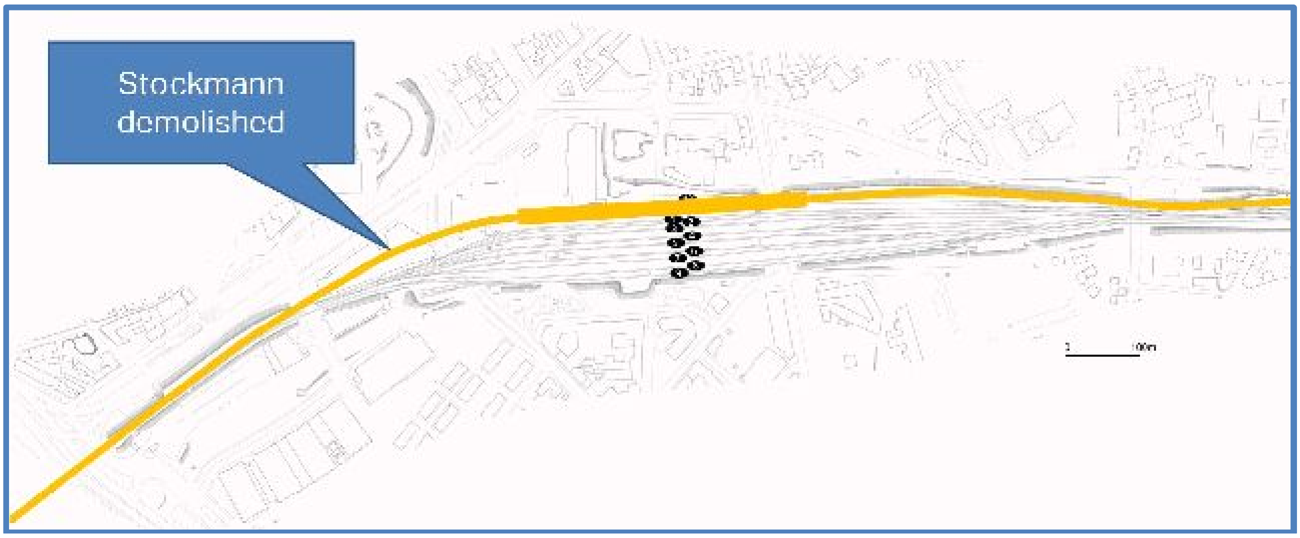


Figure 9.2: Indicative layout with Rail Baltica in area of tracks 10-12 and platforms adjacent to western accesses *(Source: AECOM)*

Modifying the above option to avoid Stockmann would locate the western end of the platforms about 100m east of the proposed station building (see below). This would result in long walks for passengers arriving, departing or interchanging with 1520mm trains or other transport modes. This option is viable but not attractive.

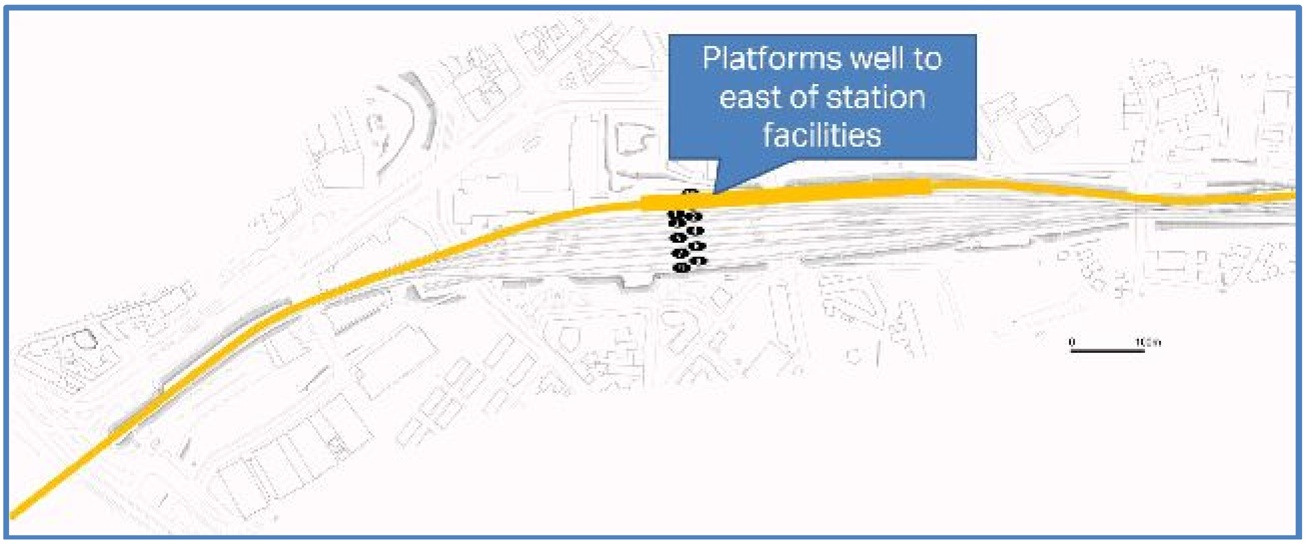


Figure 9.3: Indicative layout with Rail Baltica in area of tracks 10-12, avoiding demolition of Stockmann *(Source: AECOM)*

9.3.2 In area of tracks 1-3, keeping tracks without grade separatation

Locating the western end of the Rail Baltica platforms near the proposed station building without demolition of Stockmann would require Rail Baltica to be in the area of existing tracks 1 to 3. Flat crossings between 1435mm and 1520mm are ruled out, so if all tracks remain near the existing track level then 1520mm gauge tracks would be required on both sides of the Rail Baltica track to maintain access to tracks 10 to 13. This increases the width required at the narrowest part of the alignment at Daugavpils Iela, as there would have to be six or more 1520mm tracks (and one 1435mm track) instead of five today. It also means that trains could not run directly between the Skulte and Sigulda lines and any tracks other than 10 to 13. Therefore any trains running between these routes and the west, or the depot, would have to use the alternative connection north of Šķirotava, reversing there and in some cases making a second reversal. This is a severe operational disadvantage and makes it impractical for PV to run through services beween Skulte/Sigulda and destinations west of Riga. Hence, while technically feasible within the station area, this option is not operationally attractive.

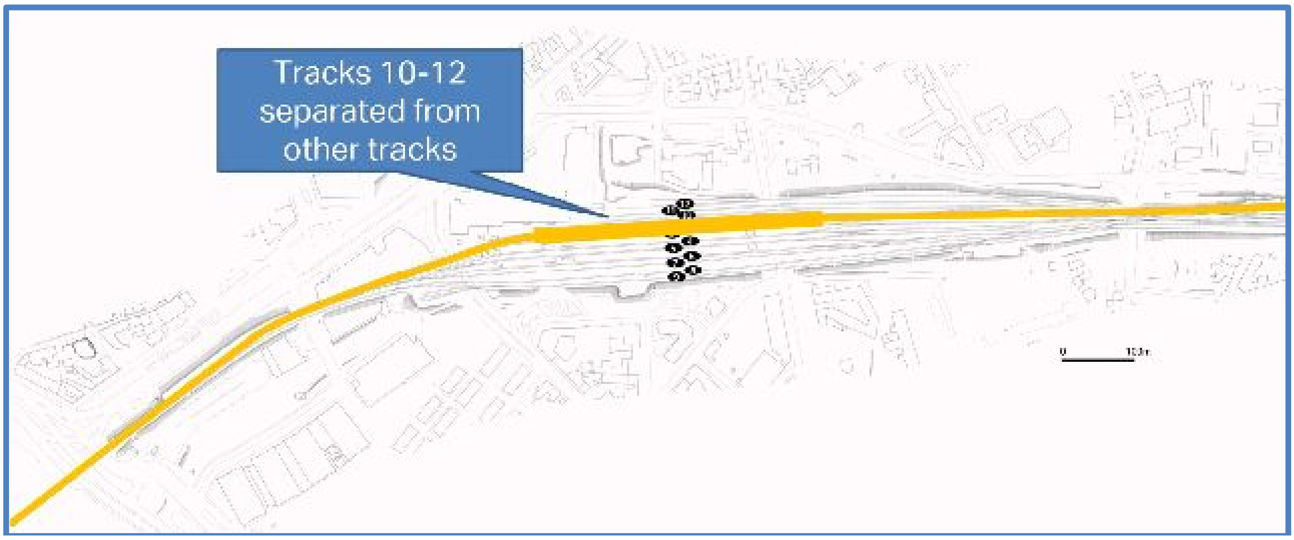


Figure 9.4: Indicative layout with Rail Baltica in area of tracks 1-3 ***(Source: AECOM)***

9.3.3 Area of tracks 1-3, keeping tracks 10-12 with grade separation

A similar layout to the preceding one could be provided within the station area, but grade separation to the east of the station (probably by elevating the Rail Baltica tracks) would allow a connection to be provided between the Skulte and Sigulda lines and the through platforms on the south side. We have not considered the feasilbilty of this grade separation in any detail, as it is outside the study area, but it is evident that:

- It would require a second level of elevation above the existing embankment for several hundred metres of the built-up area Daugavpils Iela.
- This option would require more width than the previous option in the same area, because not only would there be at least six tracks in total, but one of them would be on a flyover ramp requiring extra width for parapets and walkways.

This option is therefore considered to be technically feasible (at least within the study area) but more complex, and therefore likely more costly and disruptive than other options.

9.3.4 Area of tracks 1-3 abandoning tracks 10-12 with grade separation

A further alternative would be for Rail Baltica still to replace tracks 1 to 3 as above, but tracks 10 to 12 could be abandoned, so that there were no 1520mm tracks north of Rail Baltica in the station area. This option requires grade separation, similar that decribed in the previous option and with the same disadvantages, so that Skulte and Sigulda line trains can still access the remaining platforms south of the 1435mm tracks. It would release some land to the north of the station, probably of limited usefulness as it is a long and narrow strip. It would however require a similar area of land to the south of the station to provide replacement platform tracks if equivalent station capacity is to be maintained. This option is also considered technically feasible (at least within the study area) but more complex therefore likely more costly and disruptive than other options.

9.3.5 Layout Development

From the above it is concluded that choosing a north side option for Rail Baltica creates several major disadvantages within the study area, with no benefits to compensate. The remainder of the study is on the basis that Rail Baltica is to the south of the 1520mm tracks.

The Rail Baltica international service only requires one platform, assuming that the timetable can be drawn up so that the trains in both directions do not call at Riga at the same time. These trains may be up to 400m long. To operate the airport shuttle, two more platforms are needed since it is not reliably possible to terminate and reverse a train every

15min from a single platform, considering that Latvian Railways requires a reversing train to be timetabled to wait 12min in winter. However the airport trains would be shorter, probably 100m or less. Therefore one long through and two short terminating platforms are required.

The "saw-tooth" arrangement shown below for the Airport platforms is efficient in its use of space, and also provides a second through platform track. In this arrangement the airport service would normally use the terminating platform and the shorter through platform. Although single track is shown for the Rail Baltica line to the east, the arrangement is adaptable for double track.

Figure 9.5: "Saw-Tooth" track layout *(Source: AECOM)*

This provides a through platform track for international services (every 2hr in each direction), which could be 400m long or built initially at a shorter length. For the airport service there is a terminating platform track about 100m long and a second through platform track about 300m long (which might also be shorter initially). This layout has some spare capacity for future regional service expansion: the northern through platform is only used for a few minutes every hour and the southern one is unoccupied for around 10min every 30min (depending on the airport shuttle timetable) that would allow another train to call there.

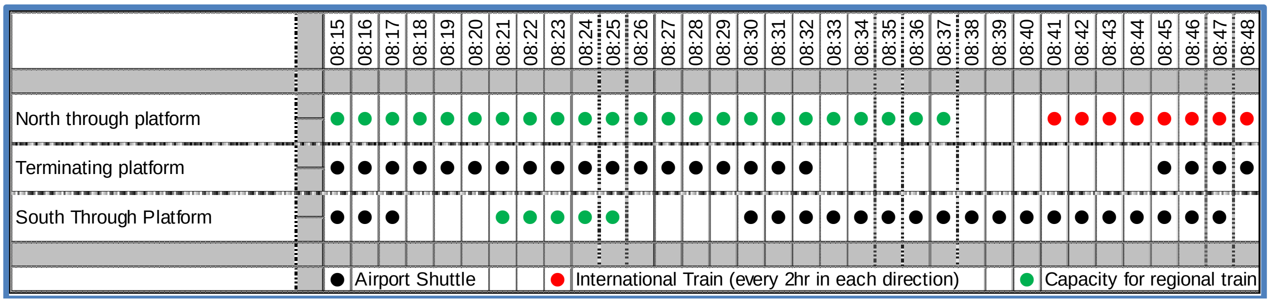


Figure 9.6: "Saw-Tooth" example platform occupancy *(Source: AECOM)*

An alternative with one through and two terminating platform tracks alongside each other would require another platform and at least 5m extra width in a confined area at the western end of the station, and would also have less operational flexibility. Greater provision, such as two 400m through platforms with two separate terminating platforms, would require even more width and cannot be justified in view of the extra capacity available with the simpler layout and the absence of any firm proposals to increase services on Rail Baltica. Extra capacity might be provided by adding a reversing siding to the east, with airport trains turning back here instead of in the station.

9.4 1520mm Layout Options

The track layout is determined by operational judgment based on the expected train service. Micro-simulation is then used to verify whether this is suitable. Several broad approaches were considered in defining the track layout to be tested. These are illustrated as schematic track layouts, not considering realignment which is necessary to achieve suitable platform widths and track spacing. This is considered in chapter 8.

Better Use of Terminating Tracks: Tracks 10-12 are relatively lightly used compared to other tracks, possibly because the track layout restricts the frequency of use more than it does with the through platform tracks. Adding some extra crossovers at the east end increases the efficiency of the terminating tracks, so that potentially Skulte and Sigulda trains using these platforms have little or no conflict with trains on other routes:

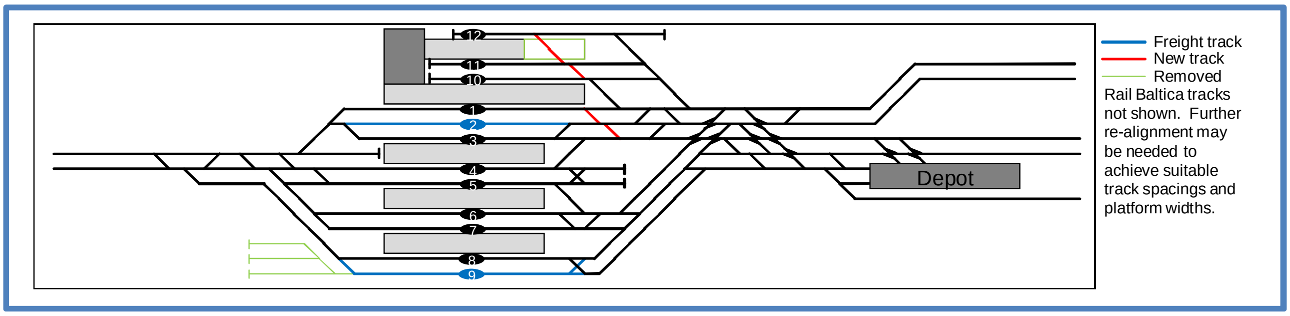


Figure 9.7: Better use of terminating tracks *(Source: AECOM)*

Removal of Track 12: This track is little-used at present and the platform between tracks 11 and 12 would be dangerously narrow if passengers were simultaneously boarding and alighting at both tracks. Moving track 12 northwards to widen this platform might encroach on land required for other purposes. Therefore consideration is given to whether track 12 can be removed.

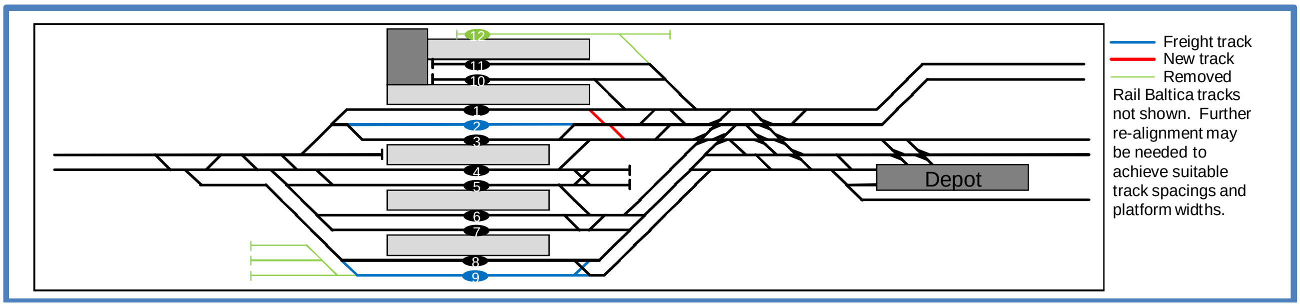


Figure 9.8: Removal of track 12 *(Source: AECOM)*

Combine Platform and Freight Tracks: The station currently has two non-platform through tracks 2 and 9, used for passing freight trains. There is an option to eliminate these tracks and run freight trains through the adjoining platform tracks 3 and 8 instead. Other tracks would be re-aligned to create wider platforms and/or space for Rail Baltica. Stakeholder views on this option are considered in section 4.

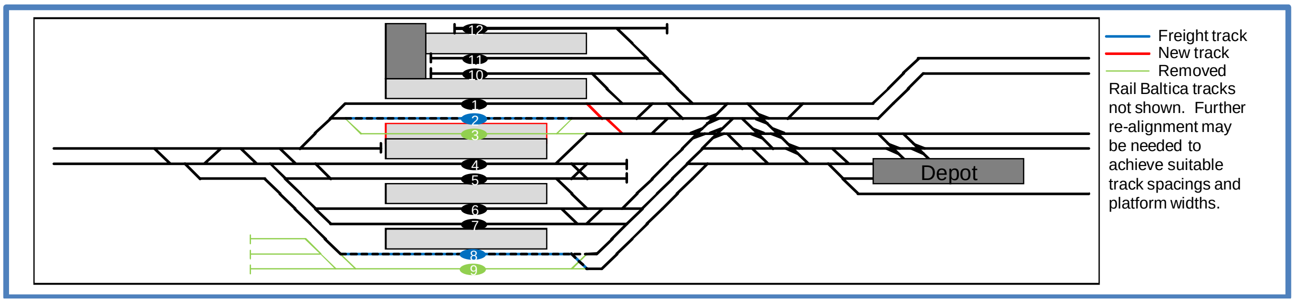


Figure 9.9: Elimination of Freight Tracks *(Source: AECOM)*

Remove Platform Tracks: In combination with other options or separately, one or more through platform tracks might be removed, probably from the south side where they could make space for Rail Baltica.

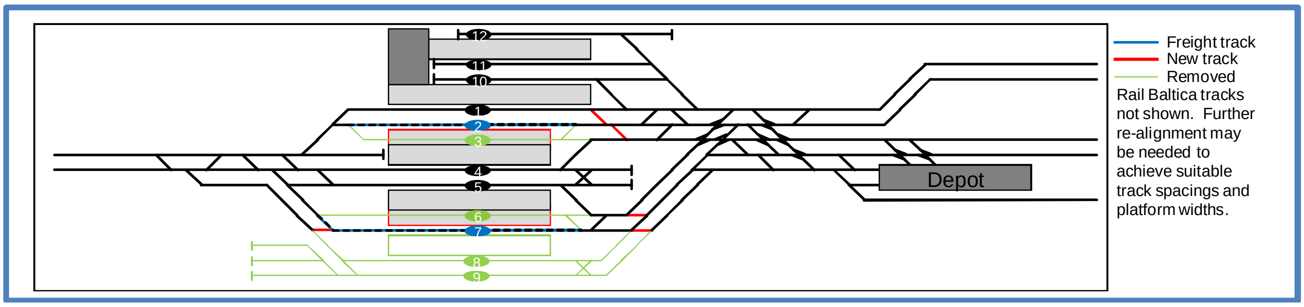


Figure 9.10: Example – elimination of Tracks 2, 6, 8, 9 *(Source: AECOM)*

Two Trains per Platform (not illustrated): Because the platforms are much longer than most of the trains, some consideration was given to the possibility of having two trains in one platform track at the same time. This might be achieved by adding signals in the middle of the platform, by splitting the platform with back-to-back buffer stops, or by operating rules requiring trains to approach an occupied platform cautiously. However this option was discarded principally because the main entrance to the platforms is right at the western end so there would be a long walk to trains using the eastern part of the platforms. The benefits of this option are also limited if all passenger trains reverse.

To assess the appropriateness of these options, the timetable was developed with the aim of avoiding where possible the use of those facilities that are candidates for elimination.

9.5 1520mm Timetabling and Layout Selection

Timetables were developed for 1520mm services incorporating either passenger service option 1 or option 2.

9.5.1 Timetable and Micro-Simulation Rules and Assumptions

The timetable is prepared for the specific purpose of undertaking micro-simulation. Thus some of the allowances and margins that would normally be included in a timetable are not included here, as their effect would be to mask any problems identified by the micro-simulation. The intention is that any lateness created by congestion in the station area should be identifiable as an output from the micro-simulation. Parameters chosen were also conservative, leading to slower and less efficient operation and therefore greater probability that delays will result.

The following were defined with this principle in mind:

Parameter	Value		Justification and Remarks
	Timetable	Micro-Simulation	
Headway	As existing timetable	Calculated by simulation	Trains will be scheduled with the same minimum time interval as used in the existing timetable for the same route.
Train type (electric)	UK class 321, 240m long		160km/h electric multiple unit with 25% of axles motored. This is a conservative assumption as higher-performance trains could be used and would generally reduce the total amount of delay. Train length is longest likely maximum, to maximise the time the train takes to pass over junctions. This would probably in fact be 200m or less, but cannot be changed in the simulation (sidings have been made long enough to hold this train).
Train type (diesel)	UK class 43 2+8 coaches, 200m long		Express diesel passenger train with medium power to weight ratio. Length adjusted to match likely maximum for the same reason as above.

Train type (international)	UK class 43 2+8 coaches, 400m long Maximum speed 10km/h when reversing to/from depot.		As for domestic diesel train but modified to reflect potential use of longer train. Speed restriction between platforms and depot is because locomotive is propelling train on these moves.
Train type (freight)	UK class 60 plus 2000 tonnes trailing, 850m long Maximum 25km/h in simulation area		Typical heavy diesel freight train performance, with length modified to match maximum in Latvia.
Sectional running times	Calculated by simulation		Time for train to travel between timing locations assuming the train has clear signals. This is the same in the timetable and the micro-simulation so if a train takes longer than the timetable time a delay will be recorded.
Platform reoccupation – same direction	First train leaving platform, plus second train arriving under clear signals, plus 1min.	Calculated by simulation	Based on existing speed restrictions. All connections in both station throats are assumed to have permitted speeds of 35km/h. Time of second train is measured from place it would have to start slowing down if its route over the junction was not set – generally on the approach to the second signal before the junction.
Platform reoccupation – opposite direction	First train leaving platform and junctions at end of station, plus second train arriving under clear signals, plus 1min.	Calculated by simulation	Based on existing speed restrictions. All connections in both station throats are assumed to have permitted speeds of 35km/h. Time of second train is measured from place it would have to start slowing down if its route over the junction was not set – generally on the approach to the second signal before the junction.
Junction margins for conflicting routes at non-station junctions	First train passing over junction, plus second train approaching junction under clear signals, plus 1min.	Calculated by simulation	Based on existing speed restrictions. All connections in both station throats are assumed to have permitted speeds of 35km/h. Time of second train is measured from place it would have to start slowing down if its route over the junction was not set – generally on the approach to the second signal before the junction.
Dwell time in station for passenger train continuing in same direction	5min	3min	Timetable value advised by Latvian Railways. Micro-simulation value to allow some margin for recovery from minor delays.
Dwell time in station for passenger train reversing	12min	10min	Timetable value advised by Latvian Railways, applicable to winter timetable which is worst case. Micro-simulation value to allow some margin for recovery from minor delays.
Delay for passenger trains entering micro-simulation from main lines.	Not applicable	Negative exponential distribution, 95% within 1min	Figure advised by Latvian Railways.
Delay for passenger trains entering micro-simulation from depot.	Not applicable	Negative exponential distribution, 99% within 1min	Judgment based on previous figure.

Extra delay for passenger trains leaving station.	Not applicable	Negative exponential distribution, 99% within 1min	Judgment based on previous figure.
Delay for freight trains entering micro-simulation.	Not applicable	Negative exponential distribution, 85% within 1min	Figure advised by Latvian Railways.

Table 9.6: Comparison of Timetable and Micro-Simulation Parameters *(Source: AECOM)*

The timetables reflect a reasonably optimistic projection of services in 2050, cover the 0700-1100 period, and assume all passenger trains terminate in Riga. This combination is considered to represent the most onerous situation for train operational modelling for platform and track occupation (the evening peak may have similar numbers of domestic trains but there are no international trains that occupy platforms for long periods).

Both options are based on regular intervals for shorter-distance Pieriga services, as proposed by the company "Passenger Train" that operates them. Longer-distance trains are fitted into the gaps between the Pieriga services, except on the Sigulda route where services are less frequent and the longer-distance trains are also treated as part of the regular interval service. In both options the Pieriga services run every 30min in the off-peak period.

Both the timetable and the micro-simulation consider occupation of the platforms and also of the tracks between the platforms and the edge of the micro-simulation area.

Platform occupation diagrams are presented to show the times of occupation of each platform by different types of train. Due to the method of producing the diagrams, passing freight trains are shown as occupying the platforms for only 1min. When preparing the timetable and undertaking the micro-simulation account has been taken of the length and speed of these trains, which will in fact take more than 1min to pass through the platforms.

Train graphs are also presented for each option. This is a standard method used by timetabing planners, showing the same timetables as a distance-time graph with each train represented as a line. The interaction of the lines allows occupancy of different tracks and platforms to be visualised.

9.5.2 Option 1

This timetable incorporates the option 1 domestic 1520mm passenger services, the 1520mm freight services and the 1520mm international services. It can be timetabled with no passenger trains using tracks 3, 9 or 12, as shown in the platform occupation diagram below:

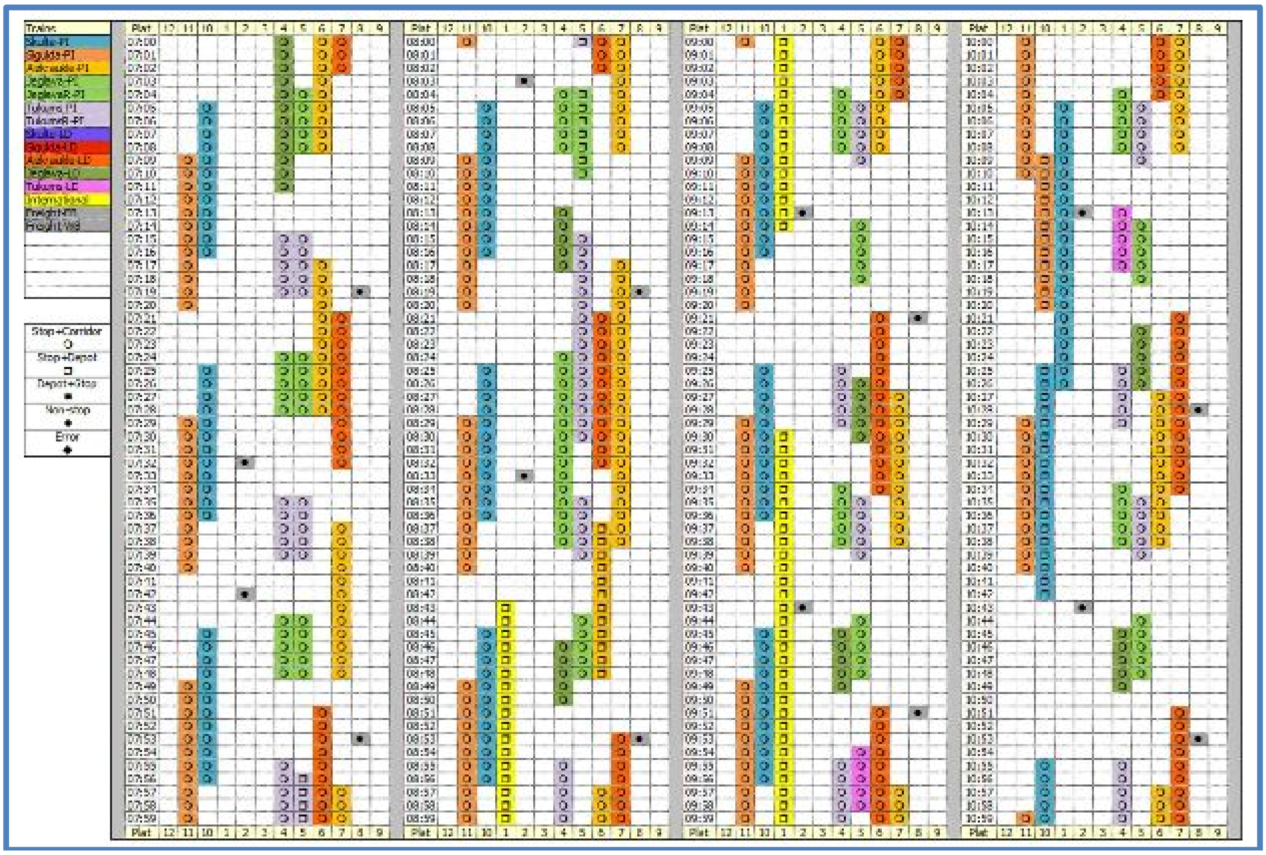


Figure 9.11: Platform Occupation for Option 1 ***(Source: AECOM)***

Figure 9.12 and Figure 9.13 show the train graphs for Option 1.

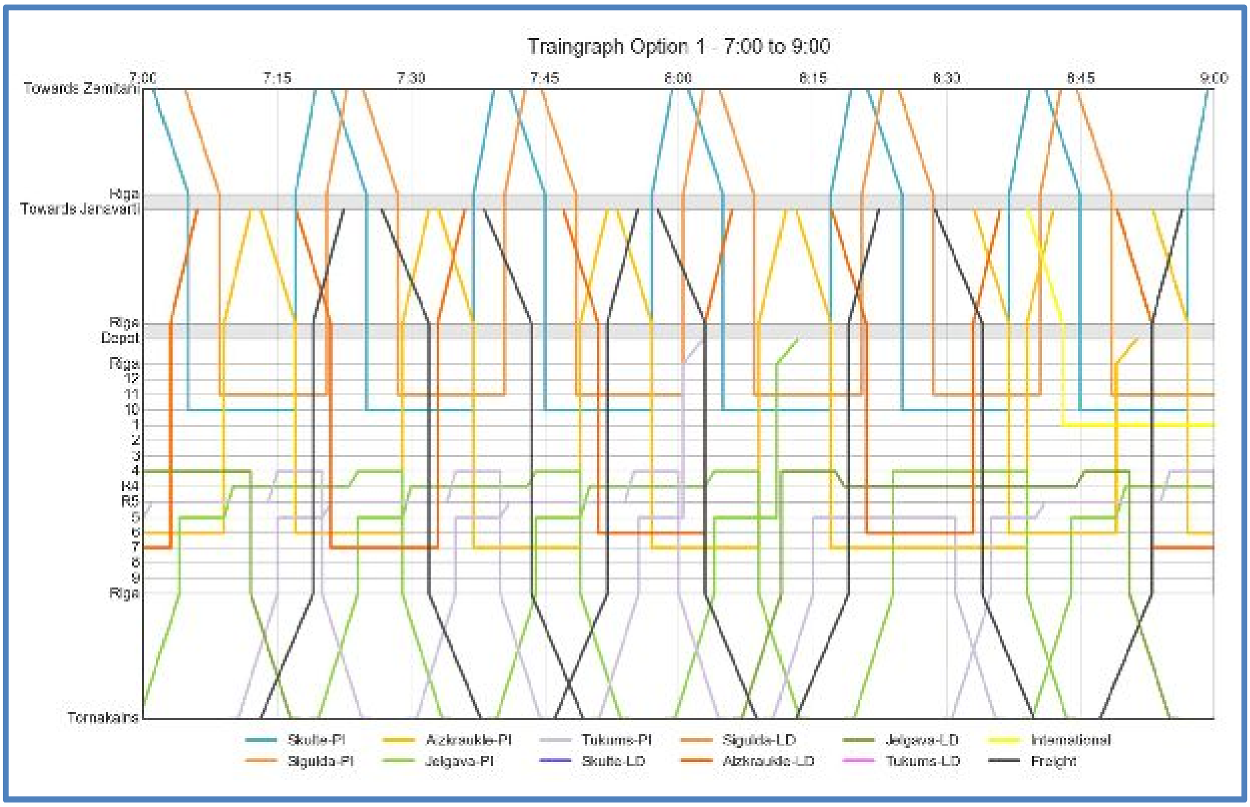


Figure 9.12: Train Graph for Option 1 0700-0900 (Source: AECOM)

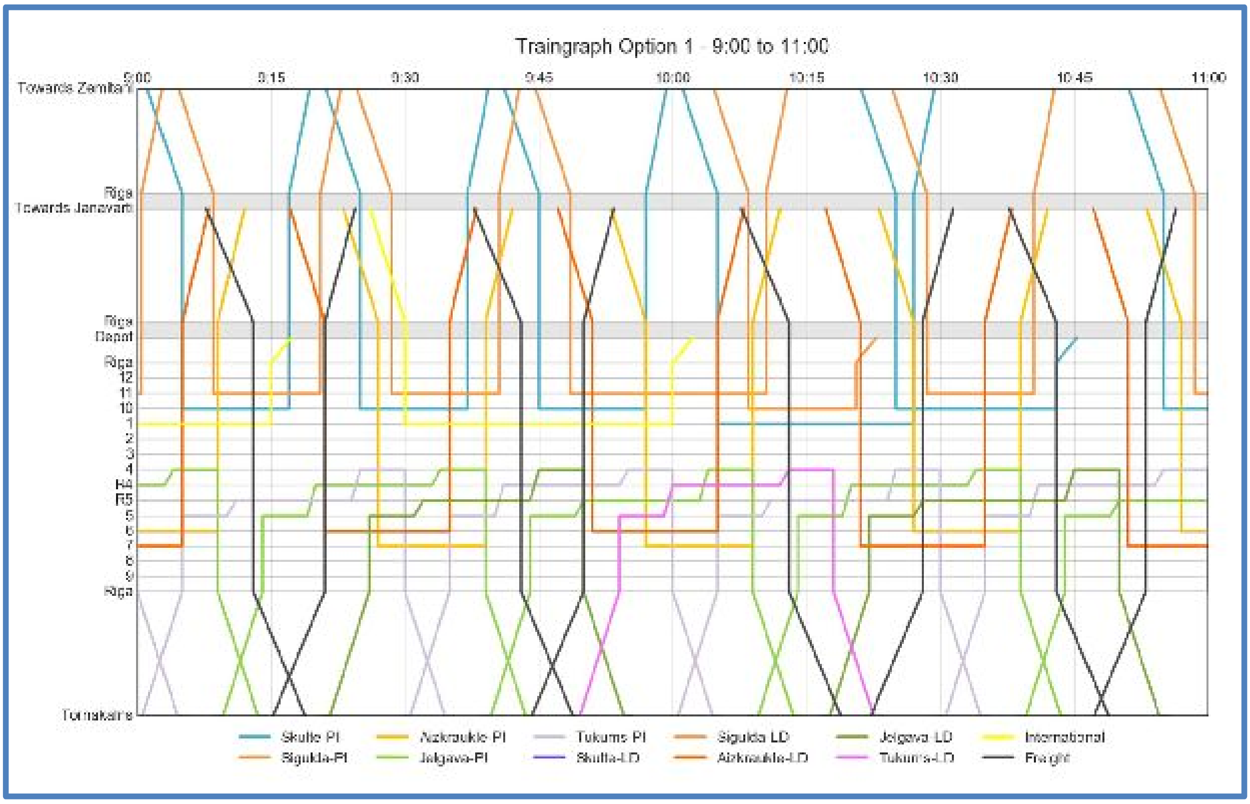


Figure 9.13: Train Graph for Option 1 0900-1100 (Source: AECOM

9.5.3 Option 2

This timetable is based on the Option 2 passenger service pattern anticipated by Passenger Train, which increases the Pieriga service to four trains per hour on some corridors. Other service levels are the same as the Option 1 timetable.

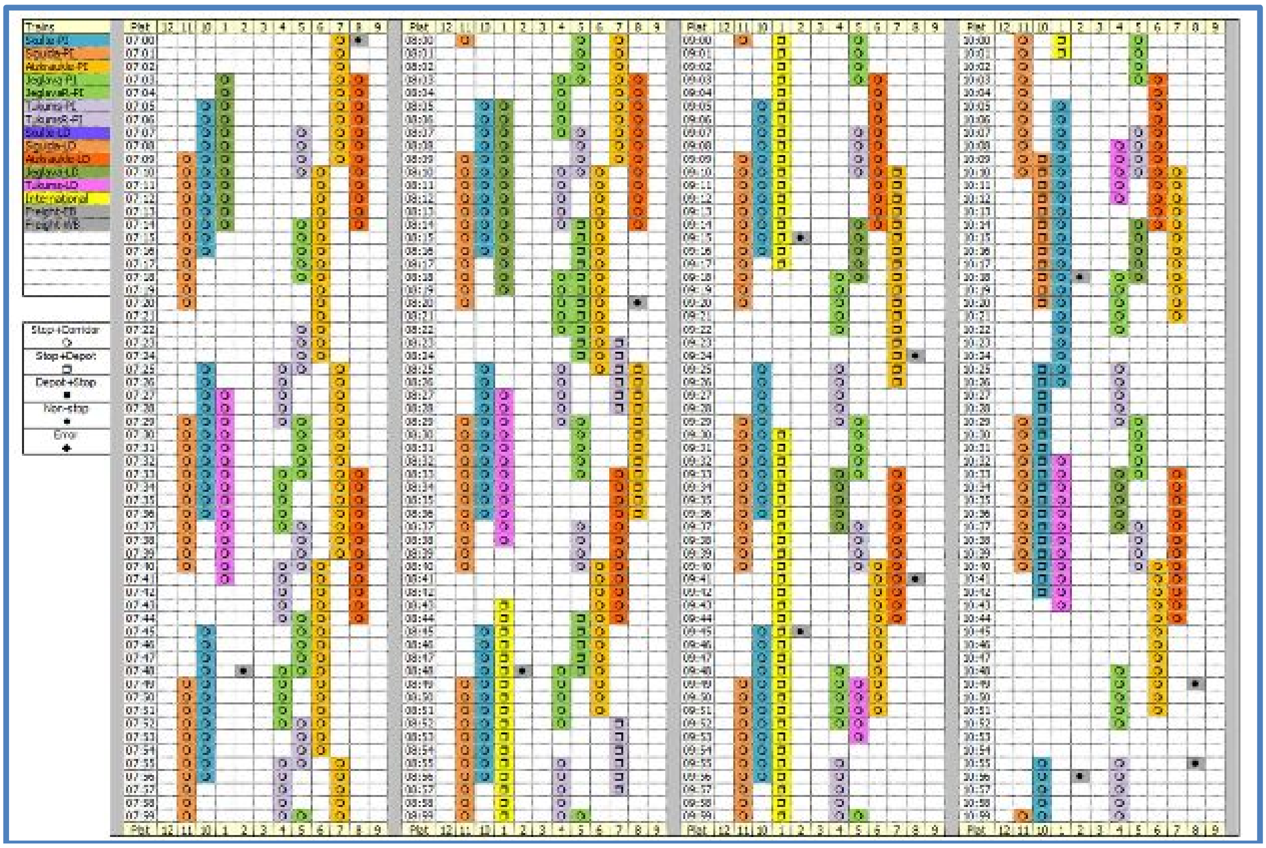


Figure 9.14: Platform Occupation for Option 2 (Source: AECOM)

Figure 9.15 and Figure 9.16 show the train graphs for Option 2.

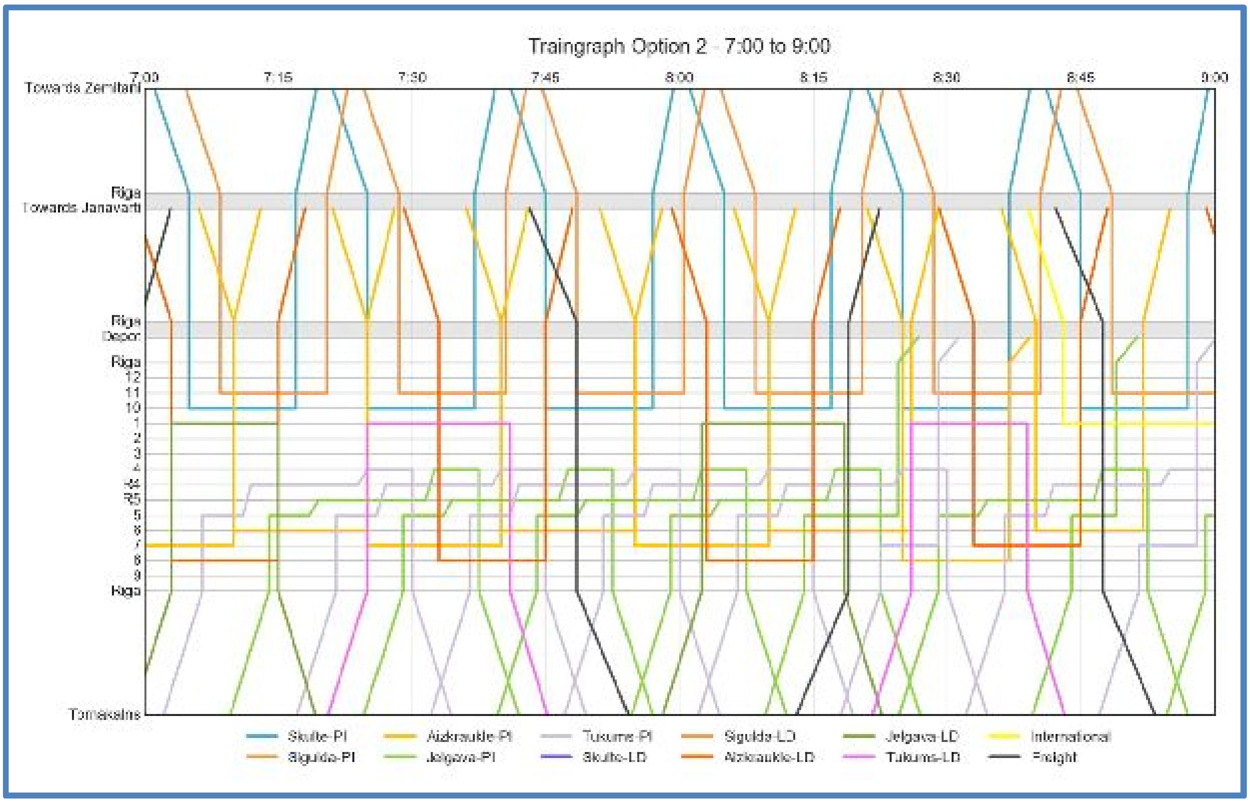


Figure 9.15: Train Graph for Option 2 0700-0900 (Source: AECOM)

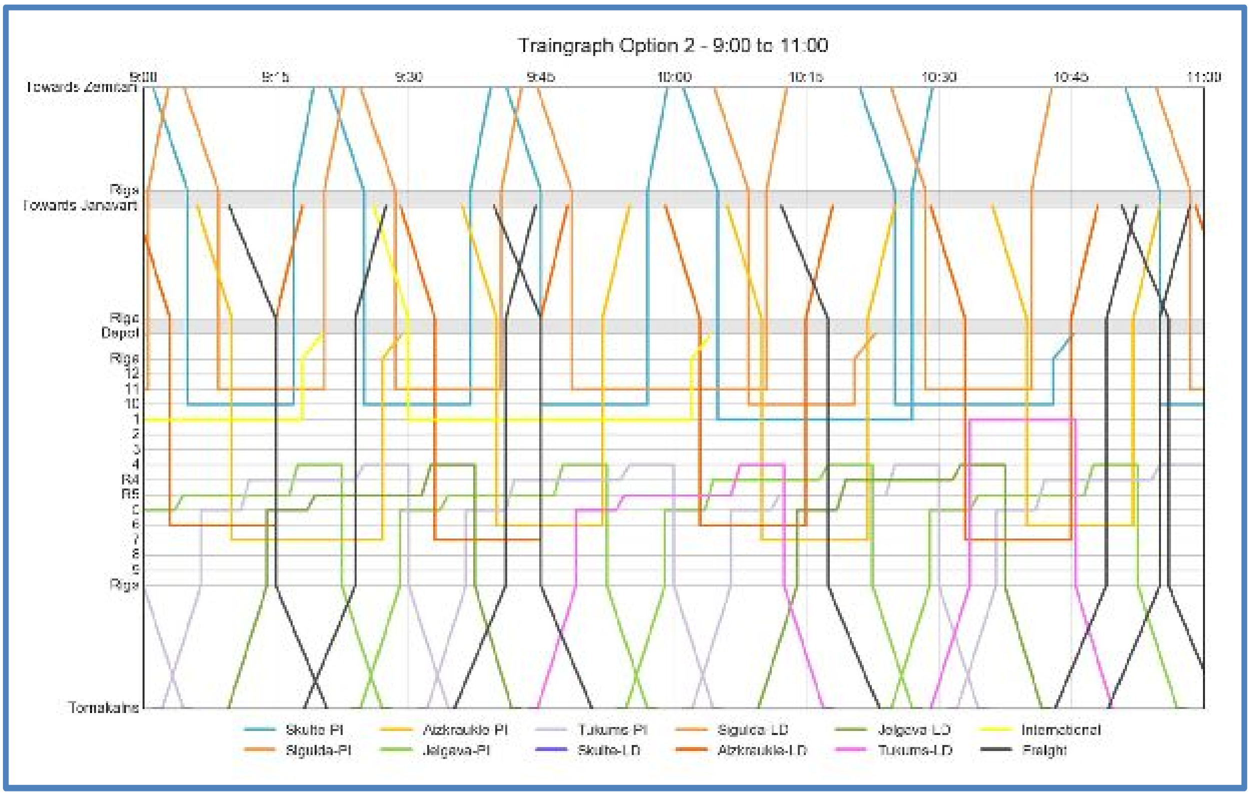


Figure 9.16: Train Graph for Option 2 0900-1100 (Source: AECOM)

Again this service can be timetabled without using tracks 3, 9 or 12, but there are some additional constraints compared with Option 1:

- Only one freight train per hour in each direction can be accommodated in the peak hours. This is not due to station layout but is dictated by the assumption of a 5min interval between trains on the Daugava bridge, and the fact the freight train has slightly different running times from the passenger trains.
- Platform track 8 is used by peak hour passenger trains as well as freight trains.
- Some passenger trains terminating at Riga and continuing in the same direction to a depot or siding have station dwell times reduced from the previous assumed minimum of 5min to 4.5min. This is considered acceptable because passengers will only be alighting from the train during the 4.5 minute period whereas the 5 minute allowance also includes time for other passengers to board the train.
- A few trains are 1min behind the exact regular interval. This is common in services of this type and the train would probably be advertised as departing at the regular time but actually depart 1min later.

9.6 Micro-Simulation

The aim of micro-simulation of train movement is to test the robustness of the timetable. It seeks to demonstrate that the timetable allows recovery from the small delays that inevitably happen to trains in actual operation, avoiding the situation where the timetable might work in theory but there is insufficient capacity in practice so one delayed train causes delay to many more.

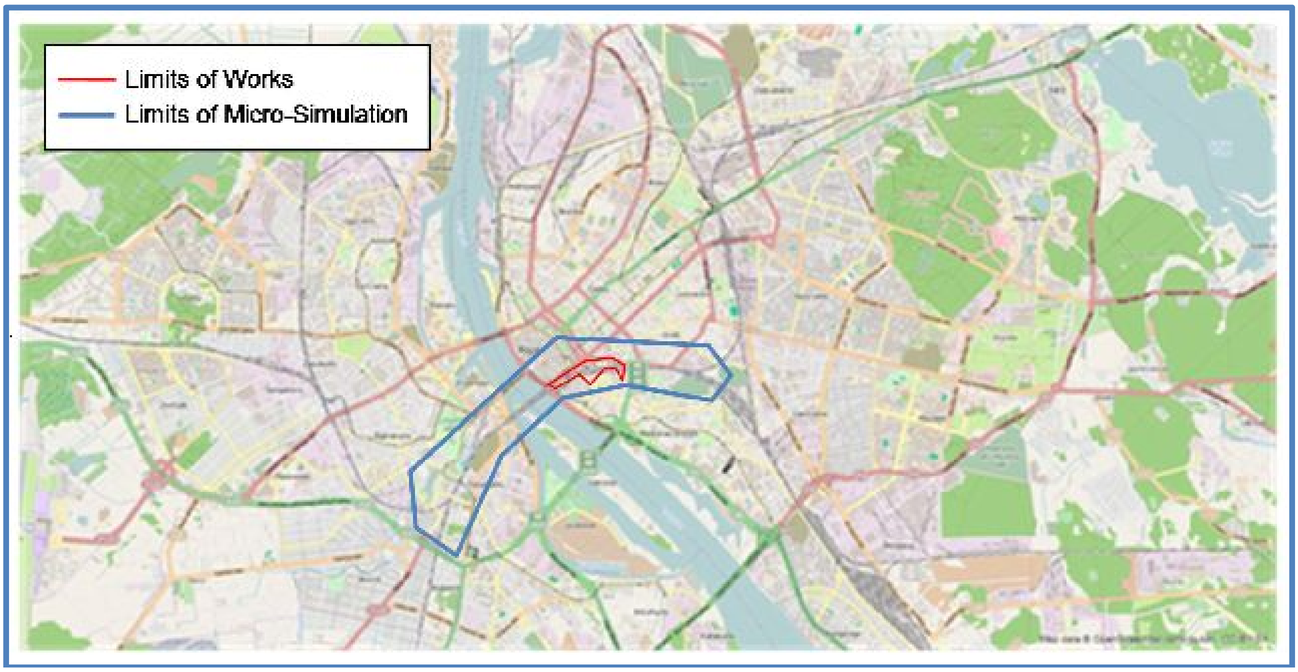


Figure 9.17: Micro-Simulation Area (Source: AECOM)

Micro-simulation covers the area shown above, including the station and the junctions each end. The simulation does not consider constraints outside this area, because the infrastructure enhancements necessary on the rest of the network to support the suggested 2050 train service specifications are not defined.

The two timetable options were subjected to micro-simulation using the RAILSYS software package. This is a sophisticated piece of software, which simulates the trains moving along all tracks within the micro-simulation area according to defined performance characteristics. It also simulates the behaviour of the signalling so that realistic constraints are imposed on the occupancy of tracks whether in platforms or elsewhere in the simulated area.

Initially each timetable was refined by running the simulation with all trains following the timetable, which was then adjusted to ensure that no significant delays were caused and therefore it was free of conflicts. In practice a few small delays of less than 10s remained, but these are not significant in assessing the result.

The simulation was then configured to impart delays to certain trains either when entering the simulation area or when departing from Riga station. These represent, respectively, delays encountered elsewhere on the network and delays encountered during the station stop (for example the arrival of a wheelchair passenger shortly before departure time). The actual delays are random but reflect typical train performance as reported by Latvian Railways. More details are shown in section 9.5.1.

The simulation was then run 100 times with delays imparted to trains at random but in accordance with the defined delay parameters. The software recorded the lateness of trains passing several locations and the total additional delay was calculated as follows:

- Delay recorded to trains arriving at Riga station
- *minus* Delay imparted to trains as they enter the simulation
- *plus* Delay recorded to trains as they leave the simulation
- *minus* Delay recorded to trains (including delay imparted by simulation) as they leave Riga station

The result of this calculation represents the amount of delay encountered due to conflicts with other trains when approaching and departing from the station, and therefore provides a metric of the ability of the track layout to handle realistic scenarios of service disruption.

	Trains in study period	Additional delay in study period	Additional delay per train
Option 1	85	31:34	22s
Option 2	90	42:15	28s

Table 9.7: Micro-Simulation Results *(Source: AECOM)*

In practice the delay would be even less, because the operating staff would be able to employ techniques not used in the simulation, such as diverting a train into a different platform or using the scheduled platform but accessing it by a different route. The assumptions made are also conservative in areas such as train performance and train length, as recorded in section 9.5.1.

The conclusion of the micro-simulation is therefore that a track layout omitting tracks 2, 9 and 12 is compatible with either AECOM's or PV's optimistic projection of the train service in 2050. The resulting track layout is shown below:

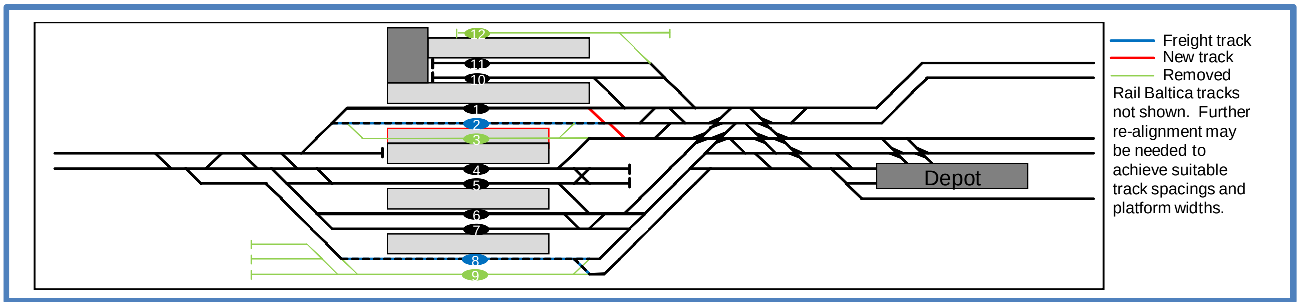


Figure 9.18: Layout resulting from timetabling and micro-simulation (Source: AECOM)

9.7 Discussion and Development

This section considers a number of issues that arose during the above operational study, or from client or stakeholder comments made on the emerging results as submitted in interim reports. Where changes are suggested, in some cases these have been identified too late to include in other parts of the study. In this case an explanation is given of the likely impact should they be incorporated later.

In the further chapter 14.8 Track Layout Considerations, the impact of the possible alternatives is explained. There are two options for the track layout according to the best Railway Operations. One leaves track 9 for Freight, as cross section 1 shows, and option 2 leaves track 2 for Freight as shown in cross section 2.

This last option is the one developed in the multimodal hub building. The architectural and structural drawings of the multimodal hub are based on option 2." See chapter 14.8 for the figure references.

9.7.1 Use of Platform Tracks by Freight Trains

One option considered has been to remove the non-platform tracks and run freight trains through platform tracks. The timetabling and micro-simulation concluded that this layout would be operationally viable.

However, stakeholders have expressed some concern regarding the possibility of freight trains running through platform tracks. We believe this practice would be acceptable as it already happens in many countries (including in the UK), with busy freight trains passing busy platforms at speeds of 100km/h or more rather than a 25km/h maximum as assumed for Riga.

However, should this still be a concern, it would be possible to create a fence and gate arrangement which could be locked at times when a particular platform was used by freight trains. Because freight trains passing through platforms are accepted elsewhere fences are not being used for this purpose, but a similar arrangement is used in the UK to deter those contemplating suicide from accessing platforms not regularly used by stopping trains but where trains pass at high speeds.

Figure 9.19: Platform centreline fence and gate, London *(Source: AECOM)*

Figure 9.20: Lockable sliding gate in platform centreline fence, London *(Source: AECOM)*

9.7.2 Elimination of Freight Tracks

In later stakeholder discussions, the concern was expressed that delayed freight trains having to stop in the station would disrupt passenger operations. Although the micro-simulation produced no evidence of unacceptable performance, it was agreed that retention of one freight track would be possible within the footprint of the station building. The initial preference was for the retention of track 3, and some of the architectural drawings presented elsewhere in the report reflect this arrangement. However this was later changed to favour retention of track 9, which is operationally better as it allows a longer freight train to stand without blocking other trains. Track 9 is also predominantly used for eastbound trains which have travelled a long distance and are therefore more likely to be delayed. Westbound freight trains all originate a short distance away in Šķirotava and could remain there if there was likely to be a problem getting them through Riga station.

The switch from keeping track 3 to keeping track 9 makes no difference to the overall dimensions or technical feasibility of the station, although the platform accesses and some structural elements are positioned differently within the building.

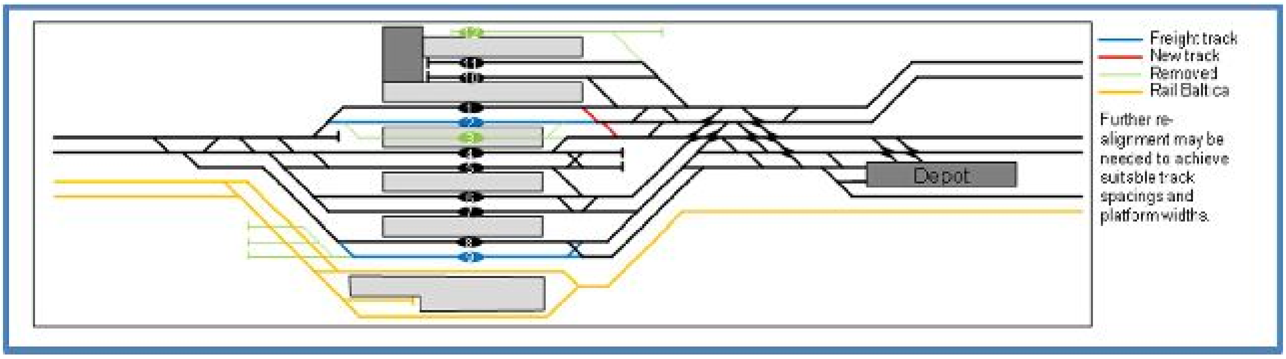


Figure 9.21: Final layout removing track 3 but keeping track 9 *(Source: AECOM)*

Track 2 is nominally a dedicated freight track but is alongside a platform. Although this platform could be made single-sided to face track 3 only, it is likely to be preferable to keep is as a double-sided platform with a fence and gate arrangement. This allows its use for passenger trains in times of disruption or if the passenger service increases more than anticipated.

9.7.3 Dedicated Platforms

The current timetable has all trains for a particular destination departing from the same platform at Riga, and stakeholders have expressed a wish for this to continue in the future. While this is attractive to passengers, we consider it is not sustainable with a more intensive train service. In particular, if four trains per hour are operated to the same destination as proposed by service option 2, the same platform would have to be used by reversing trains every 15min. This is not reliably achievable, assuming that the requirement still exists for trains to wait in the platform for 12min when reversing.

Since the proposed layout has the same number of platform tracks as the old one, excepting only the rarely-used track 12, the use of dedicated platforms would be impossible under the option 2 timetable even if the existing station layout was unchanged. The rebuilding of the station would be expected to provide easier passenger access to platforms and better information systems to advise them of the correct platform for their departure regardless of which station entrance they use. These features mitigate the disadvantage of less consistent use of platforms.

Similar considerations apply to the stakeholder desire to keep one platform track (track 1 as timetabled) only for international trains. If the international trains were re-scheduled to different times then domestic trains could also be re-timed to avoid using platform 1 at these times. Passenger use of platform track 2, discussed in the previous section, also provides an alternative location for domestic trains to use if an international train arrives much later than expected.

It should be noted that the timetables developed in this study are produced for the purposes of testing the track layout, and therefore the assumptions made are those that put the greatest pressure on the station's capacity. This approach gives good confidence that other timetabling options, that put less pressure on the track layout, can be adopted if the operators wish. Increased dedication of platforms would probably be achievable with, for example, a less frequent service or a timetable that has trains continuing in the same direction through the station instead of reversing as this study assumes.

9.7.4 Electrification

We understand that the 3kV electrification in Latvia may be converted in the future to 25kV, but that this might take place route by route rather than converting the whole electrified network at one time.

If all electric trains were replaced with dual-voltage units then the whole of the Riga station 1520mm gauge tracks could remain electrified on the same voltage, with trains changing to the other voltage at a suitable transition location away from the station. However it is also possible that some or all lines would use single-voltage units, with different platforms at Riga station electrified at different voltages, thus avoiding the more expensive solution of switching the voltage on a particular section to match that needed by the next train.

From the platform occupancy diagrams above it can be seen that, for both timetables:

- The only electric trains using platform tracks 1 and 10 are on the Skulte route
- Sigulda trains only use tracks 10 and 11, so this route could be electrified in future provided it was at the same voltage as the Skulte route with which it shares tracks.
- The only electric trains using platform tracks 4 and 5 are on the Jelgava and Tukums routes, which would have to use the same voltage as they share tracks west of Riga.
- The only electric trains using tracks 6 to 8 in Option 1 are on the Aizkraukle route, including all the long-distance trains on this route which may become electric in future as electrification is extended.
- However in Option 2 two Tukums trains also use track 7. This timetable would require adjustment if the Tukums and Aizkraukle routes were at different voltages.

Thus, in broad terms, different parts of the station could be electrified at different voltages to align with the voltage used on each of the train service groups. There are three issues that would need to be considered:

- Long-distance trains on routes other than Aizkraukle, and international trains, use a variety of platforms. Further consideration would be needed if any of these was electrically operated during any period when two electrification voltages were present on the Riga station 1520mm tracks.
- Electric trains would not necessarily be able to access the depot sidings east of Riga because this might involve crossing a track electrified at a different voltage. Alternative stabling and servicing provision would be needed elsewhere, with some extra movements of trains without passengers to and from these locations.
- The same situation might not hold true if additional services were converted to electric operation.

9.7.5 Lines east of Riga

The timetables do not use the southernmost track (to the south of the depot), with all eastbound trains on the Aizkraukle corridor using the next track to the north. The timetable would allow some or all trains to use the southernmost track, for example freight awaiting access to Šķirotava yards, but it is beyond the scope of the current study to assess whether this is necessary or whether the track can, for example, be replaced by the Rail Baltica track.

9.8 Work Package Summary

The work package has developed a train service and timetable proposal, which while indicative is considered to be broadly representative of an optimistic projection of what might happen in 2050. It has also developed a schematic track layout based on the existing operation, and demonstrated that this layout adequately handles the future service.

10 WP 2.3 - Modelling of Passenger and Pedestrian Flows within RPTH

10 WP 2.3 - Modelling of Passenger and Pedestrian Flows within RPTH

10.1 Introduction

The dynamic microsimulation modelling has been undertaken using LEGION Spaceworks R5. The application allows the user to simulate individual pedestrian movements within a defined space. The modelling exercise involved the development of two separate models, a station model and a shopping centre model.

The base/existing layout station model includes the internal ground floor and the platform level. The assessment has been undertaken for the AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hour periods based on the 2015 passenger demands. Figure 10.1 shows the area modelled.

These are the flows obtained from the Linstow data validated on site by the AECOM modelling team. The models developed for this project are representative of these peak hours

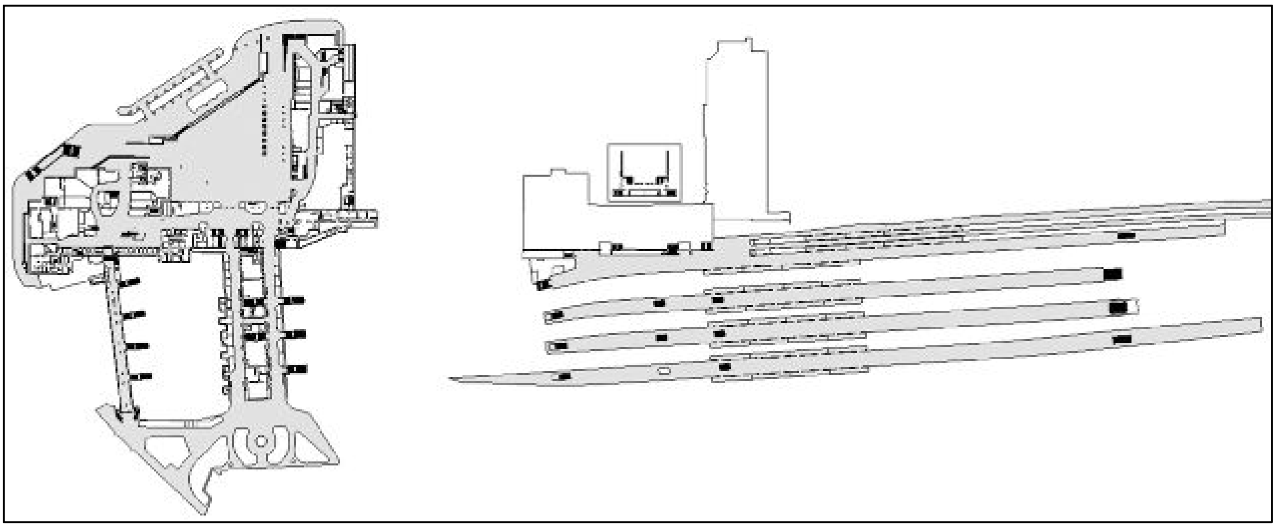


Figure 10.1 – Station Legion Model (Source: AECOM)

The second model covers the Origo Shopping Centre base/existing layout. The assessment has been undertaken for the PM (17:00 – 18:00) peak hour period based on the 2015 passeneger demands. Figure 10.2 shows the area modelled.

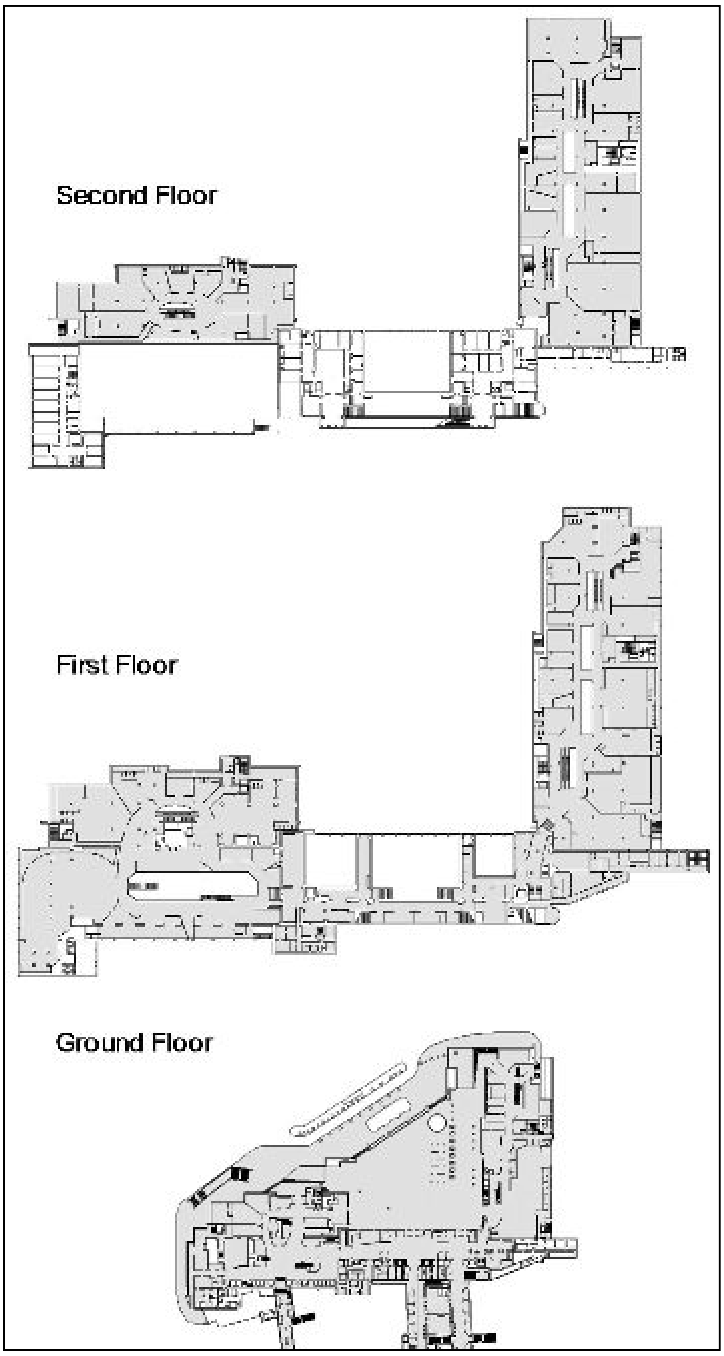


Figure 10.2 – Shopping Centre Legion Model (Source: AECOM)

10.2 Industry Standard Outputs

The acknowledged industry measure for pedestrian spatial requirements is Fruin's 'levels of service' (see Figure 10.3). This refers to the relationship between the density and the speed at which passengers can move and/or circulate along/across a given space. The 'Levels of Service' system uses the letters A through F as described below:

- **LoS A**: Free circulation;
- **LoS B**: Uni-directional flows and free circulation; reverse flows with only minor conflicts;
- **LoS C**: Slightly restricted circulation; reverse and cross flows with difficulty;
- **LoS D**: Restricted circulation for most pedestrians; significant difficulty for reverse and cross flows;

- **LoS E: Restricted circulation for all; intermittent stoppages and serious difficulties for reverse and cross flows; and**
- **LoS F: Complete breakdown in circulation; many stoppages.**

A visual representation which shows the correlation between the 'levels of service' and the quality of the passenger's space is provided below:

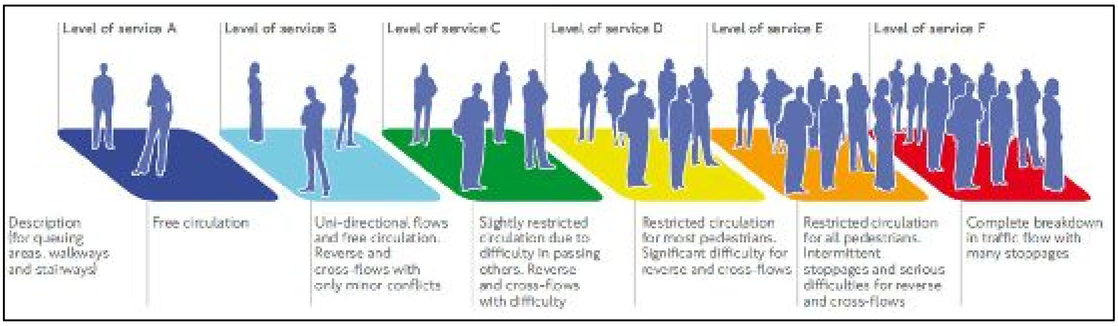


Figure 10.3 – Fruin's Levels of Service (Source: London Underground Station Planning Standards and Guidelines, July 2012)

10.3 Platform Width Assessment

Network Rail Guidance (SCAG 2015) has been used as a guideline in order to calculate platforms widths for the proposed Riga Central Station development. 2015 demands have been factored up to 2050 using the background growth, Rail Baltica and RIX Shuttle forecast numbers.

The platform width calculations comprise separate calculations for individual platform elements (yellow line zone, waiting zone, circulation zone, and activity zone); total platform width refers to sum of each individual component. Each element requires a different formula – as such peak minute demand data was calculated (using London Underground Limited SPSG 1-371) and certain assumptions were made e.g. train car length of 22m and a block load of 35%. Headway/number of services per platform have been assumed as follows:

- **Regional service (platforms 1/12-7/8): 3 arrivals and departures per hour**
- **Riga International Airport (RIX) Shuttle: 4 arrivals and departures per hour**
- **Rail Baltica: 2 arrivals and departures per hour (1 per direction)**

As such, the following island platform widths have been calculated, compliance-checked against minimum requirements set out in SCAG 2015.

Summary

	Proposed Width	***Check***
Platform 1/12	**5.29**	**OK**
Platform 3/4	**9.96**	**OK**
Platform 5/6	**9.91**	**OK**
Platform7/8	**9.91**	**OK**
Platform RIX/RB	**7.60**	**OK**

10.4 Vertical Circulation Specification

Regarding the vertical circulation requirements, calculations based on the same demands would require 2 escalators per platform (1 per boarding/alighting direction). Additionally, we would suggest the inclusion of a 2-way staircase (min. width: 2m inc. edge effects) as contingency. The inclusion of stairs also essentially provides an appropriate means of access/egress for evacuation (in addition to an SME at the East end of the platform). Findings from the passenger

survey reinforce the need for sufficient and well-designed vertical circulation elements, with over 70% of passengers surveyed agreeing that such improvements would likely increase their willingness to use the station.

10.5 Pedestrian Micro-Simulation Modelling

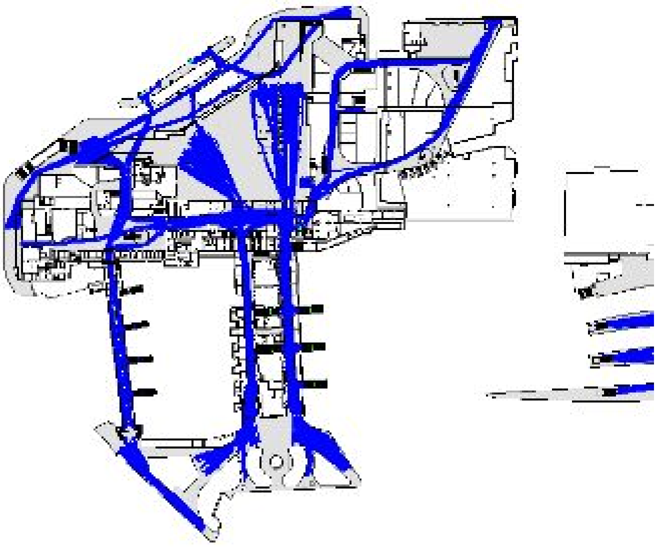
The 'Base' 2015 station model was developed using both Primary and Secondary data sources. The station demand was derived from the Linstow counts undertaken at each of the entry/exit points to the station. The AECOM modelling team also collected data on-site during the peak periods, this included the train timetables, boarding/alighting counts, direction distribution and platform activity.

Appendix WP 2.3 – Base Model Outputs contains the full set of modelling results and analysis undertaken for the base model.

'Do Minimum' and 'Do Something' 2025 and 2050 scenario testing CMD outputs are shown on the following pages.

10.5.1 'Do Minimum' Station Model Outputs

Ground Floor Level – AM 2025



Platform Level – AM 2025

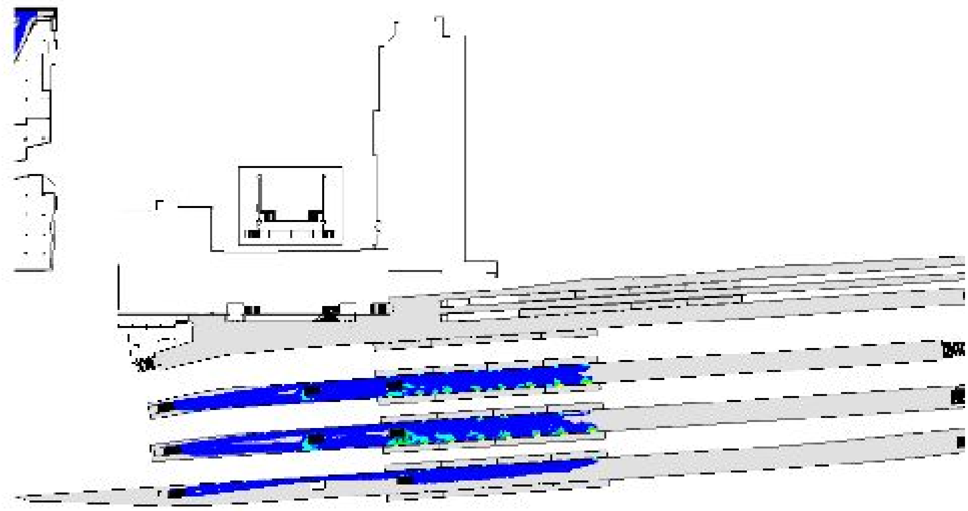


Figure 10.4 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Queuing) (Source: AECOM)

Based on the CMDs shown in Figure 10.4, it has been shown that space associated with queues in the 'Do-Minimum' model experience an acceptable level of service across the peak 15 minutes. Access to and from the platforms are the only locations likely to experience some form of congestion, with the vast majority of the space operating at LoS A (blue). As such, instances of congestion are likely to be minimal and are within the acceptable threshold for level of service.

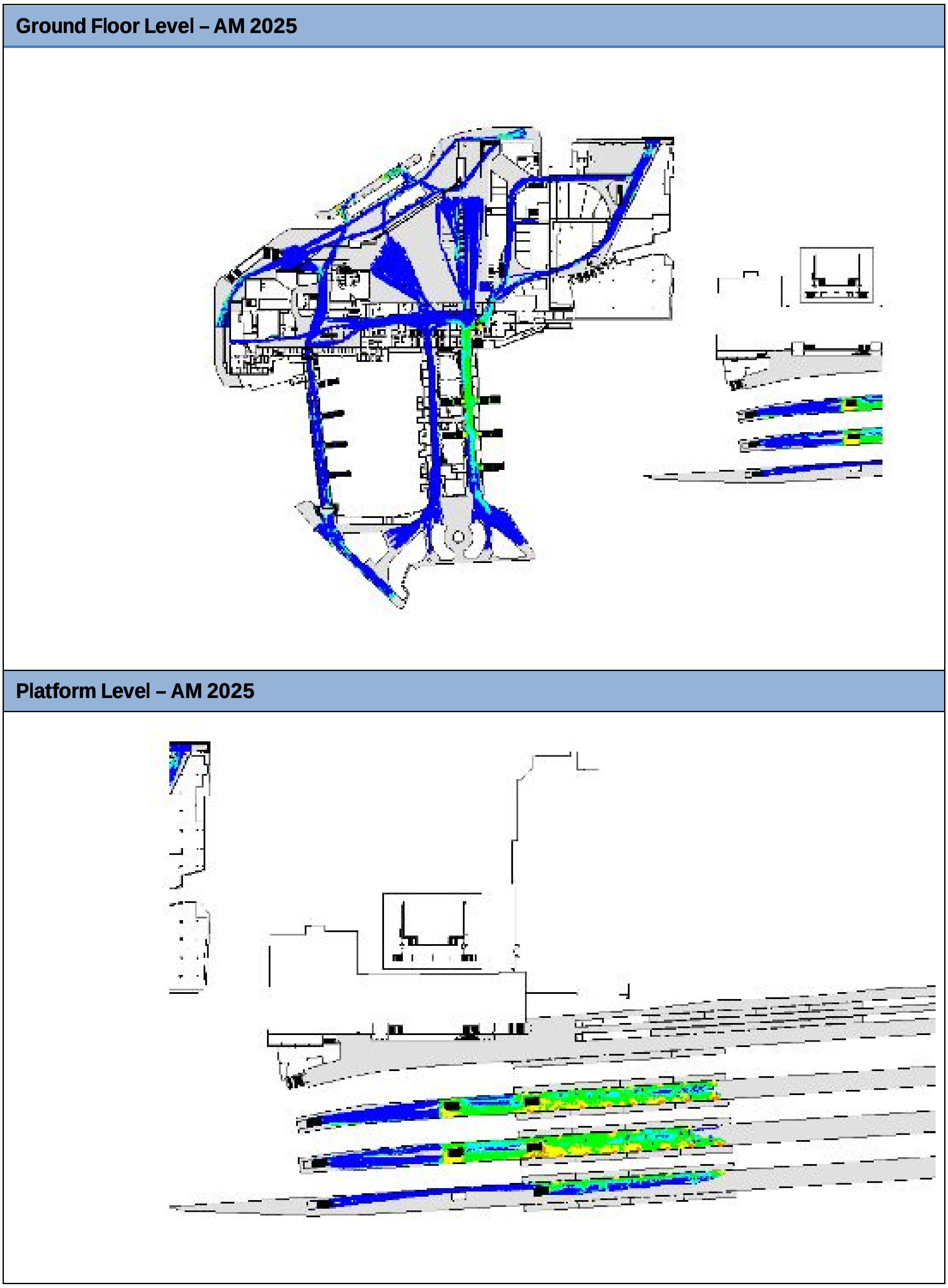
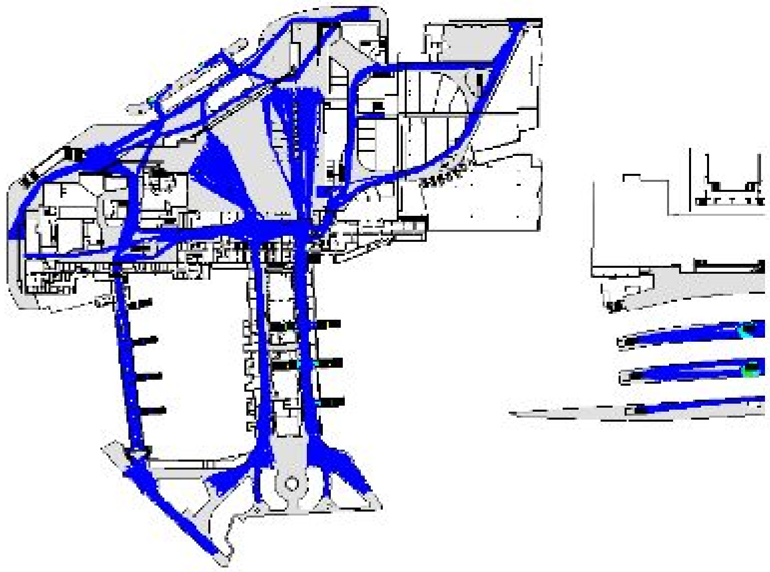


Figure 10.5 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Walkways) (Source: AECOM)

LoS 'Walkways' has also been employed to analyse the areas of the existing layout associated with major passenger through-movements, for example in the tunnels leading to the platform staircases. As can be seen form the CMD plots in Figure 10.5, the easternmost tunnel is the most likely area to experience some congestion with much of this space operating at LoS 'C' (green). Movements at this location may be subject to minor breaks in circulation, however this remains within the acceptable threshold for level of service.

Ground Floor Level – AM 2050



Platform Level – AM 2050

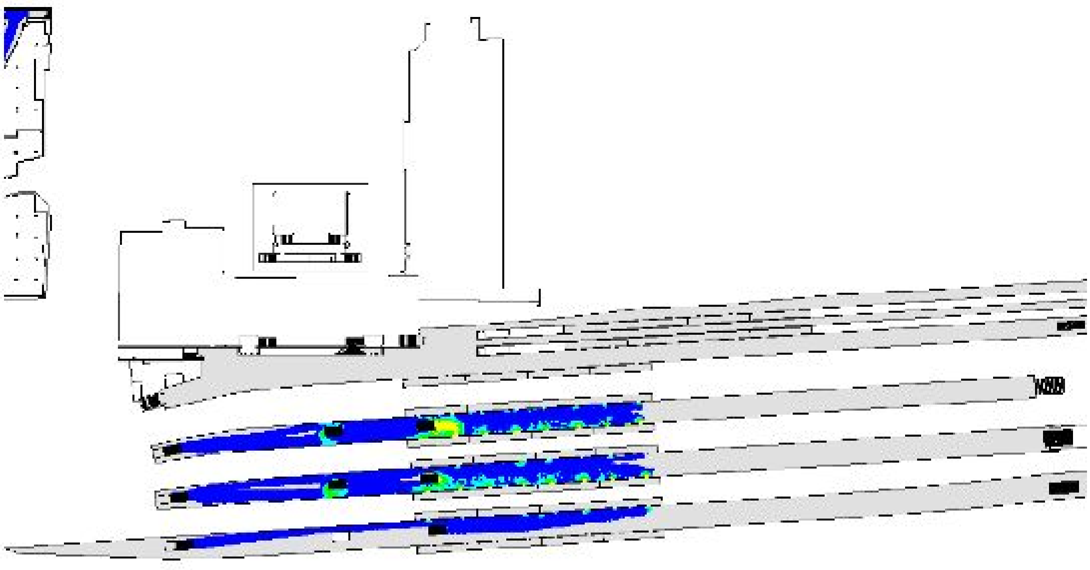
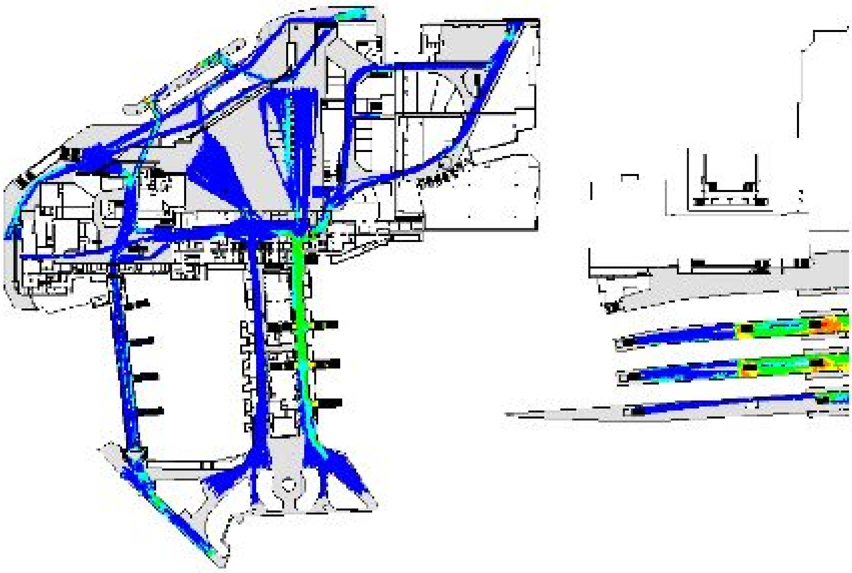


Figure 10.6 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Queuing) (Source: AECOM)

Demands uplifted to 2050 would see greater congestion at the same locations discussed in the LoS 'Queuing' analysis for the 2025 model; namely the locations associated with queuing such as at the top/base of staircases. As showin in Figure 10.6, the 2050 scenario sees a higher proportion of LoS 'C' and as such, passengers might encounter some restrictions to their overall circulation, however it should be noted that this is still within the acceptable threshold.

Ground Floor Level – AM 2050



Platform Level – AM 2050

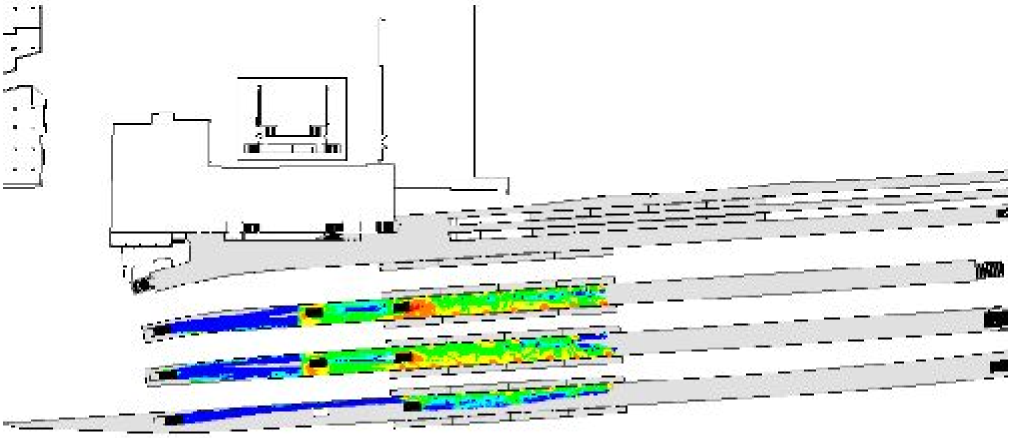
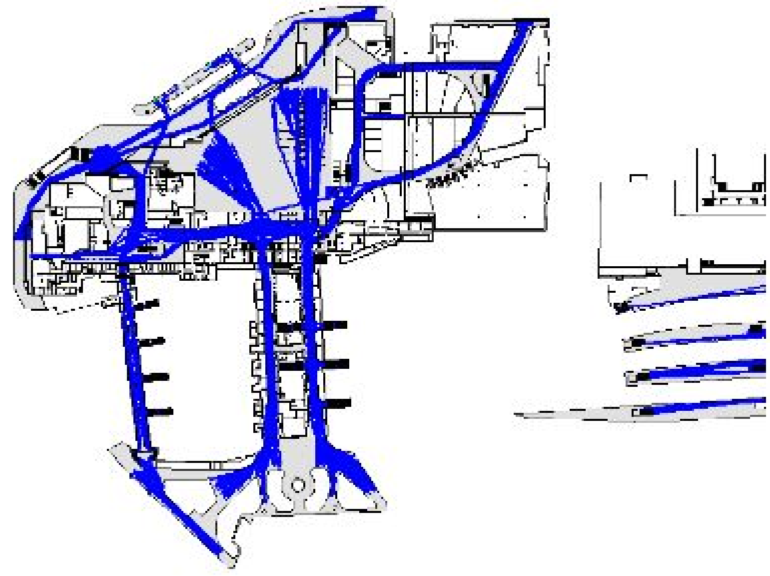


Figure 10.7 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Walkways) (Source: AECOM)

LoS 'Walkways' has been used again to assess the existing layout, with a particular focus on the pedestrian areas on the ground floor level of the building (where the majority of through-ways and walkways are located). As can been seen from the CMD in Figure 10.7, this area also registers predominantly at a LoS A (blue), with the easternmost pedestrian tunnel operating at LoS C (green). This suggests that the tunnel sees the highest movement flows and and as such, passengers are most likely to experience congestion at this point, however at LoS C, it remains within the acceptable threshold.

Ground Floor Level – PM 2025



Platform Level – PM 2025

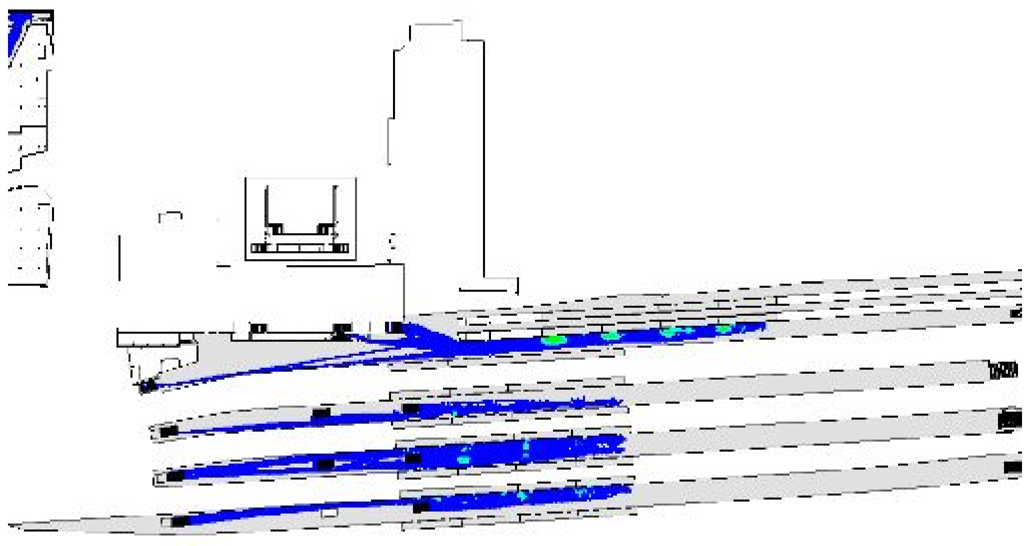


Figure 10.8 – PM Peak 15 Minute Cumulative Mean Density Plot (LoS Queuing) (Source: AECOM)

Figure 10.8 illustrates that level of service across the peak 15 minutes during the PM period sees the vast majority of space operating at LoS A (blue), with very little presence of LoS B (cyan) or LoS C (green); where these do exist, they are largely confined to locations on each of the platforms where passengers are likely to wait to board trains. As such, space associated with queuing (such as at the base/top of staircases) is likely to operate with strong circulation and minimal restrictions.

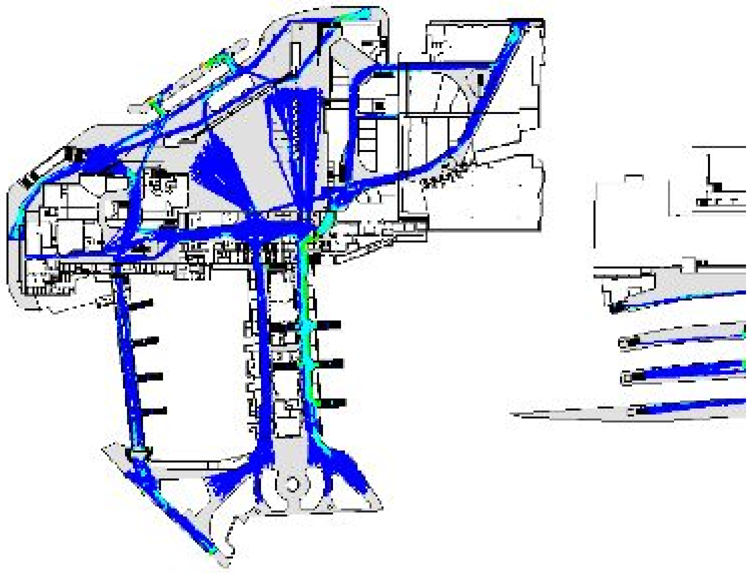
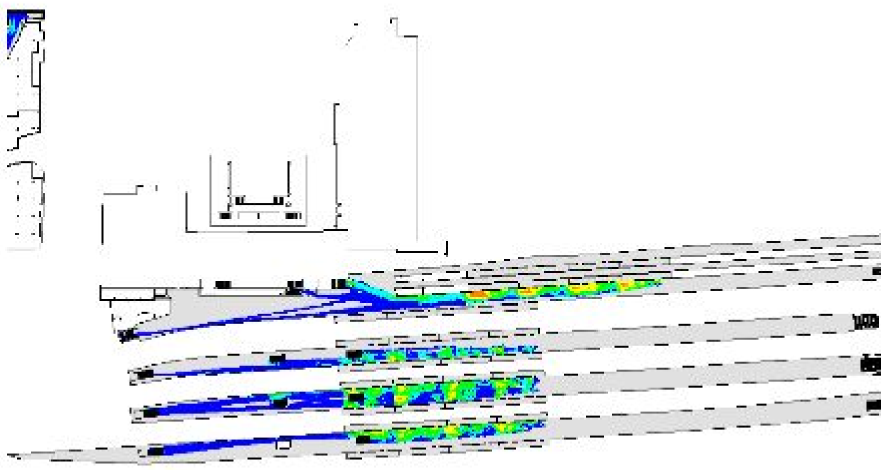
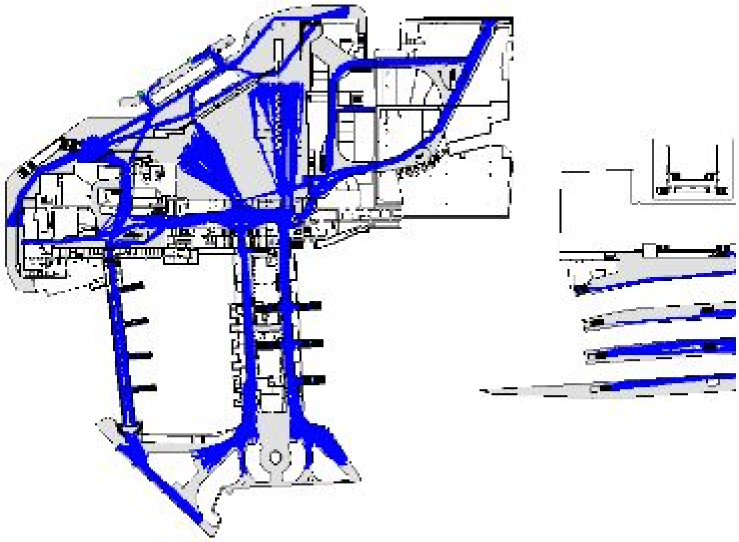
Ground Floor Level – PM 2025

Platform Level – PM 2025


Figure 10.9 – PM Peak 15 Minute Cumulative Mean Density Plot (LoS Walkways) (Source: AECOM)

LoS 'Walkways' has again been used to analyse the areas of the existing layout associated with major passenger through-movements. As shown in Figure 10.9, the easternmost tunnel is also likely to experience some congestion in the PM peak 15 minutes, with the majority of the space operating at LoS 'B' (cyan). Movements at this location may be subject to minor breaks in circulation; however this remains within the acceptable threshold for level of service. Similar congestion also occurs at the western end of Platforms 10 and 11, as passengers move to and from the nearby stairwell.

Ground Floor Level – PM 2050



Platform Level – PM 2050

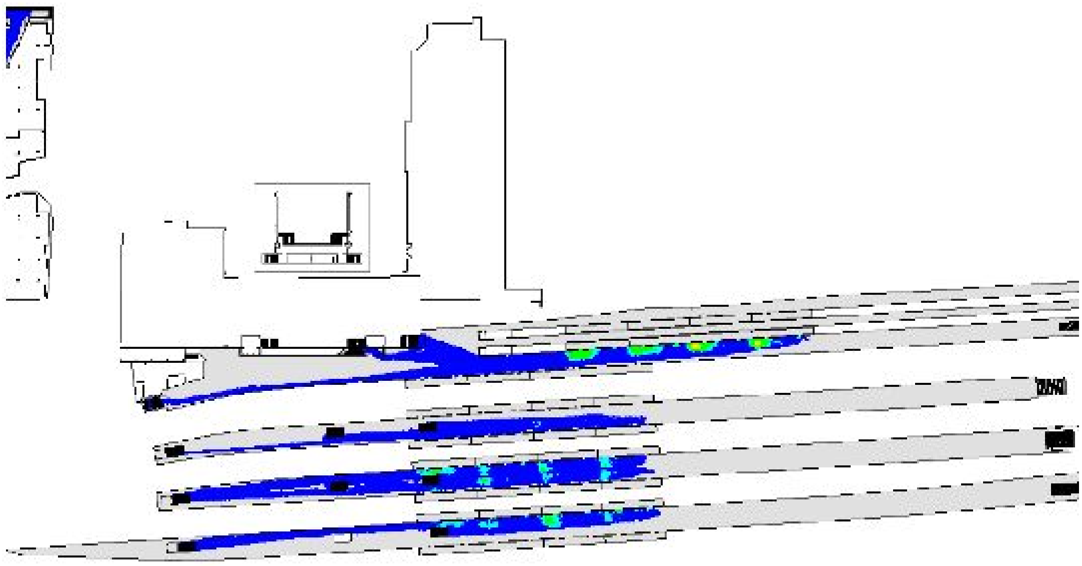
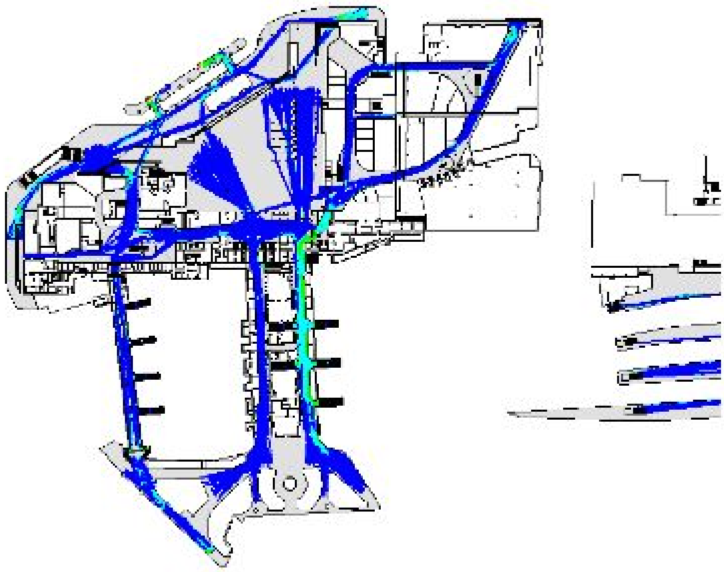


Figure 10.10 – PM Peak 15 Minute Cumulative Mean Density Plot (LoS Queuing) (Source: AECOM)

Demands uplifted to 2050 would see little difference when compared to the LoS 'Queuing' analysis for the 2025 model. Figure 10.10 shows that level of service across the peak 15 minutes sees the vast majority of space operating at LoS A (blue), with very little presence of LoS B (cyan) or LoS C (green); where these do exist, they are again confined to locations on each of the platforms where passengers are likely to wait to board trains.

Ground Floor Level – PM 2050



Platform Level – PM 2050

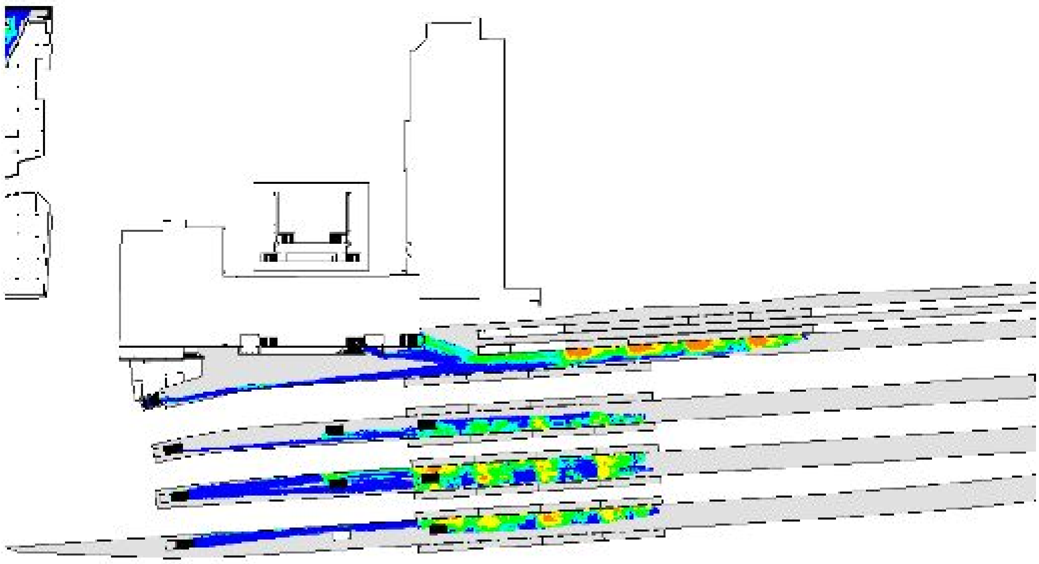


Figure 10.11 – PM Peak 15 Minute Cumulative Mean Density Plot (LoS Walkways) (Source: AECOM)

The CMDs in Figure 10.11 show that much of the pedestrian space on the ground floor level of the building (where the majority of through-ways and walkways are located) operates at LoS A (blue). The notable exception is clearly the easternmost pedestrian tunnel where there are presences of both LoS B (cyan) and Los C (green). There are further isolated spots of LoS B on the ground floor level, however these are negligible and remain well within the acceptable threshold for level of service.

10.5.2 Bus Mode Split - RPTH Passenger Arrivals & Departures (2025 & 2050 'Preferred Option' Scenarios)

Passenger arrival and departure flows in the 2025 & 2050 'preferred option' scenarios have been calculated using existing mode split data[5] and empirical evidence (surveyed flows) from fully functioning Interchange Hubs which are of similar internal function, co-location and setting[6] (i.e. located within a city of similar population size) to Riga.

Local and long distance bus mode split percentages from the data sources referenced are tabulated in Table 10.1.

	Local Bus	Long Distance Bus
Riga International Bus Station	25-30%	-
Gothenburg Central Station	35.7%	-
Kamppi Terminal, Helsinki	28.3%	17.4%

Table 10.1: Bus Mode Split Examples (Source: AECOM)

Considering that some passenger transfers will require interchange with services stopping on adjacent streets (tram, trolleybus and bus stops within walking distance to the station), the RPTH bus passenger mode split percentage is 30% of the overall RPTH arrival and departure demand.

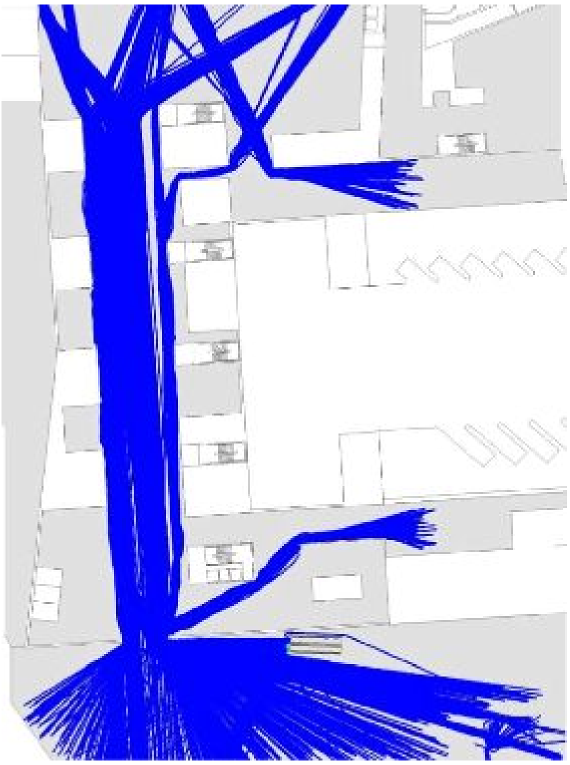
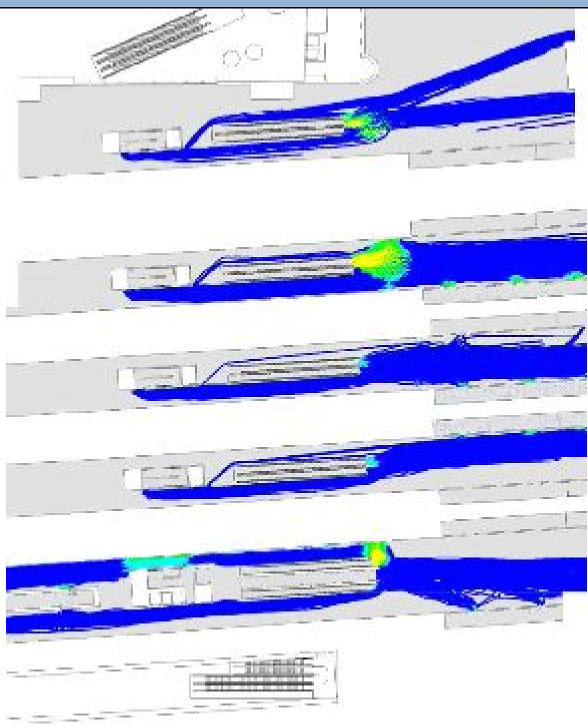
This is towards the higher end of the mode split realised at the Riga International Bus Station and approximately the same as that reported at both Gothenburg Central Station and Kamppi Terminal in Helsinki.

The overall mode split also corresponds strongly with passenger surveys undertaken at Riga central station (see Appendix WP 1.1 – Central Station Visitor Satisfaction Survey), where it was revealed that among train users, 37% of destinations are nearby public transportation stops. As stated above, future year rail-bus transfer in our pedestrian model is 30%, with a further 10% routed to nearby/adjacent stops external to the building itself. The total 40% passenger flow to bus should therefore be viewed as an appropriate assumption given the close accuracy to the 37% recorded from the survey.

[5] Autoosta

[6] Table 2 within www.wctrs-society.com/wp/wp-content/uploads/abstracts/rio/selected/993.pdf and Annex E within www.cityhub.imet.gr/Portals/0/D2.3_Lessons%20from%20descriptive%20case%20studies.pdf

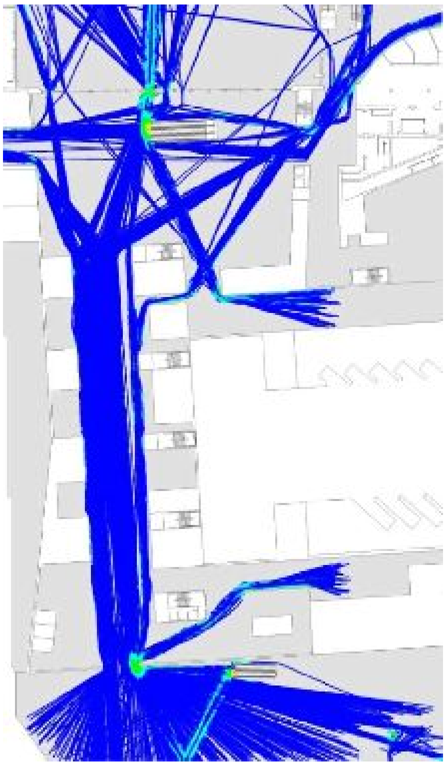
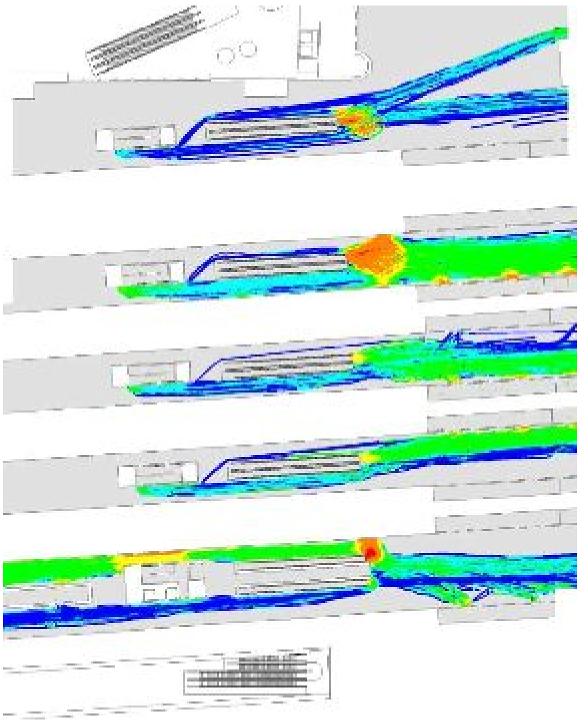
10.5.3 'Preferred Option' Station Model Outputs

Ground Floor Level – AM 2025

Platform Level – AM 2025


Station Level – AM 2025


Figure 10.12 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Queuing) (Source: AECOM)

Based on the CMDs shown in Figure 10.12, demands uplifted to 2025 (plus committed developments), it has been shown that the locations associated with queues in the preferred option design would experience an acceptable level of service across the peak 15 minutes. Down escalators on both the station and platform levels are most likely to experience congestion, with space in these areas operating at LoS 'Queuing' D (highlighted in yellow) – however this is still within the acceptable threshold for level of service.

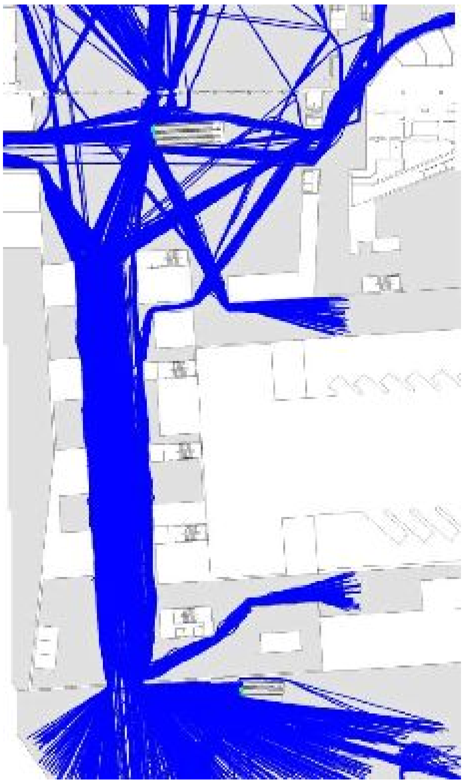
Ground Floor Level – AM 2025

Platform Level – AM 2025


Station Level – AM 2025

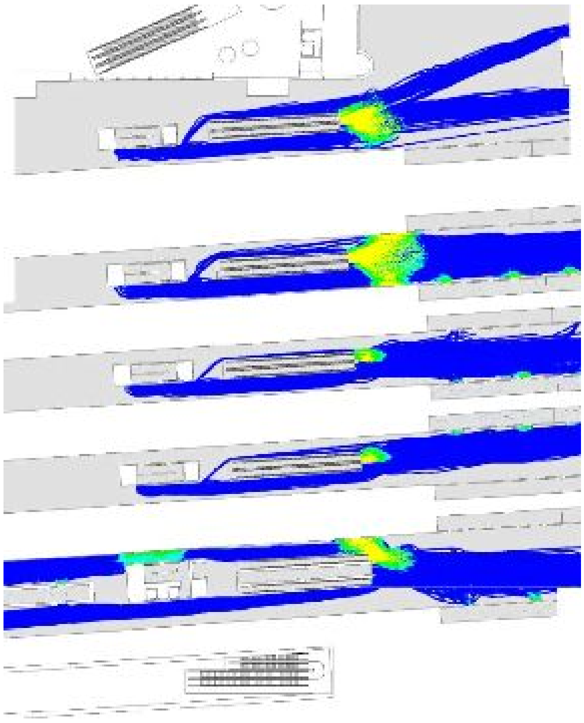
Figure 10.13 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Walkways) (Source: AECOM)

LoS 'Walkways' has also been used to assess the preferred option layout, with a particular focus on the concourse area on the unpaid side of the Station Level. As can been seen from the CMD plots in Figure 10.13, this area registers predominantly at a LoS C (green); within the acceptable threshold for walkways.

Ground Floor Level – 2050



Platform Level – 2050



Station Level – 2050

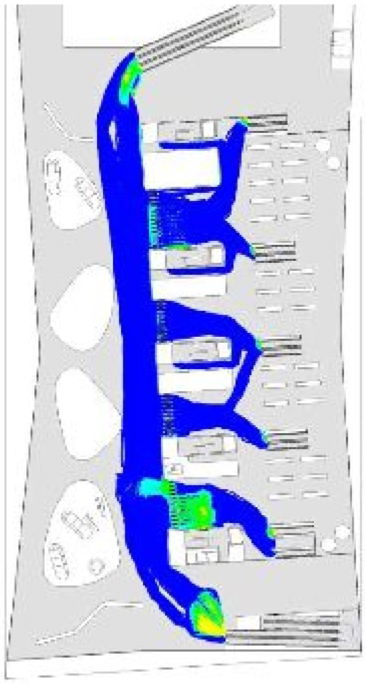
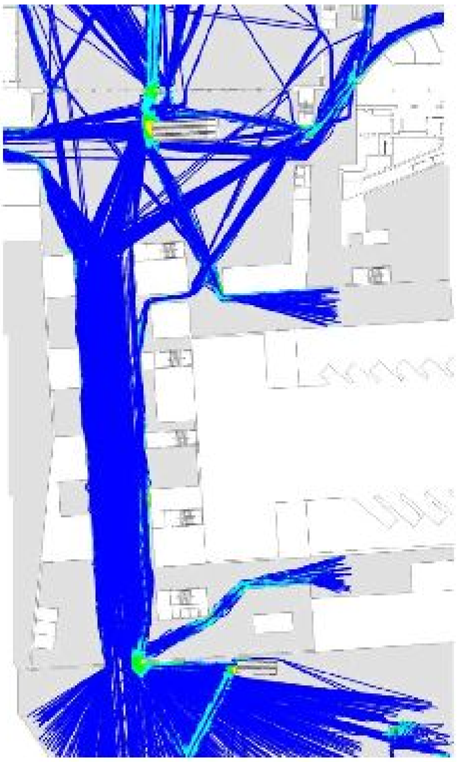
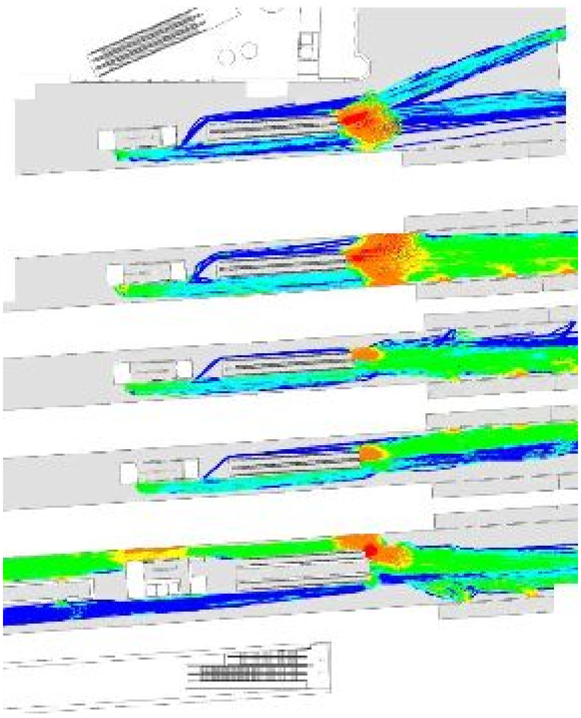


Figure 10.14 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Queuing) (Source: AECOM)

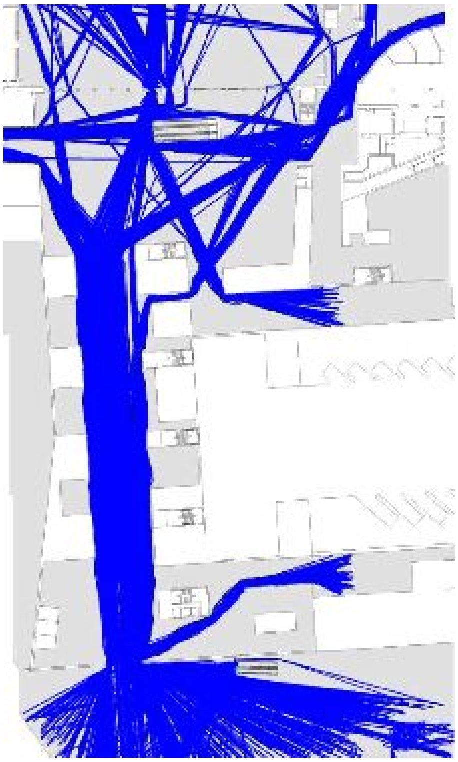
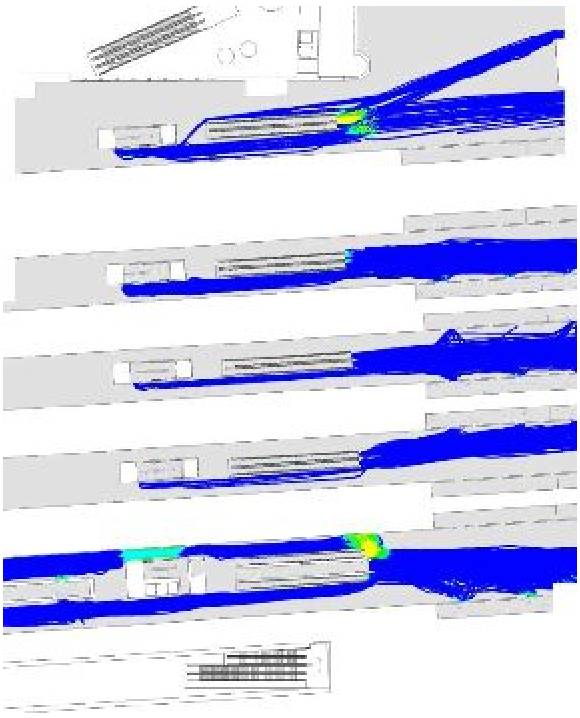
Figure 10.14 shows that demands uplifted to 2050 (plus committed developments) would see further congestions at the points mentioned previously; namely the space immediately in front of the escalators at platform level and at station level where escalators connect to the ground floor. The preferred option would still experience an acceptable level of service across the peak 15 minutes, however there is a higher proportion of space operating at LoS 'Queuing' D (highlighted in yellow). As such, passengers might encounter some restrictions to their overall circulation, however it should be noted that this is still within the acceptable threshold. Some minor congestion was also associated with the Rail Baltica/Airport Shuttle gateline.

Ground Floor Level – 2050

Platform Level – 2050


Station Level – AM 2050

Figure 10.15 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Walkways) (Source: AECOM)

LoS 'Walkways' has been used again to assess the preferred option layout, with a particular focus on the concourse area on the unpaid side of the Station Level. As can been seen from the CMD plots in Figure 10.15, this area also registers predominantly at a LoS C (green) for 2050 plus committed development demands; within the acceptable threshold for walkways.

Ground Floor Level – 2025

Platform Level – 2025


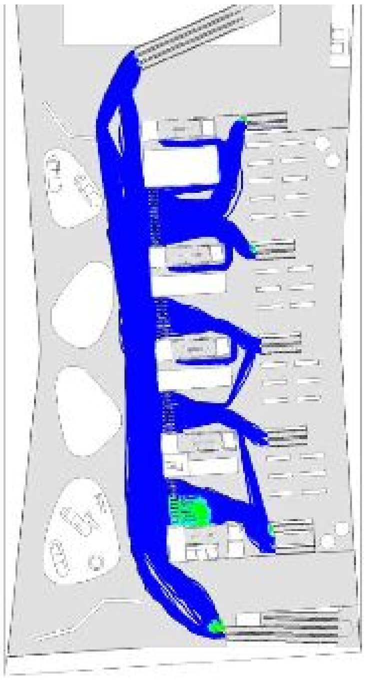
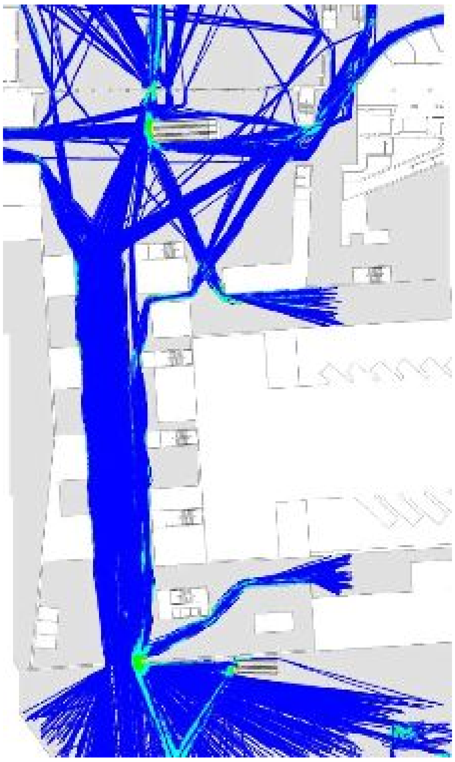
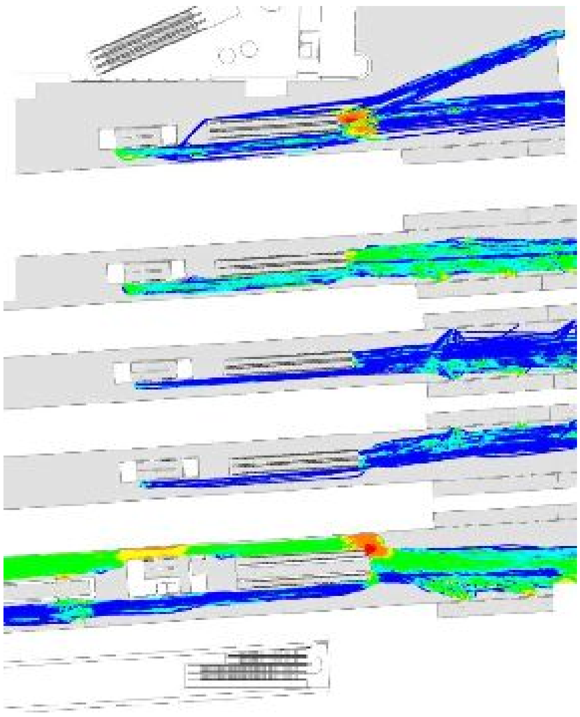
Station Level – 2025


Figure 10.16 – PM Peak 15 Minute Cumulative Mean Density Plot (LoS Queuing) (Source: AECOM)

Figure 10.16 shows that during the PM peak period (with demands uplifted to 2025 plus committed developments), space associate with queuing (gatelines/escalators) would operate at an acceptable level of service. Some congestion was observed at the gateline associated with the Rail Baltica/Airport Shuttle gateline and at the top of the southern escalator on the Station level, however these have registered at a LoS 'Queuing' C (green) and are within the acceptable threshold for level of service. LoS 'Queuing' D (yellow) was observed at platform level, with some alighting passengers attempting to travel up to the Station level experiencing some congestion. Again, however, it should be noted that this sits within the acceptable limits

Ground Floor Level – 2025


Ground Floor Level – 2025


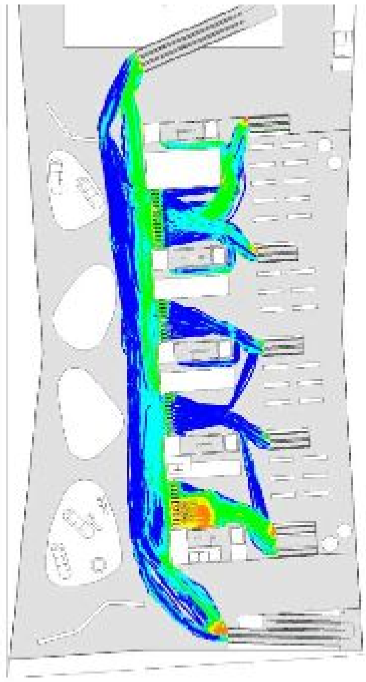
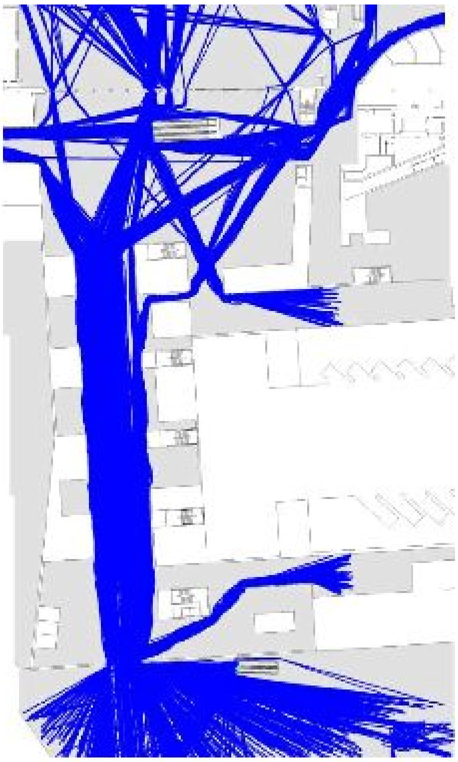
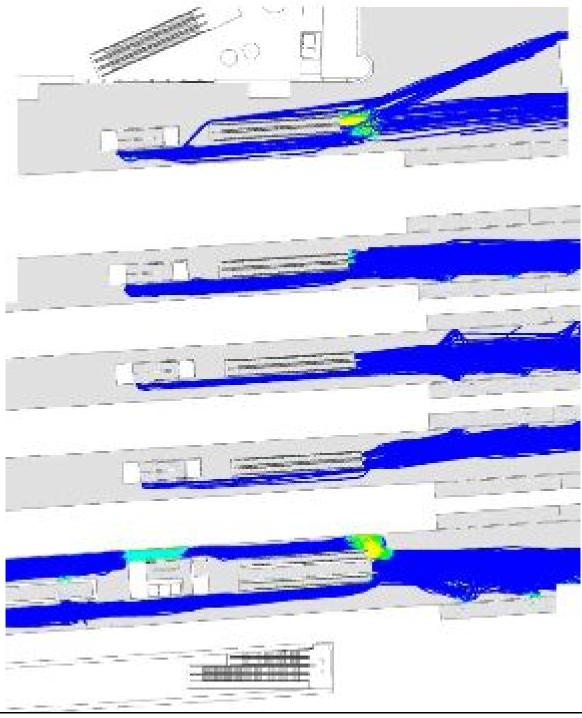
Ground Floor Level – 2025


Figure 10.17 – PM Peak 15 Minute Cumulative Mean Density Plot (LoS Walkways)Source: AECOM

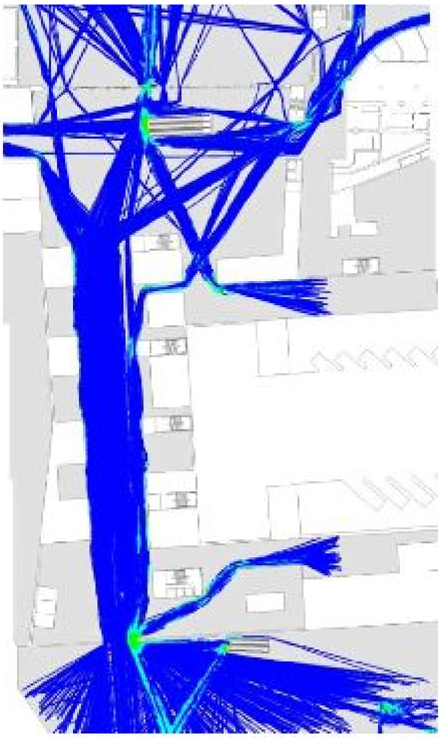
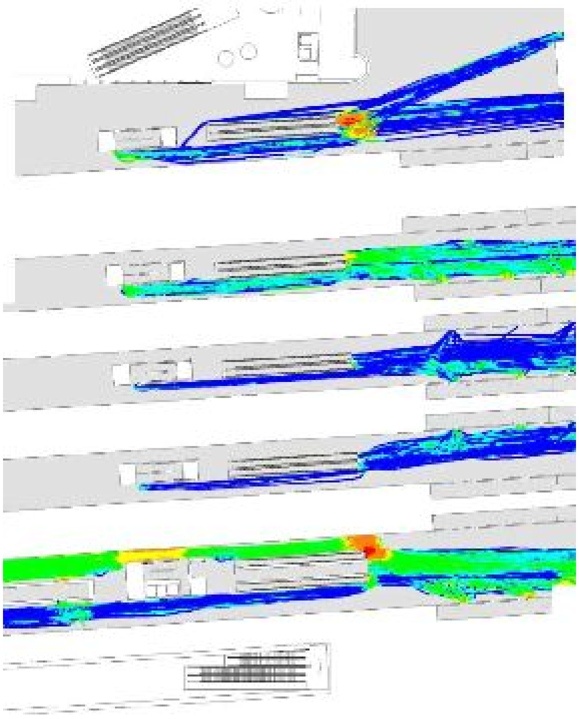
LoS 'Walkways' was used to assess the preferred option layout for PM operation, in this case with demands uplifted to 2025 plus committed developments – results have been displayed in Figure 10.17. The areas in focus in this analysis (areas experiencing major through flows such as the concourse area on the unpaid side of the Station level) register predominantly at LoS A, B and C (blue, cyan and green respectively); within the acceptable threshold for walkways.

Ground Floor Level – 2050

Platform Level – 2050


Station Level – 2050

Figure 10.18 – PM Peak 15 Minute Cumulative Mean Density Plot (LoS Queuing) (Source: AECOM)

Demands uplifted to 2050 (plus committed developments) would see further congestions at the points observed in the previous CMDs for 2025 demands; namely the space immediately in front of some escalators at platform level and at station level where the southern escalator connects to the ground floor, as has been illustrated in Figure 10.18. The preferred option would still experience an acceptable level of service across the peak 15 minutes, however in some cases there is a higher proportion of space operating at LoS 'Queuing' D (highlighted in yellow), for example at the Rail Baltica/Airport Shuttle gateline.

Ground Floor Level – 2050

Platform Level – 2050


Station Level – 2050

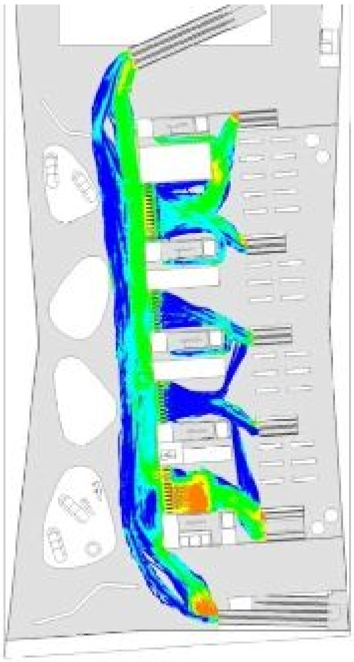


Figure 10.19 – AM Peak 15 Minute Cumulative Mean Density Plot (LoS Walkways) (Source: AECOM)

LoS 'Walkways' was again used to assess the preferred option layout for PM operation, in this case with demands uplifted to 2050 plus committed developments. Results have been shown in Figure 10.19. The areas in focus in this analysis (areas experiencing major through flows such as the concourse area on the unpaid side of the Station level) register predominantly at LoS A, B and C (blue, cyan and green respectively); within the acceptable threshold for walkways.

10.5.4 CMD Results Summary

In summary, the LEGION modelling exercise revealed that the preferred design option for the RPTH station building would operate within capacity and provide an appropriate level of service for passengers using and passing through the building. The layout was tested using both LoS Walkways and LoS Queuing up to future demand year 2050; incorporating further demand from associated committed developments. Modelling results compared well between the preferred option and 'do-minimum' model, with LoS recorded between A-D for queuing and A-C for LoS walkways. Crucially, all gatelines were shown to operate within acceptable thresholds and operated within capacity, having been tested to peak 2050 demands. The analysis revealed the areas most likely to experience congestion and identified elements of the station design that may lack capacity during peak periods of demand. The approaches to escalators on both the overbridge station level (south), as well as on the platforms, were shown to operate at LoS D – suggesting that passengers attempting to pass through these points might encounter restrictions to movement and potential break-downs in circulation. This was most evident during testing for the AM peak scenario uplifted to 2050 demands. It should be noted however, that this remains within the acceptable threshold for level of service.

10.5.5 Riga Station Journey Time Comparison

In addition to assessing the preferred design through CMD analysis, the average un-weighted journey time per passenger over the peak hour period for specific origin-destinations were calculated for both the 'Do-Minimum' and the preferred 'Option' layouts. The un-weighted journey times provide a good insight into walk times.

It should be noted that the journey times have been recorded from and to the Northern entrance/exit as this route experiences the largest volume of passengers during the peak period and is therefore considered to be the busiest route. In addition, the platform origin/destination has been taken as Platform 5 as this is effectively the most central platform, and the busiest, in both layout options.

Table 10.2 and 10.3 below state the average journey time per passenger and the difference between the 'Do-Minimum' and preferred 'Option' over the peak hour period.

Route	'Do-Minimum' (sec)	Preferred 'Option' (sec)	Difference (sec)
North Entrance to Platform	202	167	-35
South Entrance to Platform	92	180	88
Platform to North Exit	236	275	38

Table 10.2: AM Journey Time Comparison (Source: AECOM)

Route	'Do-Minimum' (sec)	Preferred 'Option' (sec)	Difference (sec)
North Entrance to Platform	196	170	-26
South Entrance to Platform	75	169	94
Platform to North Exit	242	231	-10

Table 10.3: PM Journey Time Comparison (Source: AECOM)

Based on the results presented in Table 10.2 and 10.3 above it can be seen that the preferred 'Option' provides a reduction in the average journey time per passenger on some of the routes. The main routes which benefit from the preferred 'Option' are those to and from the North entrance and platform. This is primarily due to the proximity of the new escalator bank which provides passengers with a direct route to and from the platform overbridge. It should be noted that the preferred option

Some routes do result in an increase in journey time, however it should be noted that the preferred 'Option' provides revenue protection in the form of gatelines whereas the 'Do-Minimum' layout does not. The gatelines carry an additional delay which results in an overall increase in passenger journey times.

It should be noted that intermediary stops for passenger journeys have not been modelled as part of the journey time analysis and as such, do not reflect passengers stopping to purchase tickets at ticket windows in either the 'Do-Minimum' or Preferred 'Option' scenarios. In both AM and PM comparisons (see Tables 10.2 and 10.3 respectively), journey times to platforms in the 'Do-Minimum' layout are considerably shorter when routing from the southern entrance. However, in reality, these times would likely be closer to (and if not, longer than) those recorded from the north given that passengers buying tickets essentially have to travel past the platforms, visit the ticket window, and then double back on themselves to reach the platforms.

This considerable delay to passengers entering from the south would clearly be rectified in the Preferred 'Option' layout with the inclusion of a second ticket window close to the southern entrance/exit. Passengers buying tickets would therefore be able to do so close to their respective entrance before moving to the station level via nearby escalators. We would therefore expect journey times in reality (including the purchasing of tickets) from both North and South entrances to be similar to those displayed in Tables 10.2 and 10.3 above.

There are further benefits to the Preferred 'Option' design proposal and are primarily associated with the separation of passenger flows across the ground floor level. With the main station level proposed to be above the platforms, the new vertical circulation elements at both the northern and southern 'filter off' train-passenger traffic, effectively separating this movement from other passenger flows (both bus and general through-traffic) routing through the ground floor corridor. As such, circulation is likely to be better overall, with less chance for conflicts or breaks in movement. This has been demonstrated in the dynamic modelling results displayed in section 10.5.3 above where LoS registers primarily at 'A' in all testing scenarios.

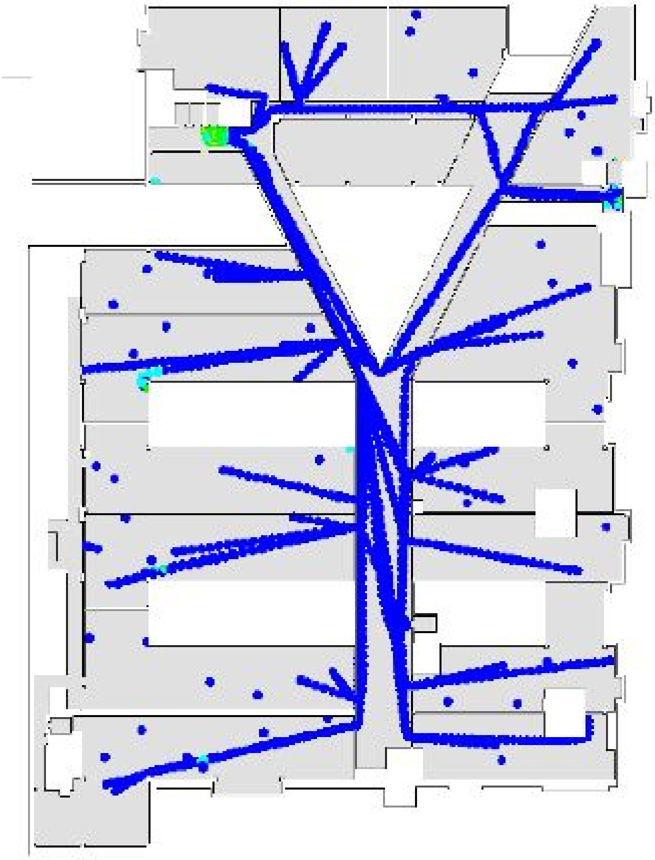
10.5.6 Do Minimum Origo Shopping Centre Model Outputs

Ground Floor Level – 2025 PM

Second Floor Level – 2025 PM

Third Floor Level – 2025 PM

Fourth Floor Level 2025 PM



Fifth Floor Level 2025 PM

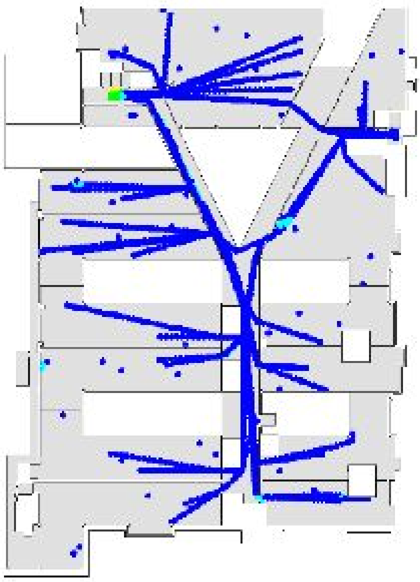
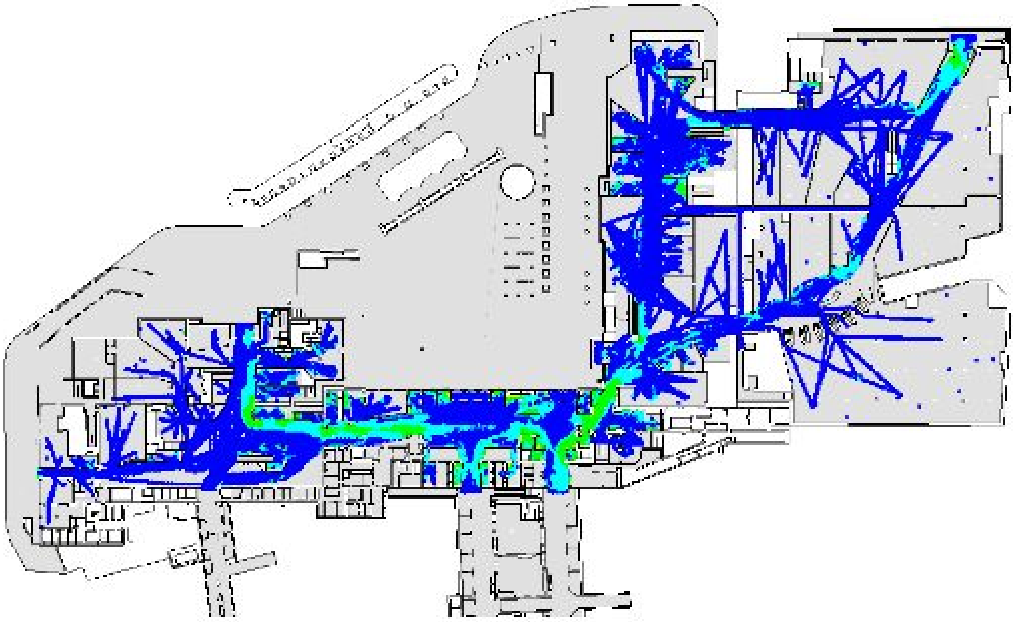
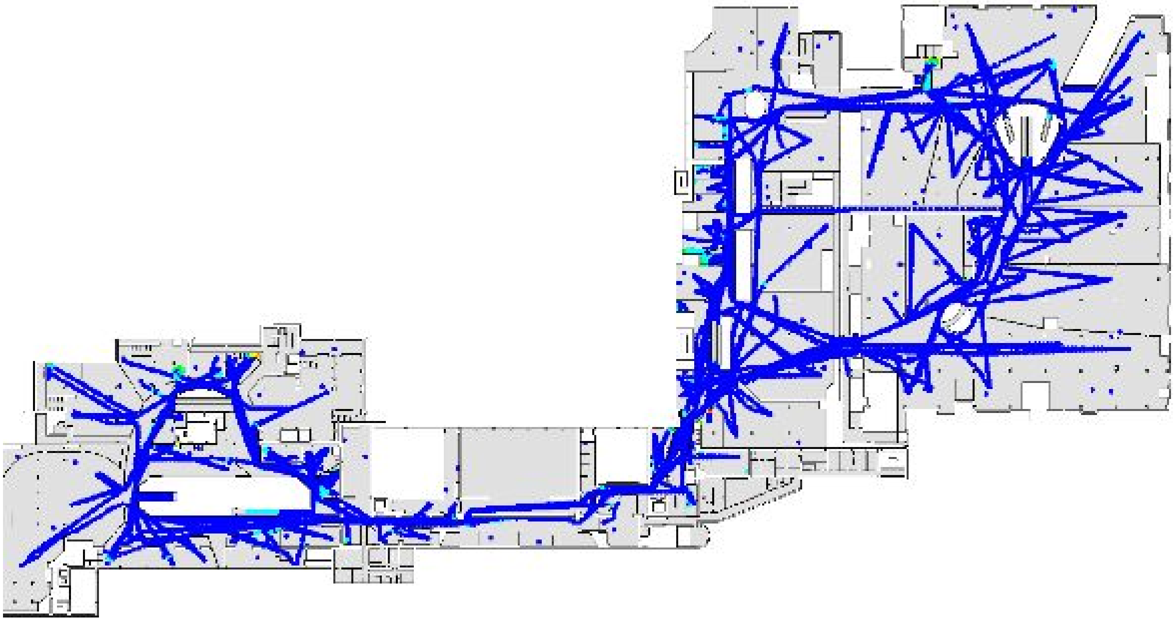
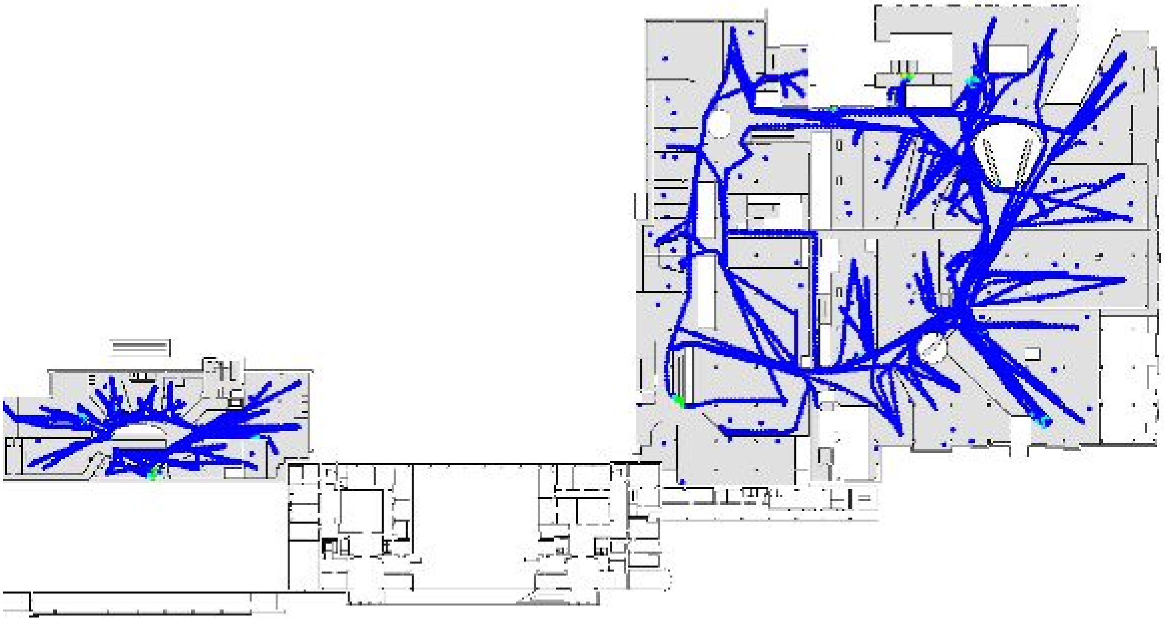


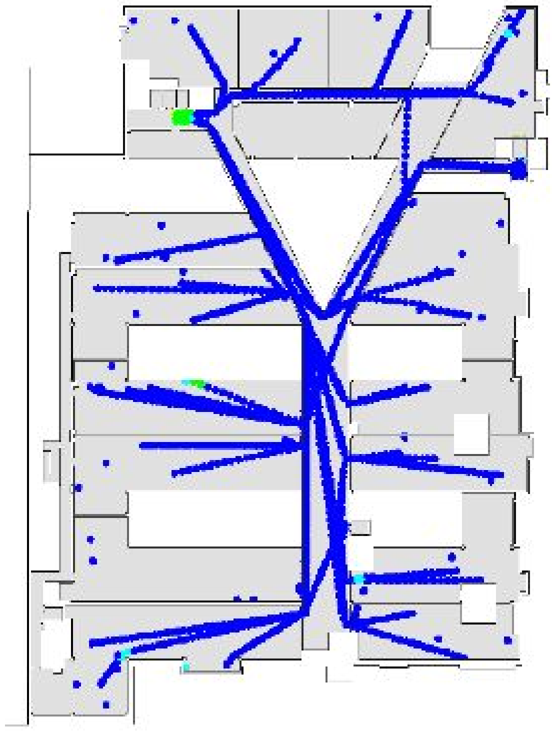
Figure 10.20: Origo Do Minimum 2025 Model Outputs (Source: AECOM)

Ground Floor Level – 2050 PM

Second Floor Level – 2050 PM


Third Floor Level – 2050 PM



Fourth Floor Level 2050 PM



Fifth Floor Level 2050 PM

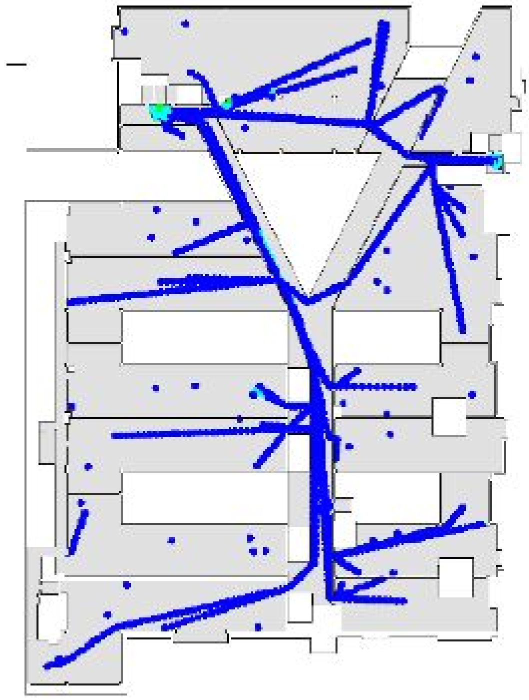
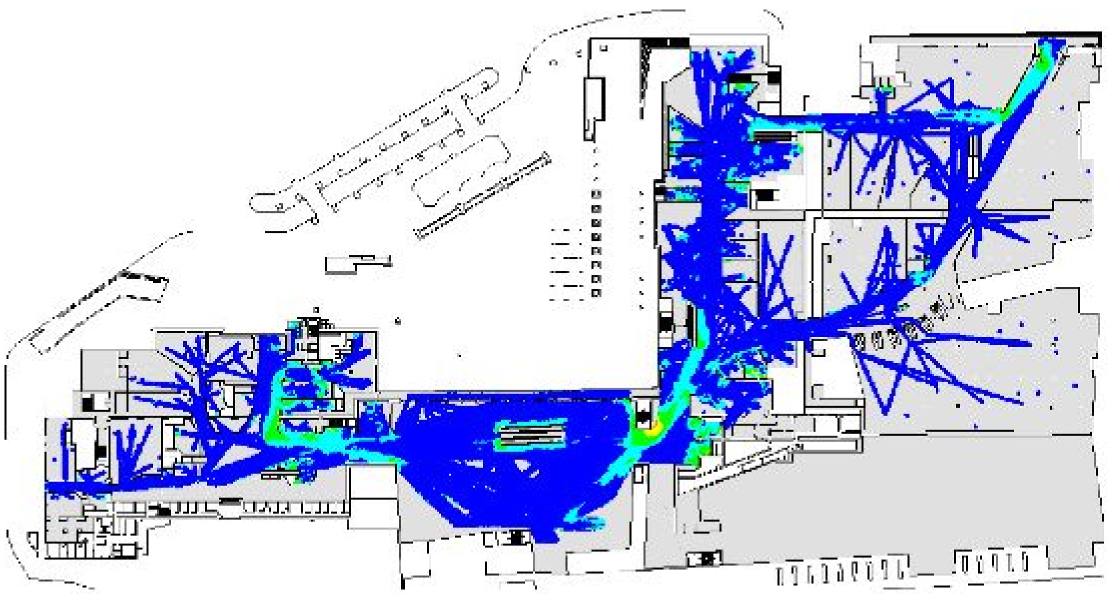


Figure 10.21: Do Minimum 2050 Model Outputs (Source: AECOM)

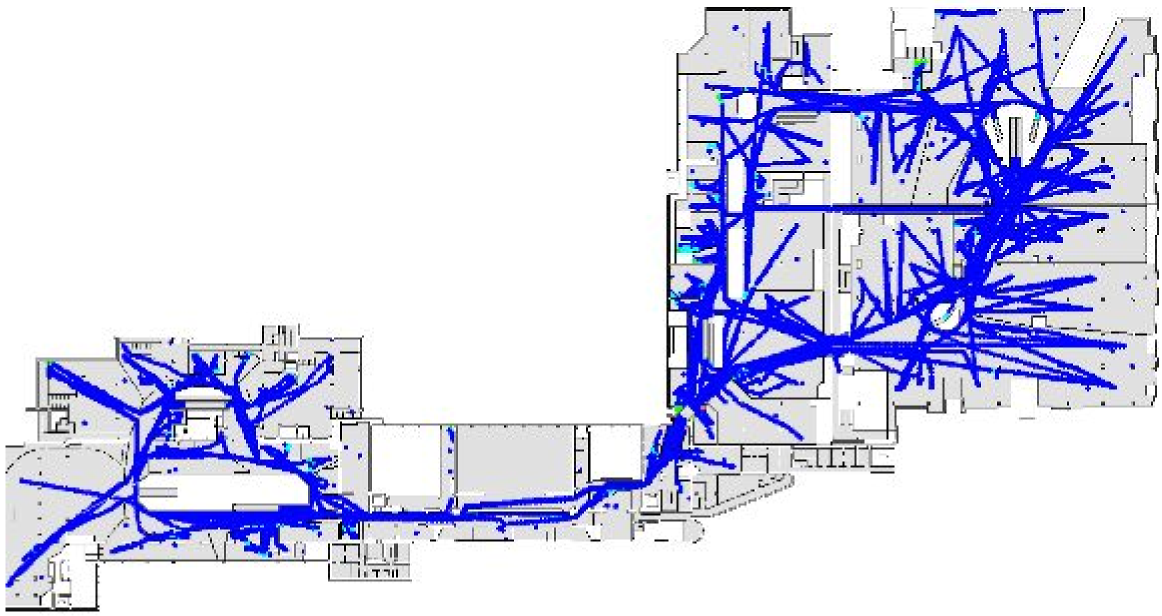
Figure 10.20 and Figure 10.21 show the CMD maps for the Origo Shopping Centre Model for the Do Minimum scenario. From the plots it can be seen that most of the ground level operates at LoS A with some LoS B at the narrowest point of the corridor. This means that within the shopping areas there is sufficient room for free circulation. Levels two to five show mainly LoS A meaning that there is ample circulation space on all these levels.

10.5.7 Preferred Option Origo Shopping Centre Model Outputs

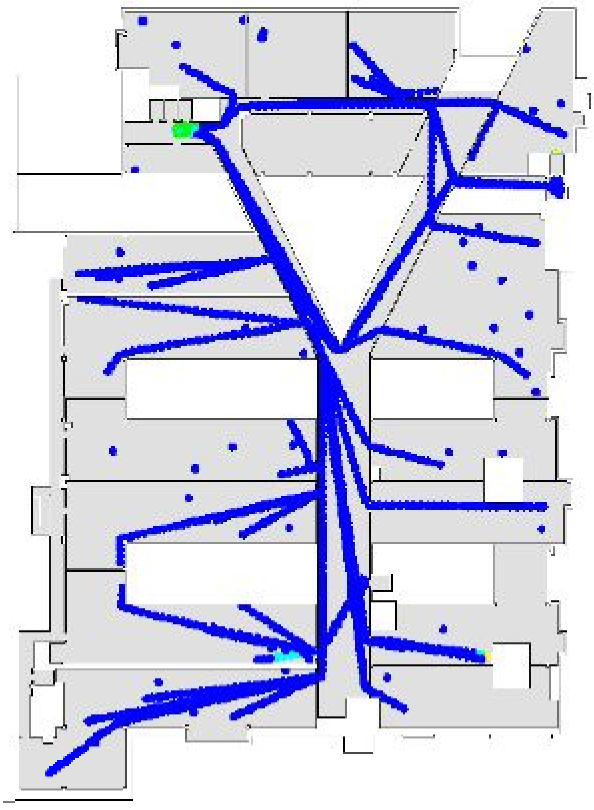
Ground Floor Level – 2025 PM



Second Floor Level – 2025 PM



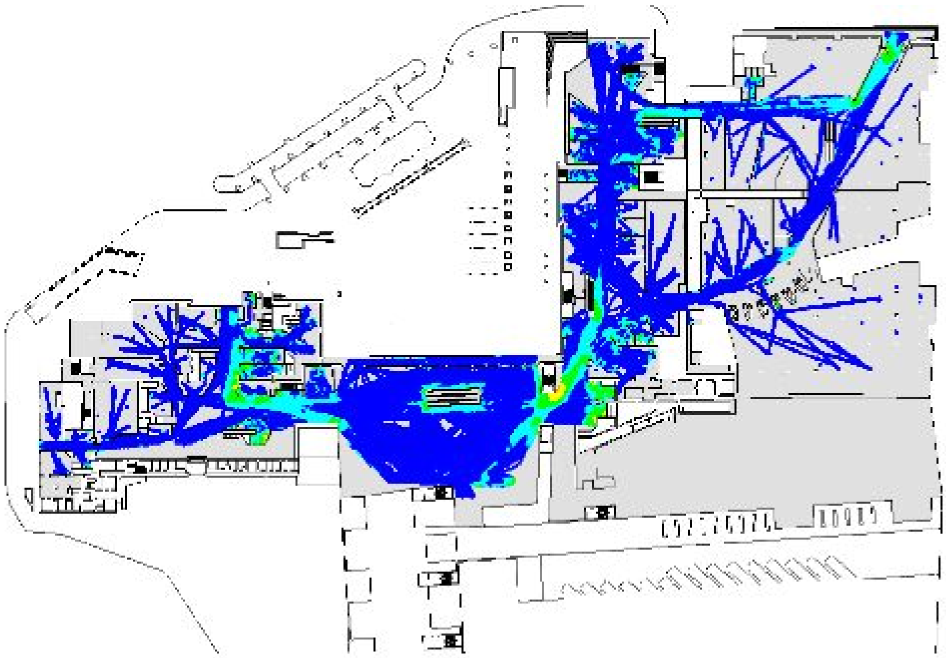
Third Floor Level – 2025 PM

Fourth Floor Level 2025 PM


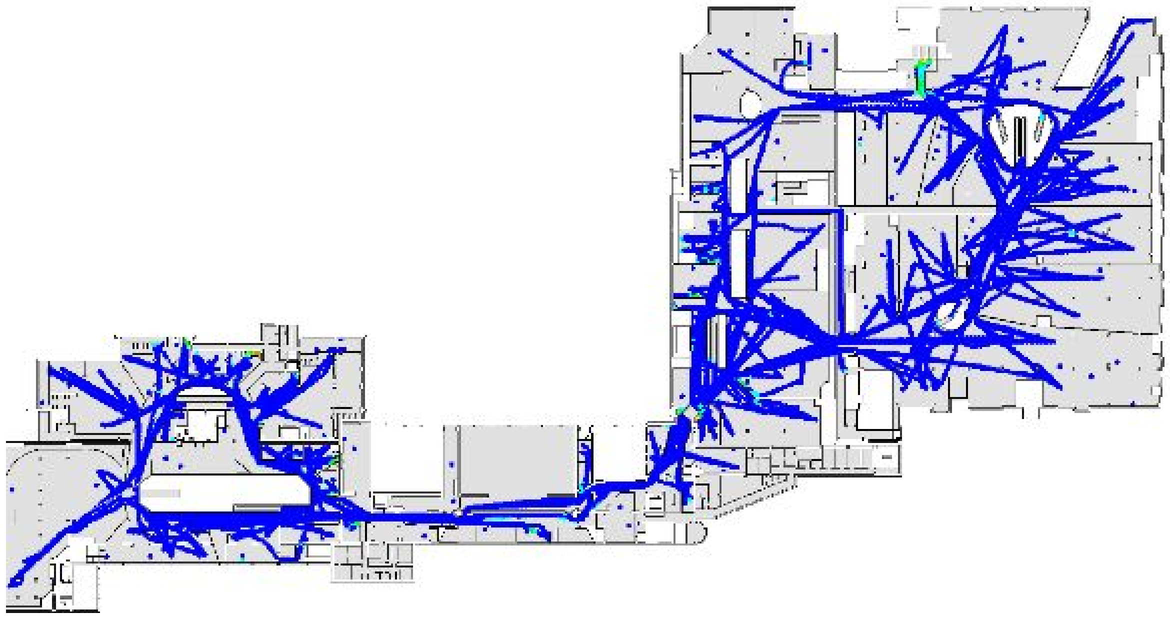
Fifth Floor Level 2025 PM

Figure 10.22: Origo Preferred Option 2025 Model Outputs (Source: AECOM)

Ground Floor Level – 2050 PM

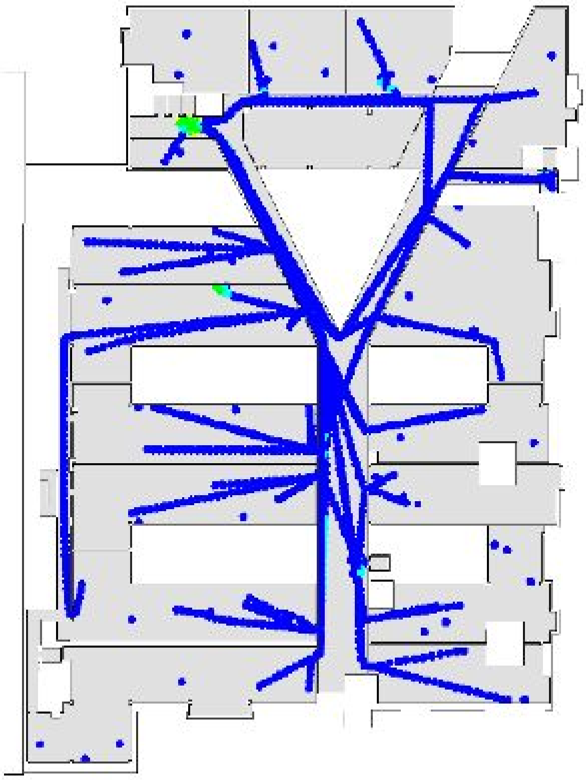


Second Floor Level – 2050 PM



Third Floor Level – 2050 PM

Fourth Floor Level 2050 PM



Fifth Floor Level 2050 PM

Figure 10.23: Origo Preferred Option 2050 Model Outputs (Source: AECOM)

Figure 10.22 and Figure 10.23 display the CMD maps for the Preferred Option modelling of the Origo Shopping Centre. As can be seen from the maps, most of the areas operate at LoS A, meaning that there is sufficient space for free circulation. When compared to the Do Minimum model, the Preferred Option model shows less congestion as the area where the shopping centre connects to the station is open and spacious.

There are some localised areas of congestion (LoS C/D) at the connection between Origo and the Station in the preferred option design. However most of the space at this connection is operating at LoS A/B meaning that there is enough space for comfortable movements in this area. One way in which the level of service experienced by people in this area could be improved is by re-locating the staircase that is adjacent to this space around which the higher LoS levels have been recorded. This would open up the space more giving people more room in which to spread out and would help to reduce crowding in this space.

10.6 Work Package Summary

This work package presents all the robust performance assessment modelling that have been undertaken for the station interior and the forecourt, for the adjoining Origo shopping centre and for the adjoining road network and junctions. A range of modelling suites have been applied to realistically assess the performance the capacities and operational performances of the rail interchange and the transport network, in “do-minimum” and “Do Something” (Preferred Option) scenarios. The outputs form this modelling work has informed the selection of the preferred option and given the project team adequate confidence that the preferred option will work efficiently in the horizon year(s).

11 WP 2.4 - Modelling of Passenger and Pedestrian Flows around RPTH

11 WP 2.4 - Modelling of Passenger and Pedestrian Flows around RPTH

11.1 Introduction

In accordance with the study Technical Specification, this report chapter states the pedestrian and traffic analysis and modelling process and the outputs of the analysis/modelling undertaken.

11.2 Industry Standard Outputs

The acknowledged industry measure for pedestrian spatial requirements is Fruin's 'levels of service' (see Figure 11.1**). This refers to the relationship between the density and the speed at which passengers can move and/or circulate along/across a given space. The 'Levels of Service' system uses the letters A through F as described below:**

- **LoS A: Free circulation;**
- **LoS B: Uni-directional flows and free circulation; reverse flows with only minor conflicts;**
- **LoS C: Slightly restricted circulation; reverse and cross flows with difficulty;**
- **LoS D: Restricted circulation for most pedestrians; significant difficulty for reverse and cross flows;**
- **LoS E: Restricted circulation for all; intermittent stoppages and serious difficulties for reverse and cross flows; and**
- **LoS F: Complete breakdown in circulation; many stoppages.**

A visual representation which shows the correlation between the 'levels of service' and the quality of the passenger's space is provided below:

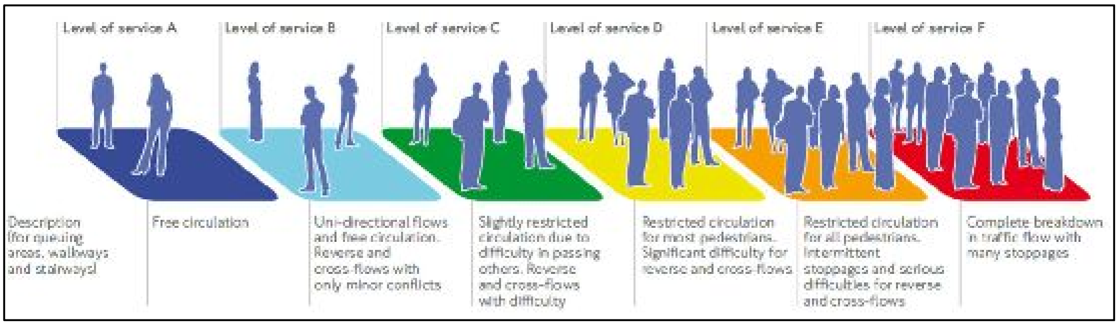


Figure 11.1 – Fruin's Levels of Service (Source: London Underground Station Planning Standards and Guidelines, July 2012)

11.3 Strategic Pedestrian Analysis

In order to develop the 2015 'Base' model, two key inputs to the strategic analysis tool were required:

1. ***Effective Widths*: The measurements used for this analysis were taken at the narrowest point along each link; effectively representing the pinch-points or bottlenecks present in the physical street environment that pedestrians must navigate through/around. These were measured in autoCAD against a topographical survey of the wider area provided by the client and corroborated using Google Streetview /Bing maps.**

2. ***Pedestrian Flow Data:* Counts of the external study area were completed as part of the pedestrian survey undertaken in September 2015; peak hour two-way flows have been used for each of the study periods (AM, PM, and Saturday peak). Data was then checked and corroborated against historical survey data provided by the survey company. The full set of survey results is attached as Appendix WP 1.5 & WP 1.6 2 – Flow Diagrams.**

The strategic analysis tool uses the input data to calculate minimum footway width requirements; thereby determining whether or not the current minimum effective width on a particular link is adequate for the associated pedestrian flow. The formula used has been included below.

$$Two-WayPassagewayWidth = \left(\frac{PeakMinuteFlow}{40} + (2 \times 0.3)\right)m$$

$$One-WayPassagewayWidth = \left(\frac{PeakMinuteFlow}{50} + (2 \times 0.3)\right)m$$

Figure 11.2 – Static Analysis Formula used in Strategic Tool (Source: Network Rail Station Capacity Assessment Guidance, May 2015)

Definitions of the parameters used in the above formula are below:

- Two-Way Passageway: Two-way flow passing along the passageway;
- One-Way Passageway: One-way flow passing along the passageway;
- Peak Minute Flow: maximum flow passing along the busiest section of the passageway;

When incorporated into the strategic tool, this calculation helps determine the 'level of service' of the link which is given in *passengers per metre per minute*. An example of the full calculation (showing 'level of service') has been shown below.

Link 1	Peak Period	
Assessment Criteria		
Two-way Passageway Flow (LOS C)	40	Passengers per metre per minute
Edge Effects	0.3	Metres
Assessment	AM	
Peak 1 hour Flow (two-way)	294	
Peak 15 minute Flow (two-way)	79	
Peak 5 Minute flow (two-way)	32	
Peak Minute Flow	6	
Two-way Entry Width Requirement (m)	0.16	
Two-way Entry Width Requirement inc Edge Effect	0.76	
Passangers Per Metre Per Minute (inc. Edge Effect)	8	
Level of Service (LoS)	A	
Actual Width (wall to wall)	1.41	
Conclusion	OK	

Table 11.1 – Pedestrian Link Capacity: Static Analysis Example Output (Source: AECOM)

The Level of Service A denotes a very good performance indicator in terms of capacity of pedestrian walkways.

GIS mapping software (arcMap) was used to visualise the results of the analysis by plotting 'level of service' against the relevant part of the pedestrian network sourced from OpenStreetMap. This was done in order to create 'level of service' mapping for the entire study area (see '*Outputs'*) below.

11.4 Strategic Pedestrian Analysis Outputs

Scenarios

Level of Service maps have been produced for the following scenarios:

- **'Base' 2015**
- **'Do Minimum' 2025 & 2050 scenario**
- **RPTH 'Do Something' (Preferred Option) 2025 & 2050 scenario**

Periods

For each scenario, outputs have been produced for the following three peak periods:

- **Weekday AM peak: 08:00 – 09:00**
- **Weekday PM peak: 17:00 – 18:00**
- **Saturday peak: 13:00 – 14:00**

11.4.1 Base 2015

Analysis revealed that for each of the three study periods, Level of Service was calculated to be 'A' (blue) for all links within the pedestrian network (see Figures 11.3-11.5); well within the acceptable threshold of LoS 'C'. This means that with regards to pedestrian flows, every link examined experiences 'free circulation' with no blockages or conflicts.

In some places, this is likely due to the particularly wide sidewalks and pavements present across Riga's urban environment. Even where 'busier' pedestrian movements have been recorded, such as the underpass across Gogoļa iela (a peak hour two-way flow of 2,341 for Saturday), the effective width of the link (12.56m) is sufficient to provide adequate capacity.

It should be noted that wide pavements/sidewalks are not present everywhere within the network – there are numerous links that have effective widths of less than 1.5m. For example, on the southern side of Satekles iela between Elizabetes iela and Dzirnavu iela, the effective width is 1.49m and the pedestrian footpath on Maskavas iela is 1.41m. However in these cases flows are low enough that the width of the link is still sufficient; again producing LoS A.

Given that the base network operates at LoS A across each of the three study periods, the mapping shows the exact degree of LoS.

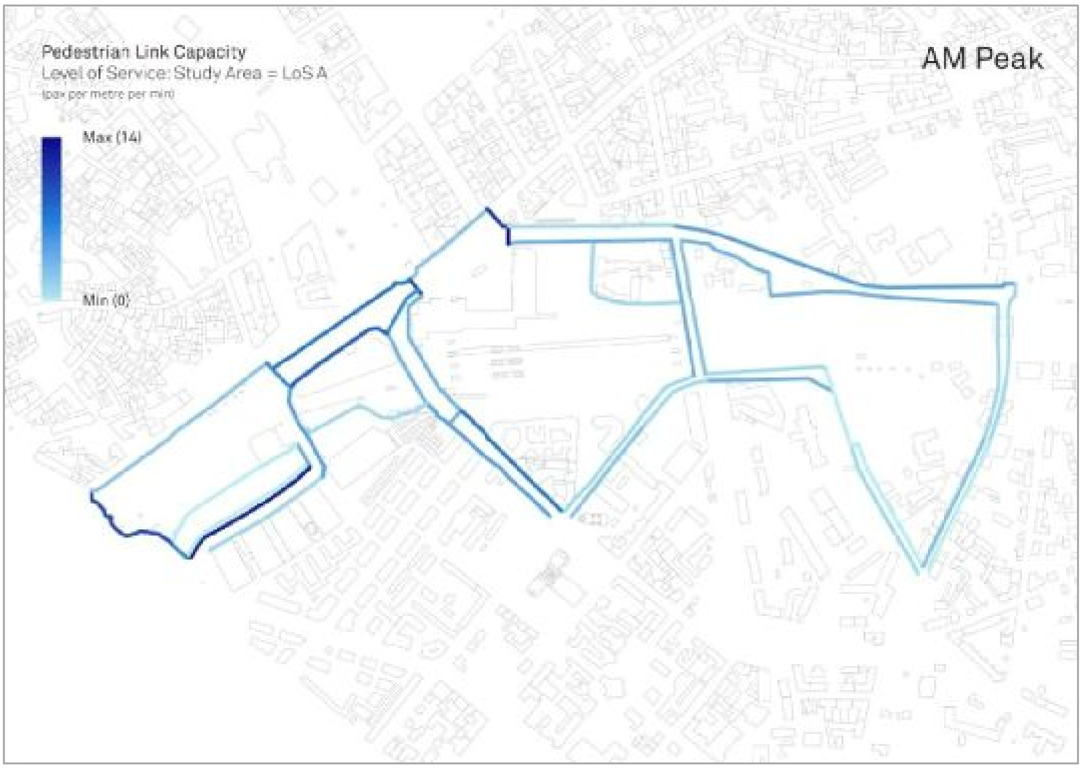


Figure 11.3 – Base Network AM Peak Hour LoS (Source: AECOM)

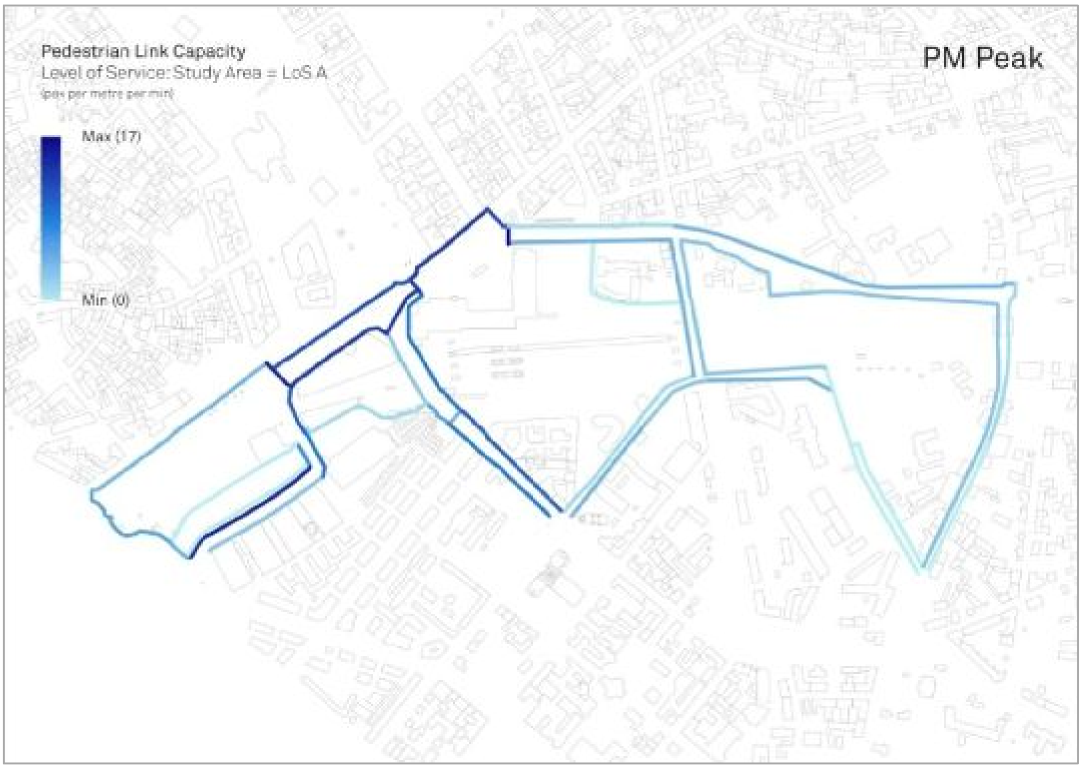


Figure 11.4 – Base Network PM Peak Hour LoS (Source: AECOM)

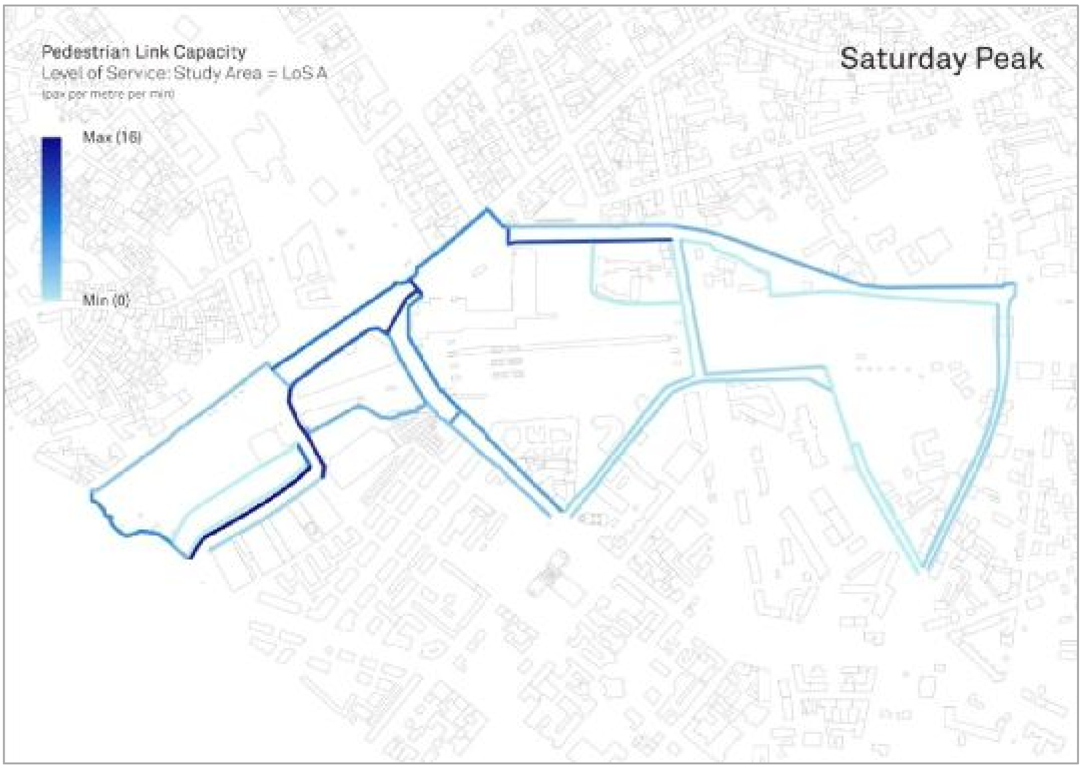


Figure 11.5 – Base Network Saturday Peak Hour LoS (Source: AECOM)

11.4.2 'Do Minimum' 2025 & 2050 scenario

Additional analysis was undertaken to test the pedestrian network against uplifted demands to both future years 2025 and 2050. A 9.4% background growth uplift was applied (until 2025) and 33.25% was applied between 2025 and 2050. The testing also incorporated additional demands associated with several committed developments in the immediate area; namely:

- **Two hotels to be built at the intersection of Satekles iela and Dzirnavu iela;**
- **The Origo extension; and**
- **A new connection between Elizebetes iela and Timoteja iela with both north and south movements.**
- **SATURN model outputs**

Each scenario uses the base 2015 models with the above changes incorporated into the demands for each respective future year. To gain an understanding on the impacts of the proposed hotels on the pedestrian network around the study site, the multi-modal data collection service TRICS was used to obtain a trip rate for the hotels, which were assumed to be 200 beds each. This methodology was then applied again to account for the Origo extension, using city-centre shopping centres with similar total floor space to Origo as proxy subjects.

Analysis revealed slight changes to the overall Level of Service when tested against uplifted demands. The 2025 'Do Minimum' model saw no change during the AM peak period (Figure 11.6), with a uniform LoS 'A' registered across the network. The PM and Saturday peak periods both registered the same change, with LoS for one link (the pedestrian route along westbound Satekles iela opposite Stockmanns building) changing from LoS 'A' to LoS 'B' (cyan); remaining well within the acceptable threshold for level of service (see Figures 11.7 and 11.8 respectively).

As such, the network examined using 2025 demands would experience 'free circulation' with only minor blockages or conflicts on the link mentioned above.

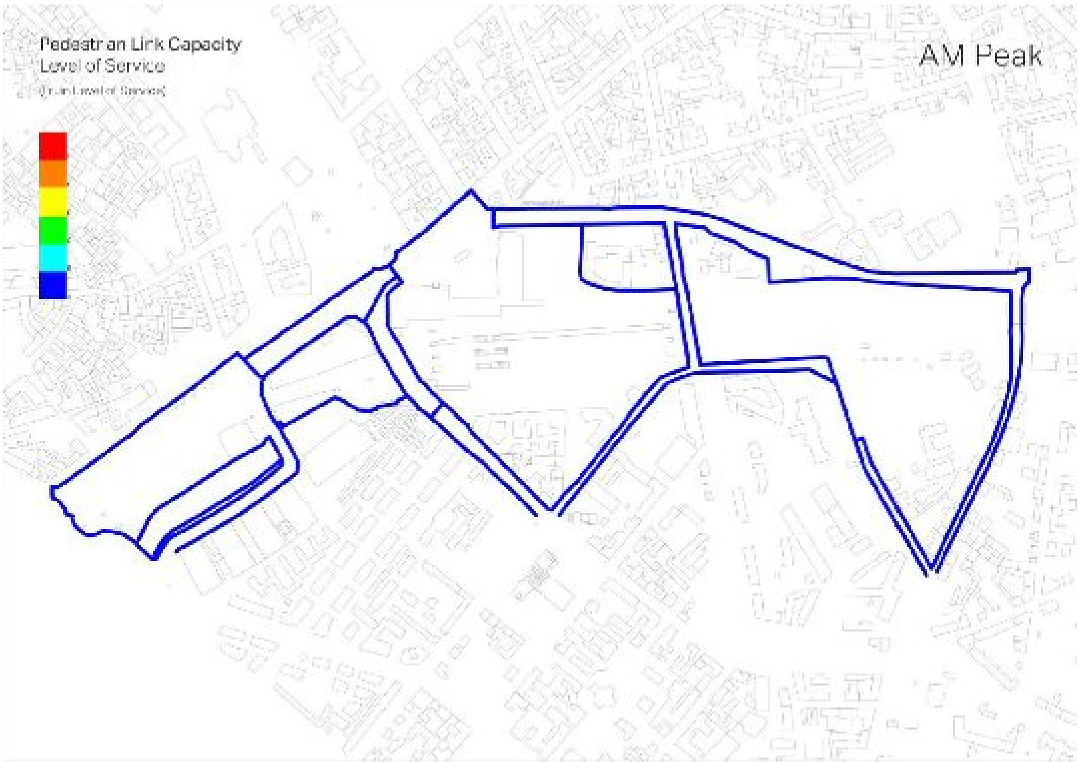


Figure 11.6 – "Do Something" Preferred Option 2025 Network AM Peak Hour LoS (Source: AECOM)

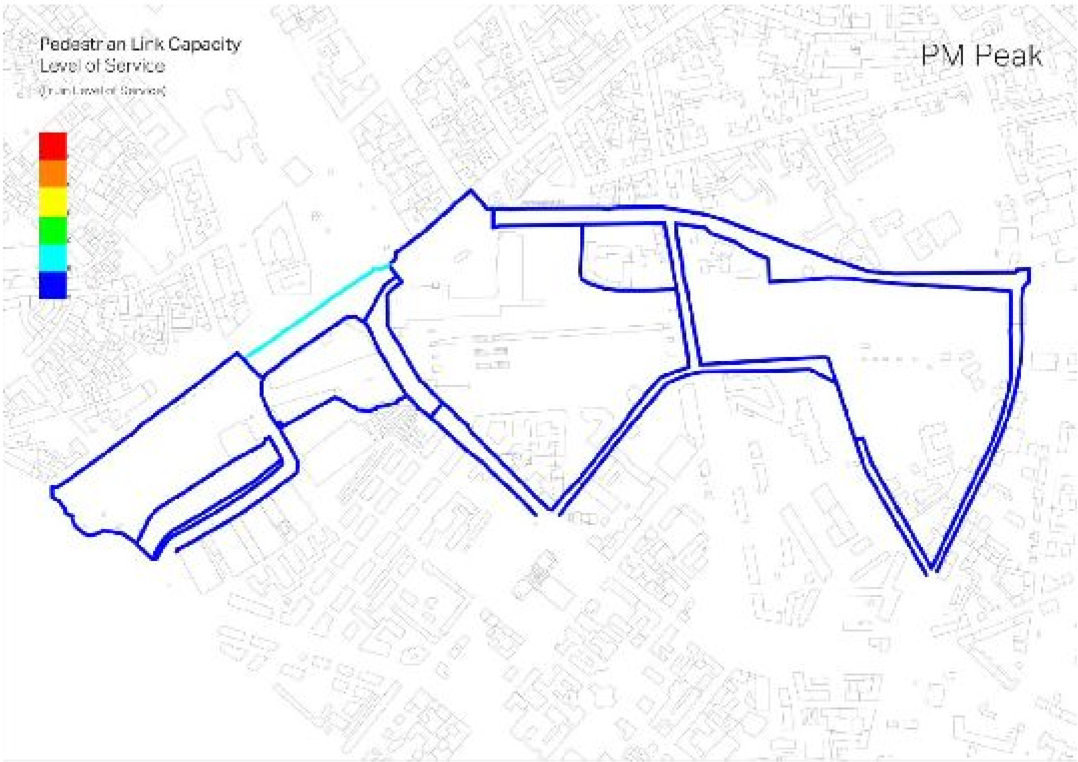


Figure 11.7 – "Do Something" Preferred Option 2025 Network PM Peak Hour LoS (Source: AECOM)

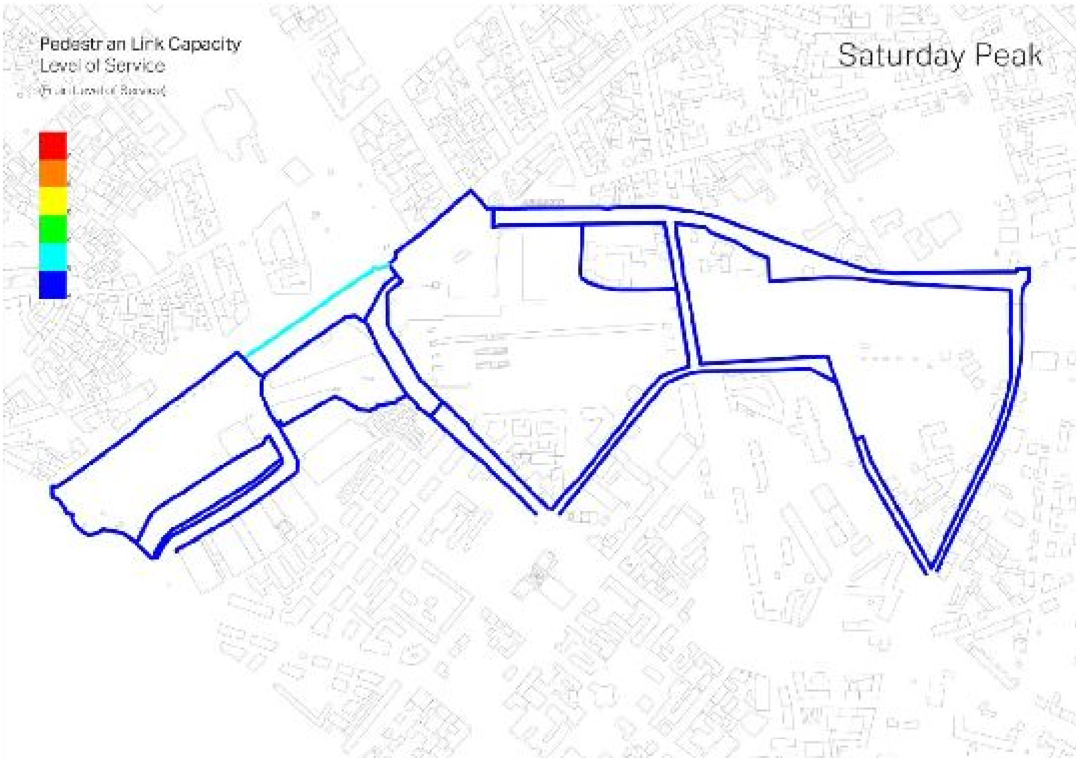


Figure 11.8 – "Do Something" Preferred Option 2025 Network Saturday Peak Hour LoS (Source: AECOM)

For the 2050 'Do Minimum' model, further changes were observed to the overall level of service; with links across each of the three periods (AM, PM and Saturday peak) shifting from LoS 'A' to both LoS 'B' and LoS 'C' in cases. These are largely minor, with only one link registering at LoS 'C'. This occurs on the pedestrian route immediately in front of the Stockmanns building for the PM and Saturday peaks (see Figures 11.10 and 11.11).

Again, the overall network tested using 2050 demands would experience free circulation with minor blockages in places; largely occurring towards the centre of the study area where pedestrian flows are generally higher (i.e. proximity to Stockmanns Building/Origo/Station). Level of service therefore remains within the acceptable threshold for each of the three peak periods up to and including future year 2050 scenario.

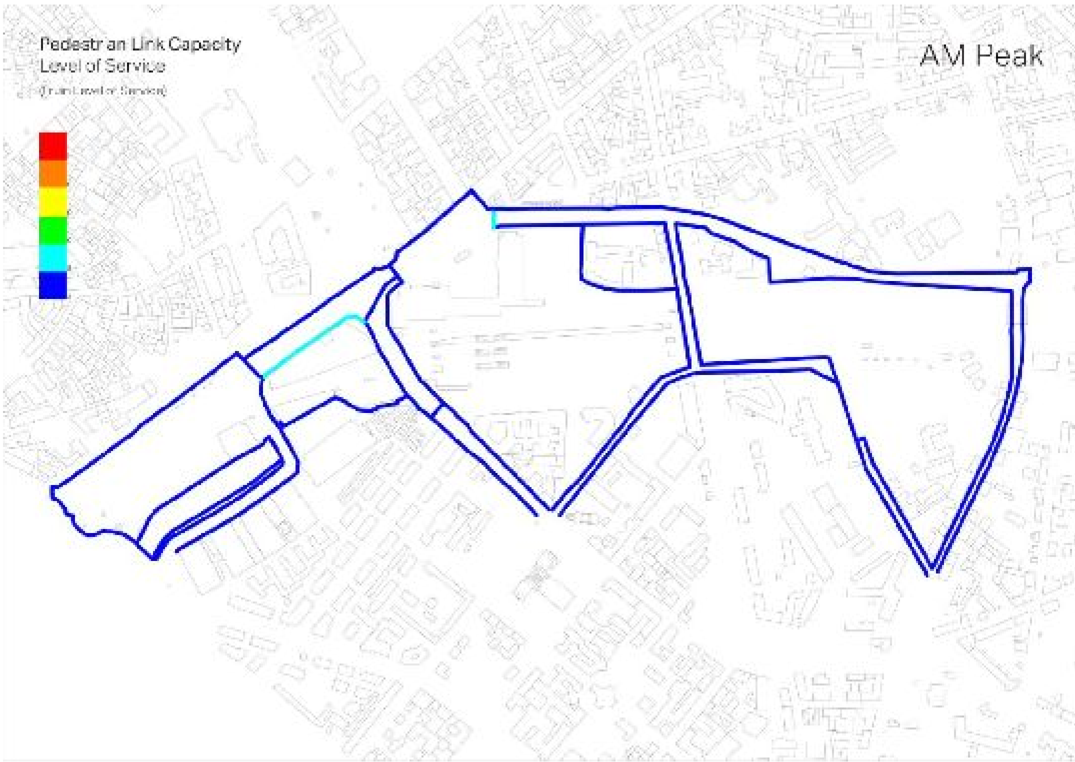


Figure 11.9 – "Do Something" Preferred Option 2050 Network AM Peak Hour LoS (Source: AECOM)

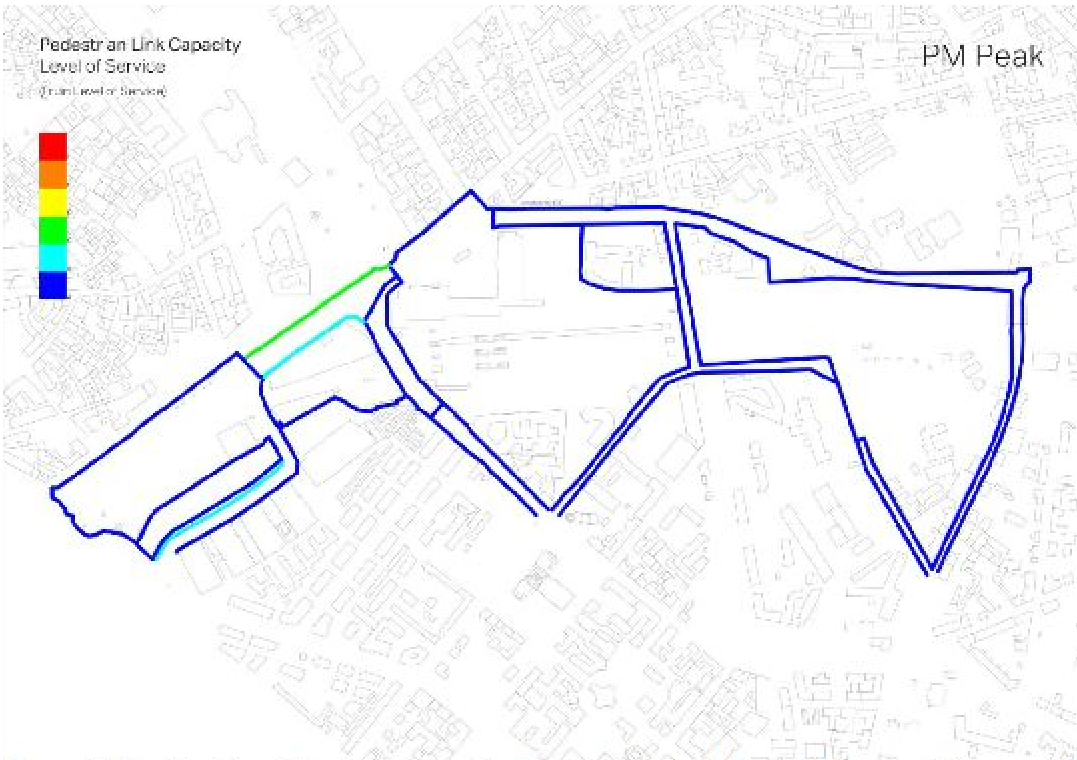


Figure 11.10 – "Do Something" Preferred Option 2050 Network PM Peak Hour LoS (Source: AECOM)

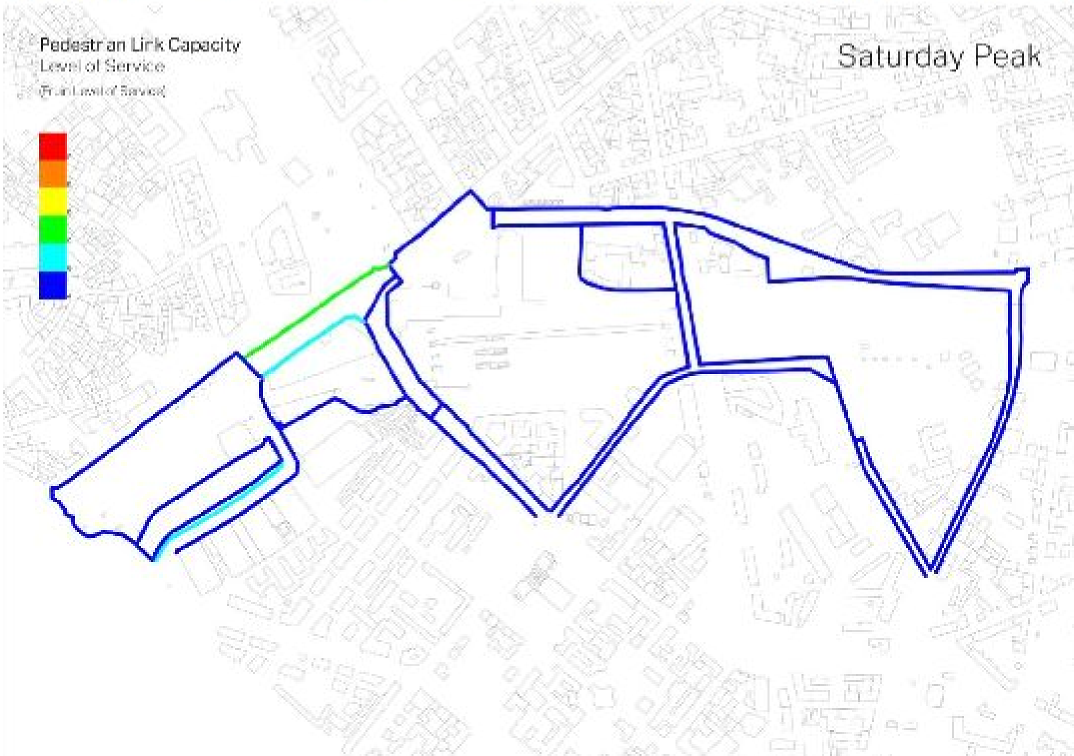


Figure 11.11 – Preferred Option 2025 Network Saturday Peak Hour LoS (Source: AECOM)

11.4.3 RPTH 'Preferred Option' 2025 & 2050 scenario

Similar to the 'Do Minimum' scenario, this analysis utilises the base model with additional changes on top of the 'Do Minimum' scenario. These include:

- **Inclusion of the multi-modal transport hub; and**
- **Associated SATURN model outputs.**

Analysis revealed that results for both the 2025 and 2050 uplift scenarios, across each of three peak periods, were unchanged from the 'Do Minimum' Model.

The network examined using 2025 demands would experience 'free circulation' with only minor blockages or conflicts during the PM and Saturday peaks, whereas the 2050 demands would result in a slightly higher number of links operating at LoS 'B' and LoS 'C'.

As such, level of service would remain within the acceptable threshold for each of the peak periods across each 'Do Something' scenario.

11.5 Strategic Traffic Analysis of RPTH Study Area

The development of the strategic traffic static analysis tool is adapted from the Transport Road Research Laboratory RR67 document[1], using calculations to derive junction saturation flows. The required inputs for the model include; lane type, traffic flow data and observed traffic signal timings (where required) to produce Degree of Saturation values for each junction arm. The model assumes a maximum lane flow of 2080 passenger car units an hour, a lane width of 3.2m and the lane to have sufficient capacity for any queuing traffic[1].

11.5.1 Modelling Process - Priority Junction:

The calculations used to determine the Degree of Saturation values vary depending on the lane and junction types. Fundamentally, for priority junctions such as crossroads and T-junctions, traffic inflow (*v*) is calculated as a proportion of road capacity (*c*):[2]

$$\frac{v}{c}$$

For ahead only lanes on the main road is based upon the proportion the actual traffic flow to the maximum saturation flow, which depends on whether the lane is opposed by oncoming turning traffic (1850 pcu/h) or unopposed (2080 pcu/h)[1].

Determining junction arm saturation on lanes with both ahead and turning traffic depends on the percentage of turning traffic. When the turning traffic is less than 10%, the expected vehicle inflow is calculated as a proportion of 1940 pcu/h to give the Degree of Saturation for that lane[2], as the turning traffic does not significantly affect the Degree of Saturation. However, when the turning traffic percentage is greater than 10%, the following calculation is used to scale the additional turning traffic:

$$S(t) = \left((S_a \times f) - (S_a \times 0.1)\right) \times 1.125$$

Essentially, the calculation works out the difference between the expected vehicle inflow (S_a) multiplied by the turning traffic proportion (*f*) and the expected vehicle inflow multiplied by 10%, which is then scaled by 1.125. This derives an equivalent flow rate for the extra turning traffic, due to the additional cars turning, therefore increasing the lane saturation. The extra turning traffic flow rate is then subtracted from the maximum flow rate of that lane, reducing the practical junction capacity.[2]

When there is a dedicated unopposed turn lane the following formula is used, where *S(r)* is the Saturation flow for the turn lane, *r* is the radius of the turn lane in metres and S_a saturation flow rate.[1]

$$S(r) = \frac{S_a}{(1 + \frac{1.5}{r})}$$

This calculates the maximum saturated flow rate of the dedicated turn lane, and the expected traffic flow is calculated as a proportion of this to give the Degree of Saturation. The saturation flow rate for priority T-junctions is ~500pcu/hr for left turns and ~700pcu/h for right turns.

Conversely, a different formula is used when oncoming traffic opposes the turn lane such as during a left turn, assuming there is sufficient storage space for left turning vehicles and the opposing traffic flow rate is below 1800 pcu/h. This is shown below, where Q_o is the opposing traffic flow rate[2], however the model requires that Q_o has already been calculated prior to the use of the formula.

$$S(r) = 1286 - 0.78Q_o$$

11.5.2 Modelling Process - Signalised Junctions

In most cases, the previous calculations contribute to the signalised Degree of Saturation (ρ) value that can be calculated using the equation below, additionally requiring the cycle time (*c*) and the effective green (*g*) of the traffic signals.

$$\rho = \frac{cq}{sg}$$

The value *q* is the expected vehicle inflow; however the model also factors in the extra over turning traffic flow for mixed straight ahead and turning lanes during the effective green period which were demonstrated previously, with *s* being the saturation flow in pcu/h on an equivalent straight section of road.[2]

11.5.3 Model Inputs

Traffic flow data was gathered between the 5th and 12th September 2015 by survey subcontractor Solvers for the AM, PM and Saturday peak hours. The surveyed traffic turn counts used in the model are shown in the Appendix WP 1.5 & WP 1.6 2 – Flow Diagrams. Survey footage was also recorded on the surveyed dates which were used to establish traffic signal timings including cycle time and green time to be input into the model. Turning counts were split across lanes (where applicable) to estimate individual lane flows and were input to the model on a junction-by-junction basis.

11.6 Model Outputs and Results

The survey data was organised and was used to inform a flow diagram, representing the present road layout and network in the study area. Formulas relevant to the vehicle movements were assigned to derive the Degree of Saturation, using the colour gradients shown in Figure 11.12.

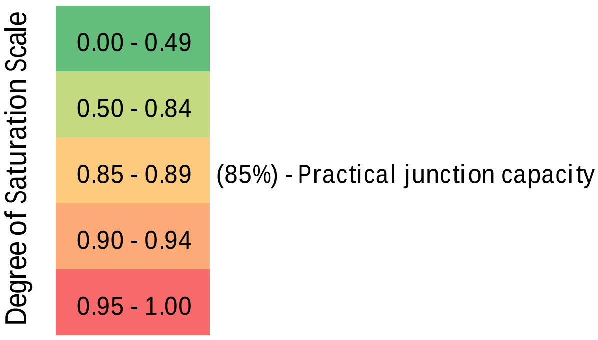


Figure 11.12 – Colour gradient representing the Degree of Saturation. Values over 0.85 indicate potential issues with the intersection.

Once a common road layout was established with base flows input, two additional versions were created to represent the two scenarios; 'Do Minimum' and 'Do Something' with the network adjusted to represent the scenario. An example of the tabular output from the model is shown in.

Note that the model assumes the worst case scenario, often with over-estimated outputs.

11.6.1 2015 Base

The flow diagram output from the model revealed most intersections in the survey area to be operating well within capacity, with no junction significantly saturated. However, in the example model output (shown in Figure 11.13) indicates the shared through/left turn lane on Marijas iela is over the practical capacity (0.85) of the junction. This is due to conflicting ahead/left turn vehicle movements during the signalled green time, while the adjacent dedicated left turn lane is underutilised. This identifies a vehicle movement to assess further.

However, green times for most intersections were well above what is currently required, and so presents some spare green time for future signal optimisation. This is demonstrated in, whereby the ratio of degree of saturation to green time is low, most notably on the Raina bulvaris junction arm. The 40 second green time for flows significantly lower than other junction arms mean this can be reduced significantly, gaining additional capacity for other junction arms if future traffic flows increase.

The other intersections appear to operate well, with the exception of the Satekles iela/Lāčplēša iela intersection. The traffic tool suggests the junction is beyond the practical junction capacity for some movements, however compared to the survey footage the junction functions well, albeit with high traffic movements.

Intersection ID: 3				
	Lane Type	Traffic Flow	Green Time	Degree of Saturation
13. janvāra iela	Ahead Only	426	34	0.63
	Ahead Only	427	34	0.63
	Ahead Only	426	34	0.63
	Ahead Only	427	34	0.63
	Right Only	147	N/A	0.08
Marijas iela	Ahead Only	301	34	0.45
	Ahead Only	301	34	0.45
	Shared Left	469	34	0.89
	Left Only	196	34	0.29
Gogoļa iela	Left Only	318	30	0.54
	Right Only	265	30	0.45
	Right Only	265	30	0.45
Raiņa bulvāris	Right Only	224	40	0.28
	Ahead Only	267	40	0.34
	Left Only	79	40	0.10
	Left Only	80	40	0.10
	Cycle Time:	105		

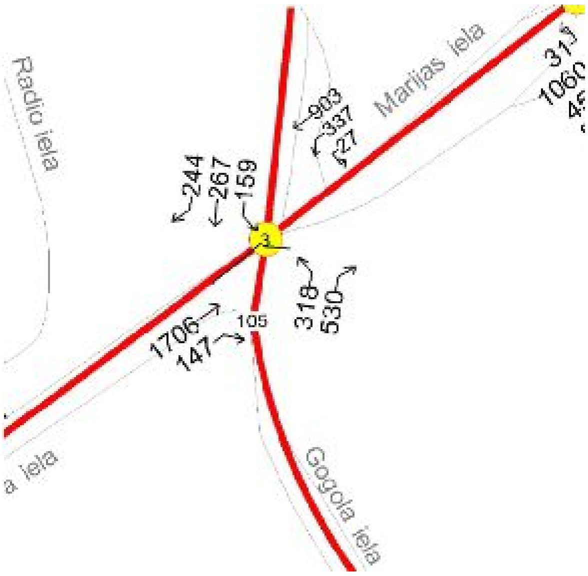


Figure 11.13 – Extract from the AM base peak hour results showing the model output (left) and the corresponding observed turning count (right) (*Source: AECOM)*

11.6.2 'Do Minimum' – 2025 & 2050

The scenario utilises the base 2015 flow diagram with the exception of the proposed changes within the study area until 2050. These include several committed developments in the surrounding area, including;

- Two proposed hotels built near the intersection of Satekles iela and Dzirnavu iela.
- The Origo extention being built
- The opening of a single carriageway road tunnel connecting Elizabetes iela and Timoteja iela with both Northern and Southern movements
- SATURN model outputs
- A 9.4% background growth uplift applied (until 2025) and 33.25% between 2025 and 2050.

To gain an understanding on the impacts of the proposed hotels on the road network, the multi-modal data collection service TRICS was used to obtain a trip rate for the hotels, which were assumed to be 200 beds each. The trip rates used to establish the additional network traffic are shown in Table 11.2.

	AM	PM	Sat
1 bed equates to			
Departures	0.067	0.044	0.034
Arrivals	0.04	0.071	0.038

Table 11.2 –Trip rates from TRICS for city centre hotels with 150 - 250 beds

Similarly for the Origo extension, TRICS was used to establish the vehicle occupancy rate in addition to passenger car modal share. Shopping centres with similar total floor space to Origo were selected that were located in city centre areas. The outputs from TRICS are shown in Table 11.3.

Vehicle Occupancy			
	AM	PM	Sat
Departures	0.034	0.561	2.601
Arrivals	0.590	0.141	2.376

Passenger Car Modal Split			
	AM	PM	Sat
Departures	8.30%	26.30%	59.20%
Arrivals	26.70%	12.50%	55.90%

Table 11.3 – TRICS outputs for city centre shopping centres, showing vehicle occupancy rates and modal split (Source: AECOM)

The current proposal for a tunnel connecting Elizabetes iela to Timoteja iela was also included in the assumptions, based on a bi-directional single carriageway tunnel.

The results from the 'do minimum' SATURN model was also factored into the traffic model to demonstrate the change in demand as a result of the scenario described above. For further information on the 'Do Minimum' SATURN model, please refer to section Figure 3.3.

The area immediately surrounding the RPTH has been extended from the model to avoid overlapping with the AIMSUN microsimulation. Following the above changes in addition to the applied uplift, the 'Do Minimum' scenario featured minor saturation differences compared to the 2015 base. Some signal timings such as Lāčplēša iela/Satekles iela required modification to accommodate the proposed changes, with saturation levels high for this intersection.

The minor impact on the junctions demonstrates the spare capacity in the network despite the rerouting and additional trips applied to the network. Refer to Appendix WP 1.5 & WP 1.6 2 – Flow Diagrams for model flow diagrams.

11.6.3 'Do Something'

Similarly to the 'Do Minimum' model, the scenario utilises the base 2015 flow diagram with several additional changes on top of the 'Do Minimum' scenario. These include;

- Inclusion of the multi-modal transport hub with modified routing assumptions reflecting the changes
- Lane and road modifications as per the 'Do Something' proposals on 13 janvara, Satekles iela and Gogoļa iela.
- One way Northern routing of Dzirnavu iela, with corresponding Southern one way system on Elizabetes iela/Timoteja iela tunnel.
- Optimisation of signals on Lāčplēša iela/Satekles iela and Gogoļa iela/Turgeņeva iela intersections.
- The modifications described in the 'Do Minimum' scenario.

The TRICS hotel and shopping centre data (Table 11.2 and Table 11.3) were also applied to this scenario with additional trips distributed on the network using routing assumptions. A separate SATURN model for the 'Do Something' was also developed, with the link percentage changes applied to the network. Please refer to section 3.3 for information on the 'Do Something' SATURN model.

The significant modifications to the network in addition to the background growth increased the saturation of several junctions significantly, most notably Lāčplēša iela/Satekles iela. Signal timings were consequently modified to improve the situation; however the model can overestimate the saturation level therefore the intersection should not be significantly affected by the changes.

Other intersections were updated as necessary to reflect the network such as Dzirnavu iela/Turgeņeva iela which were found to have spare capacity despite the increase in flows in the vicinity and the creation of the one way system. Therefore, as per the Appendix WP 1.5 & WP 1.6 2 – Flow Diagrams, the effects of the traffic on the RPTH study area will be manageable and in-line with expected growth.

11.7 AIMSUN Modelling

Traffic Modelling of the network area adjacent to the proposed RPTH has been undertaken using AIMSUN Microsimulation software. The extent of the AIMSUN model is shown as Figure 11.14**.**

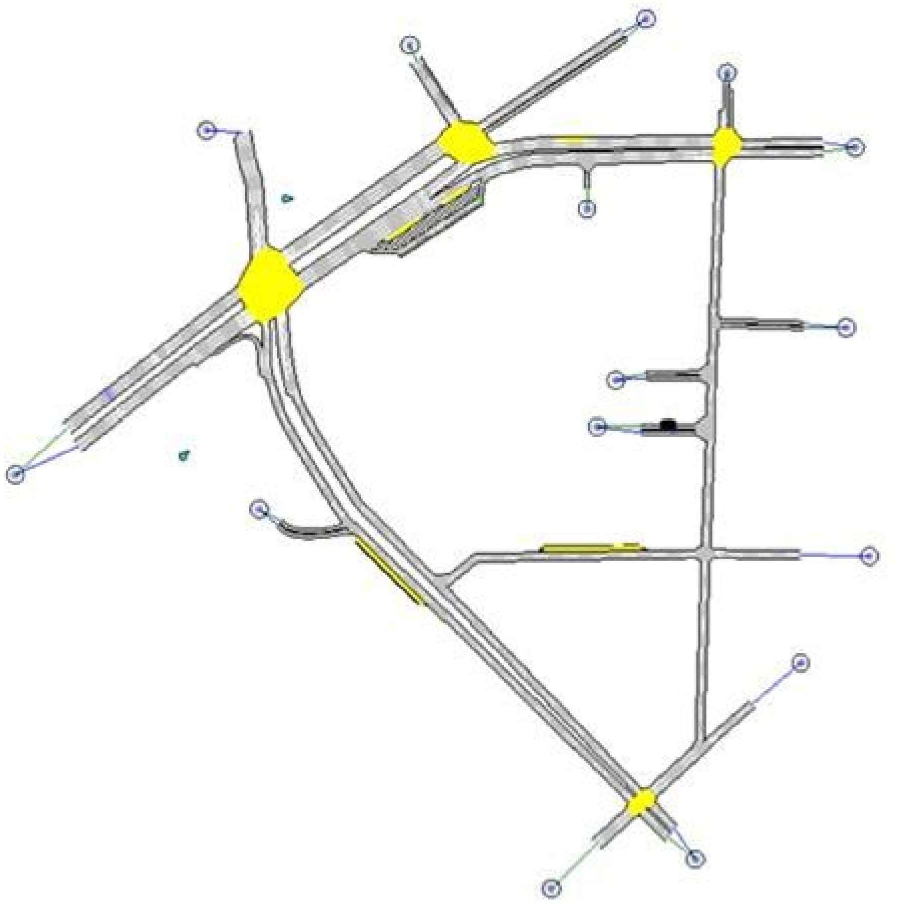


Figure 11.14 – AIMSUN Model Network (Source:AECOM)

The model has been built to help determine the feasibility of the proposed roads network in 2050. This corresponds with the layout proposed as part of the 'preferred option' design – see Chapter 10.

LINSIG modelling has essentially been undertaken to optimise the fixed time signal plans in the 2050 'do something' scenario. Alterations to the existing signal timings are required due to the layout changes proposed as part of the RPTH design.

11.7.1 Model Development Report

Please refer to Appendix WP 2.4 'AIMSUN Development Report' which states the Base 2015 model build methodology, model calibration/validation and the model changes made to the 2015 model to create the 2050 model scenarios. Also included within Appendix 2.4 are model screenshots showing the Journey Time Routes which have been defined to compare Journey Times in 2015 with the 2050 scenarios.

11.7.2 Modelling Results

Stated below in Table 11.4 and Table 11.5 are the route Journey Time results for each modelled scenario. Each Journey Time stated is an average of 10 model runs of that specific scenario.

	Scenario		
Journey Time Route	2015 AM Base/Existing	2050 AM "Do Minimum"	2050 AM "Do Something"
West to East	91	179	243
North to South	55	56	217
East to West	115	207	162
South to North	161	411	284
South to North-east	171	488	259
North-east to South	329	684	300
West to East	91	179	243

Table 11.4 – AM Journey Times

	Scenario		
Journey Time Route	2015 AM Base/Existing	2050 AM "Do Minimum"	2050 AM "Do Something"
West to East	87	133	238
North to South	61	92	202
East to West	110	184	151
South to North	151	400	147
South to North-east	110	355	132
North-east to South	112	429	247
West to East	87	133	238

Table 11.5 – PM Journey Times

The tables show that journey times increase significantly from the 2015 'base scenario' to the 2050 'do minimum'. This is, however, to be expected due to the calculated increase in flow due predominantly to background growth. The 2050 'do something' scenario journey times are significantly lower overall than those of the 2050 'do minimum' scenario and crucially, from a feasibility perspective, the observed modelled queue lengths are not extensive in the 'do something' (preferred option).

11.8 Work Package Summary

This work package sums up all the scenarios that have been assessed through traffic and pedestrian modelling with a view to inform the study in terms of determining the individual and comparative performance of the preferred development option for the Riga Passenger Terminal Hub.

12 WP 2.5 – Elaboration of the alternatives

12 WP 2.5 – Elaboration of the alternatives

12.1 Introduction

This section of the report outlines the methodology proposed to assess the alternative options identified for the RPTH. The methodology is based on a Multi Criteria Analysis (MCA), which provides a mechanism for assessing options against a wide range of objectives and criteria. It enables the performance of options to be assessed when monetisation of the costs and benefits of alternatives is not available; MCA is recommended by the European Commission in cost benefit analysis guidance for investment projects[7] and is recognised as being best practice when considering alternative options.

It should be noted that a Cost Benefit Analysis (CBA) was not a requirement of the Technical Specification for the project. Whilst this has been completed for the Rail Baltica project overall, production of a CBA specifically for this project would be a significant piece of work given the complexity of the project and the range of benefits that it would be required to cover. The MCA has therefore been used as the main tool for assessing the comparative performance of the options identified. In order to ensure that the process captured the views of a wide range of organisations, the task was extended to include a workshop with stakeholders who completed their own assessment of the options using the MCA framework. The results of this are reported here along with the AECOM assessment.

12.2 Policy Context

It is important that the criteria used in MCA are aligned to the aims of the project, in addition to relevant European Commission and national and local policy objectives. This section draws out the key aims and objectives of the project and relevant policies, which will inform the proposed assessment criteria.

12.2.1 Study Aims

Whilst specific objectives for the project have not been set, the aim of the project, as set out in section 2.1 of the Technical Specification, is as follows:

'The development of an optimal Riga Central Multimodal Public Transportation Hub engineering and urban building solution by ensuring the mutual integration of two railway systems, public transportation and individual mobility solutions within a single transport hub'.

Specific objectives for the project have not been set, but the following draft objective has been suggested:

'To integrate all public transport modes at Riga Central Station in a mutual and efficient way to facilitate shift from car to public transport and railways (especially Rail Baltica). In particular, the project should look to facilitate increased ridership of public transportation and especially this of multimodal intercity/suburban travel)'.

12.2.2 European

The European Commission's 'White Paper Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system' (2011) sets out a vision for a competitive and sustainable transport system, including the following components:

- Growing Transport and supporting mobility while reaching the 60% emission reduction target;
- An efficient core network for multimodal intercity travel and transport;

[7] Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020, December 2014

- **A global level-playing field for long-distance travel and intercontinental**
- **Freight; and**
- **Clean urban transport and commuting.**

With regard to the component relating to an efficient core network for multimodal intercity travel and transport, the White Paper makes specific reference to the need for greater integration of the networks including airports, ports, railways, metro and bus stations. The stated aim is to transform these into multimodal connection platforms for passengers. The RTPH project clearly has potential to make a major contribution towards delivering this objective in Riga and the wider area through enhanced connections between rail, bus, taxi, including better connections to the airport.

In developing the project it will be important to be cognisant of the following EU regulations:

- **Regulation (EU) No 1315/2013[8] of the European Parliament and of the Council (December, 2013) – this sets guidelines for the development of a trans-European transport network comprising a comprehensive network and the core network. It identifies the priorities for the development of the transport network and identified projects of common interest and the requirements for the management of the infrastructure. The regulations stress that implementation of projects is dependent on their degree of maturity, compliance with EU and national procedures, in addition to the availability of financial resources.**
- **Regulation (EU) No 913/2010 of the European Parliament and of the Council (September 2010) – this outlines guidelines relating to the development of a European rail network for competitive freight. It sets out the rules for the establishment and organisation of international rail corridors for rail freight, with a view to the development of a European network for competitive freight. It also sets rules for the selection, organisation and management of investment in freight corridors. Given the importance of the rail network for freight through the centre of Riga, it will be important to make provision for an appropriate number of freight paths through the station to provide capacity for future growth.**
- **Regulation (EU) No 1316/2013[9] of the European Parliament and of the Council (December 2013) - this regulation concerns the establishment of the Connecting Europe Facility (CEF), which was set up to accelerate investment in trans-European networks and to leverage funding from both the public and private sector. Funding has been transferred from the Cohesion Fund to the CEF through Regulation EU 1301/2013. The CEF has a high level of importance with regard to the RPTH project in terms of a funding source for the elements of the project required to facilitate Rail Baltica. Stage 1 of the CEF application submitted for Rail Baltica earlier in 2015 has provisionally identified total costs of €2.4m for the 'Detailed technical design of Riga Central Railway junction and related civil structures' and €82.6m for 'Construction of Riga Central Railway junction and related civil structures'.**

12.2.3 North Sea-Baltic Core Network Corridor

The North Sea-Baltic Corridor connects the ports of the Eastern shore of the Baltic Sea with the ports of the North Sea. The 3200 km long corridor will connect the ports of the Eastern shore of the Baltic Sea with the ports of the North Sea. It starts at the Gulf of Finland of Helsinki (Vuosaari) and Tallinn (Muuga) passing south through the three Baltic States and North Eastern Poland until Warsaw. It then follows the traditional East-West corridor to Lodz, Poznan and Berlin continuing to the ports on the North Sea coast. The corridor has branches to Ventspils in Latvia and to Klaipeda and Vilnius in Lithuania.

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[8] **Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU**

[9] **establishing the Connecting Europe Facility, amending Regulation (EU) No 913/2010 and repealing Regulations (EC) No 680/2007 and (EC) No 67/2010**

The corridor will provide modern transport links between Finland and the three Baltic States and Poland, Germany and the Netherlands and Belgium. A Rail Baltic (1435 mm gauge) direct line from Tallinn to the Lithuanian/Polish border has been identified as a key missing link in the network. Work is progressing on the construction of Rail Baltica to the north and south of Riga.

Given the extension of Rail Baltica to the centre of Riga, the RPTH therefore has an important role regarding the overall functioning of the North Sea-Baltic corridor.

12.2.4 National

The national transport policy of Latvia is set out in the National Transport Development Guidelines 2014 – 2020. This identifies the new aim of the transport policy as:

'Competitive, sustainable, co-modal transport system ensuring high quality mobility through efficient use of resources, including EU funds'.

It sets out the following actions going forward:

- **to integrate all public transportation types within a single public transportation route system, incl. city transport, considering that the rail transport, where feasible, is of first priority;**
- **to optimise regularly traffic schedules according to the actual situation;**
- **to improve availability of information;**
- **to ensure compliance of vehicles with European technical standards and environmental requirements by introducing new, modern, and qualitative vehicles and ensuring the use of eco-friendly energy resources; and**
- **to ensure safety of the service (safe trip, getting in and off).**

12.2.5 Local

The Sustainable Development Strategy of Riga until 2030 and Development Programme of Riga for 2014-2020 are development planning documents for the municipality of Riga. The long term objectives set out in the Riga Sustainable Development Strategy (to 2030) are as follows:

- **Society – skilful, provided and active society;**
- **Urban Environment – Convenient, safe and pleasant urban environment;**
- **Economy – innovative, open economy with export capacity; and**
- **International scale – Riga, internationally recognisable, important and competitive, Northern European Metropolis.**

With regard to transport infrastructure, the strategy identifies that infrastructure should be planned based on the following hierarchical system:

- **Pedestrian;**
- **Cyclist;**
- **Public transport;**
- **Private transport; and**
- **Freight transport.**

The strategy stresses that the amount of private transport use should be lowest in the core of the city, followed by the suburbs up to the city circle.

Priorities and key principles identified in the strategy that are relevant to the RPTH project include the reconstruction and improvement of the public transport infrastructure and enhanced integration of the public transport system.

Importantly with respect to the RPTH project, the strategy identifies that the Riga central station has multi-modal functions and that it will be the only Rail Baltica stop in Latvia. It is stressed the station needs to be functionally and architecturally connected to the international bus station, which is a key aim of the project as identified earlier in this chapter, giving due weightage to its historic and archaeological importance.

12.3 Proposed Criteria

A series of headline criteria have been identified for inclusion in the MCA framework – these are identified in Table 12.1, along with the rationale for inclusion in terms of links with relevant EU, national or local policy and the aims of the project. The criteria all relate to the potential outcomes and contribution of the project.

Headline Criteria	Rationale for Inclusion
Economy (transport user benefits)	One of the components set out in vision in the EC's White Paper is *'an efficient core network for multimodal intercity travel and transport'.*
Regeneration/Wider Economy	An objective of the Sustainable Development Strategy of Riga is an *'innovative, open economy with export capacity'.*
Urban Environment	*'A convenient, safe and pleasant urban environment'* is one of the long term objectives set out in the Sustainable Development Strategy of Riga.
Architectural features	*'Internationally recognisable, important and competitive Northern European Metropolis'* is one of the long term objectives set out in the Sustainable Development Strategy of Riga.
Integration	One of the aims of the project, as identified in the Technical specification is the *'mutual integration of two railway systems, public transportation and individual mobility solutions within a single transport hub'*. In addition, one of the actions set out in the Latvia National Transport Development Guidelines 2014 – 2020 is to integrate all public transportation types within a single public transportation route system.
Pedestrian Accessibility/Connectivity	A 'co-modal transport system ensuring high quality mobility' is one of the aims set out in the Latvia National Transport Development Guidelines 2014 – 2020.
Future Suitability	It is important that the recommended option provides capacity for future growth and offers flexibility in terms of being adaptable to future changes in proposals for the station and adjacent land uses.

Table 12.1: Proposed Headline Criteria and Rationale for Inclusion (Source: AECOM)

For each of the headline criteria, one or more assessment criteria have been identified which options can be scored against – these are identified in Table 12.2.

Headline Criteria	Assessment Criteria
Economy (transport user benefits)	Pedestrian walk times
Regeneration/Wider Economy	Facilitating development around the station
	Flexibility for future developments
Urban Environment	Public urban space quantity
	Public urban space quality
Architectural features	Natural light and ventilation
	Views from the station
	Iconic image
Integration	Interchange with bus and coach services

	Connections to taxis and Kiss and ride
	Private vehicle access and parking
Pedestrian Accessibility/Connectivity	Internal (Station)
	External (to/from station)
	External (between land-use areas)
Future suitability	Capacity
	Flexibility to accommodate future changes

Table 12.2: Proposed Assessment Criteria (Source: AECOM)

One of the objectives of the Latvia National Transport Development Guidelines 2014 – 2020 is efficient use of resources, including EU funds. Whilst this has not been included in the MCA scoring framework (which focuses on project outcomes), going forward, it will be important to consider aspects relating to the delivery of the project, including, capital expenditure, ongoing operating and maintenance costs and constructability.

12.4 Assessment of Options against Criteria

The optioneering process identified the following options to assess using the appraisal framework outlined above:

- Group A
  - Option 1 minimum intervention – construction over the tracks and the coach station is not relocated;
  - Option 2 minimum intervention – without optimisation of the existing tracks. In this scenario, the Rail Baltica tracks are located alongside the existing layout.
- Group B – construction under the tracks, including re-location of the coach station; and
- Group C – construction over and under the tracks (box type construction), including re-location of the coach station.

Options were scored qualitatively on seven point scale (+3 to -3) against each of the assessment criteria identified in Table 12.2 relative to the existing situation – the scores represent the following scale of impact:

- +3 Large beneficial
- +2 Moderate beneficial
- + 1 Slight beneficial
- 0 Neutral
- -1 Slight adverse
- -2 Moderate adverse
- -3 Large adverse

In order to aid the assessment process, Table 12.3 provides some indicators/scoring notes to inform the assessment/consideration of each criteria.

Headline Criteria	Assessment Criteria	Indicators/Notes for Scoring
Economy (transport user benefits)	Pedestrian walk times	Impact of the option on walk times for passengers using the rail, bus and coach (including passengers interchanging between modes). The location of the rail, bus and coach services in relation to each other and the linkages provided will be the primary determinate of walk times.

Regeneration/ Wider Economy	Facilitating development around the station	Extent to which the option will assist in bringing forward wider development proposals around the station and bring new economic activities to the area. For example, does the proposal release land for development that fits with planning policy for the city
Urban Environment	Public urban space quantity	Change in the quantity of public urban space as a result of the option.
	Public urban space quality	Impact in terms of the quality of public urban space generated by the option, including scope for new features. Consider linkages between urban space and adjacentdesignated areas e.g. market area and the Old City.
Architectural features	Natural light and ventilation	Change in the levels of natural light and ventilation as a result of the option.
	Views from the station/Iconic Image	Impact of the option in terms of the extent of the views from the station, particularly towards the market area and the Old City. Extent to which the option will be internationally recognisable (i.e. supporting the Riga Sustainable Development Strategy).
	Functionality	How well are functions within the facility located relative to each other? Consider the vertical and horizontal connections.
Integration	Interchange with bus and coach services	Change in the quality of connections for pedestrians between rail services and bus and coach services.
	Connections to taxis and Kiss and Ride	Functionality and location of links to taxis and Kiss and Ride.
	Private vehicle access and parking	Change in amount of provision for parking at and adjacent to the station, including pedestrian links into the station.
Pedestrian Accessibility/Connectivity	Internal (Station)	Change in quality of walk links within the station site.
	External (to/from station)	Change in quality of walk links to/from the station. Does the option reduce the barriers to movement and severance e.g. number of crossings?
	External (between land-use areas)	Change in quality of walk links between adjacent land uses around the station site, including connections between zones in the study area. For example, does the option impact positively or negatively on walk linkages between sites that have functional relationship?
Future Suitability	Capacity	Capacity of the options to accommodate higher than expected levels of growth in the period to 2050 and beyond. Consider both pedestrian and vehicular capacity.
	Flexibility to accommodate future changes.	Does the option provide flexibility to accommodate future changes to proposals for the station and adjacent land uses? How easily can the new infrastructure be adapted to accommodate future extensions?

Table 12.3: Scoring Indicators/Notes for Assessment Criteria (Source: AECOM)

There is an option within the framework to weight the criteria based on their relative importance – weighting was not applied as the assessment criteria are considered to be of broadly of equal importance – it is also important to consider the impacts of the options fully across a range of different criteria.

12.5 Results

This section outlines the results of the MCA assessment completed by AECOM in addition to the assessments completed by stakeholders.

12.5.1 AECOM Assessment

Table 12.4 presents the assessment of the options against each of the criteria, which are focused on the outcomes of the scheme.

Headline Criteria/Assessment Criteria	Weighting	Option							
		Group A - Option 1		Group A - Option 2		Group B		Group C	
		Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Economy (transport user benefits)		**1.0**	**1.0**	**1.0**	**1.0**	**1.5**	**1.5**	**1.0**	**1.0**
Pedestrian walk times	1.00	1	1	1	1	1.5	1.5	1	1
Regeneration/Wider Economy		**1.0**	**1.0**	**0.0**	**0.0**	**3.0**	**3.0**	**3.0**	**3.0**
Facilitating future development around the station	1.00	1	1	0	0	3	3	3	3
Urban Environment		**2.0**	**1.0**	**2.0**	**1.5**	**2.0**	**1.0**	**4.0**	**2.0**
Public urban space (Quantity)	0.50	1	0.5	1	0.5	1	0.5	2	1
Public urban space (Quality)	0.50	1	0.5	1	1	1	0.5	2	1
Architectural features		**6.0**	**2.0**	**-1.0**	**-0.3**	**4.0**	**1.3**	**8.0**	**2.7**
Natural light and ventilation	0.33	3	1.0	0	0.0	1	0.3	3	1.0
Views from the station/Iconic Image	0.33	3	1.0	0	0.0	1	0.3	3	1.0
Functionality	0.33	0	0.0	1	0.3	2	0.7	2	0.7
Integration		**1.0**	**0.3**	**1.0**	**0.3**	**5.0**	**1.7**	**3.0**	**1.0**
Interchange with bus and coach services	0.33	0	0.0	0	0.0	2	0.7	1	0.3
Connections to taxis and Kiss and ride	0.33	0	0.0	0	0.0	2	0.7	1	0.3
Private vehicle access and parking	0.33	1	0.3	1	0.3	1	0.3	1	0.3
Pedestrian Accessibility/Connectivity		**1.0**	**0.3**	**1.0**	**0.3**	**4.0**	**1.3**	**5.0**	**1.7**
Internal (Station)	0.33	0	0.0	0	0.0	2	0.7	1	0.3
External (to/from station)	0.33	1	0.3	1	0.3	1	0.3	2	0.7
External (between land use areas)	0.33	0	0.0	0	0.0	1	0.3	2	0.7
Future Suitability		**-1.0**	**-0.5**	**-2.0**	**-1.0**	**3.0**	**1.5**	**6.0**	**3.0**
Capacity	0.50	-1	-0.5	-1	-0.5	2	1.0	3	1.5
Flexibility to accommodate future changes	0.50	0	0.0	-1	-0.5	1	0.5	3	1.5
Total		**11.0**	**5.2**	**2.0**	**1.8**	**22.5**	**11.3**	**30.0**	**14.3**

Table 12.4: AECOM Option Assessment (Source: AECOM)

This section summarises the results of the assessment against each of the headline criteria.

Economy

Pedestrian walk times are likely to improve from the existing in all design scenarios owing to the following:

- Group A: Additional capacity and routing option to/from platforms provided by the bridge.
- Group B: With the co-location of bus and rail services, journey times between those modes would be substantially reduced compared to the current position. This would more than offset any increase in through station (i.e. people routing through the station as a shortcut) journey times caused by the reduction in the number of tunnels.
- Group C: Due to the co-location of bus and rail services, journey times between those modes would be substantially reduced compared with the current position. The routing to/from platform level via the bridge would likely increase journey times for passengers routing to/from street. Overall, however, due to the co-

location of transport modes, segregation of through trips and passengers and consequential reduction in congestion, the Group C options would reduce walk times overall compared with the current position.

Regeneration/Wider Economy

- **Group A : The main disadvantage of this option is that it does not allow the development of the water promenades as it retains the existing bus platforms and station.**
- **Group B: By relocating the bus station and the parking, the proposal allows the introduction of new commercial and cultural buildings that can regenerate the surrounding and may attract people from other parts of the city.**
- **Group C: As with Group B, a large public area is released by relocating the bus stations and the parking. In this case, even more retail can be accommodated on the "bridge building", which would result in more business opportunities.**

Urban Environment

Public urban space quantity and quality improvements (from the existing position), would be realised in all design scenarios owing to the following:

- **Group A: Additional pedestrian crossing provision at-grade adjacent to the station.**
- **Group B: The additional pedestrian crossing provision at-grade to/from the city centre and landscaping upgrades to the South and Southwest of the station would improve the quantity and quality of the urban space within the study area.**
- **Group C: The additional pedestrian crossing provision at-grade to/from the city centre and landscaping upgrades to the South and Southwest of the station would improve the quantity and quality of the urban space within the study area. The proposed 'green Boulevard' to the North of the site, and its reallocation of roadspace to facilitate more pedestrian and cyclist space, would further improve the urban space quantity and quality.**

Architectural Features

Natural light and ventilation

- **Group A: The elevated station offers better conditions for the comfort for passengers compared to the existing position. This area can be easily ventilated and its well illuminated.**
- **Group B: As the station remains under the tracks, the space would have more or less the same conditions as it has now. The option would therefore be affected by a lack of natural light and poor ventilation at the train station level.**
- **Group C: As with Group A, the elevated station allows good ventilation and very good lighting conditions.**

Views from the station/ Iconic image

- **Group A: The elevated layout proposed in Group A has very good views towards the market area. The station is visible from many points of the city and is recognizable and can become an iconic image and new gateway to the city**
- **Group B: Views from the station are very limited - the canopy is the only element which can be recognisable from the market area.**
- **Group C: As with Group A, the station could become an iconic building and a new gateway to Riga.**

Functionality

- **Group A: This option has a lack of space within the layout, impacting on the level of functionality.**

- **Group B: This option acts as a new multimodal building, allowing more functions and different connections between them.**

- **Group C: As with Group B, it gathers many functions in one building. By separating the train and bus station in different levels, Group has a clearer zoning relative to Group B.**

Interchange

- **Group A: Attending to the interchange with bus and coach services:, Group A remains the worst in terms of connectivity with the Bus Station, because there is no space for a new terminal in the plot. Connections with taxis and Kiss and ride remain he same as they are in the current station. Regarding the private car access, all groups solve the integration of the private car parking.**

- **Group B: In terms of interchange with bus and coach services, Group B is better connected because the Railway station is at the same level as the Bus Interchange. The kiss and ride and the car parking are well integrated.**

- **Group C: Despite they are in different levels, the train station is very well connected to the new Bus Interchange. Same as Group B in terms of taxi/kiss and ride and private car integration**

Pedestrian Accessibility/Connectivity

In terms of accessibility internal to the station, walk times would improve from the existing situation in all scenarios due to the following:

- **Group A: Additional capacity and routing option to/from platforms provided by the bridge.**

- **Group B: Due to the co-location of bus and rail services, journey times between those modes would be substantially reduced from the current position. This would likely more than offset any increase in through station (i.e. people routing through the station as a shortcut) journey times caused by the reduction in the number of tunnels.**

- **Group C: Due to the co-location of bus and rail services, journey times between those modes would be substantially reduced from the current position. The routing to/from platform level via the bridge would likely increase journey times for passengers routing to/from street. Overall, however, due to the co-location of transport modes, segregation of through trips and passengers and consequential reduction in congestion, the Group C options would reduce walk times overall from the existing situation.**

To/from station pedestrian accessibility/connectivity would likely be improved from the existing in all design scenarios due to the following:

- **Group A: Connectivity externally to/from the station is improved due to the segregation of pedestrian through flows and platform flows. Due to the introduction of the bridge concourse area, passengers routing from South of the station would no longer need to route through the tunnels to purchase a ticket and then double back to access platforms. Instead routing is simpler and less congested. External accessibility is also improved upon due to the proposed additional at-grade crossing facilities adjacent to the station.**

- **Group B: External accessibility is improved upon due to the proposed additional at-grade crossing facilities adjacent to the station and extensive improved connectivity between the Old Town and new Promenade area which then connects with the station access/egress (South).**

- Group C: Connectivity externally to/from the station is improved due to the segregation of pedestrian through flows and platform flows. Due to the introduction of the bridge concourse area, passengers routing from South of the station would no longer need to route through the tunnels to purchase a ticket and then double back to access platforms. Instead routing is simpler and less congested. External accessibility is also improved upon due to the proposed additional at-grade crossing facilities adjacent to the station and extensive improved connectivity between the Old Town and new Promenade area which then connects with the station access/egress (South).

Between land use area accessibility/connectivity would likely be improved from the existing in design Groups B and C due to the following:

- Group A: Minor changes proposed which would improve accessibility/connectivity between land uses.

- Group B: External accessibility is improved upon due to the proposed additional at-grade crossing facilities adjacent to the station and extensive improved connectivity between the Old Town and new Promenade area which then connects with the station access/egress (South).

- Group C: External accessibility is improved upon due to the proposed additional at-grade crossing facilities adjacent to the station and extensive improved connectivity between the Old Town and new Promenade area which then connects with the station access/egress (South).

Future Suitability

With regard to the capacity and flexibility to accommodate future changes:

- Group A: The option accommodates the Rail Baltica tracks, but does not include the wider improvements and future flexibility offered by Group C.

- Group B: This can accommodate a higher level of development than Group A, but is less flexible than Group C in terms of accommodating the future changes at the station.

- Group C: This provides the most capacity to accommodate future increases in demand.

Headline Criteria	Group A - Option 1	Group A - Option 2	Group B	Group C
Economy (transport user benefits)	1.0	1.0	1.5	1.0
Regeneration/Wider Economy	1.0	0.0	3.0	3.0
Urban Environment	1.0	1.5	1.0	2.0
Architectural features	2.0	-0.3	1.3	2.7
Integration	0.3	0.3	1.7	1.0
Pedestrian Accessibility/Connectivity	0.3	0.3	1.3	1.7
Future Suitability	-0.5	-1.0	1.5	3.0
Total	5.2	1.8	11.3	14.3

Table 12.5: AECOM Option Assessment – Summary (Source: AECOM)

Summary

It is therefore clear that Group C is the strongest performing option, with a total of 14.3 points, followed by Group B, Group A Option 1 and then Group A Option 2. Group C performs more strongly than Group A Option across all of the headline criteria.

Group A Option 1 offers some benefits, particularly in terms of 'Architectural Features' and 'Urban Environment', but it performs comparatively poorly when considering the impact on 'Integration' and 'Pedestrian Accessibility/Connectivity'. This is mainly attributable to the coach station being retained on its existing site, with little or no improvements in terms of connectivity between bus/coach and rail.

Group A Option 2 (minimum intervention without optimisation of the tracks) results in no improvement relative to the existing situation across a significant number of the criteria, but the requirement to accommodate the Rail Baltica tracks alongside the existing track layout results in some adverse impacts in relation to the 'Urban Environment' as the urban space would become constrained and oppressive. This is a particular issue at the frontage for the access to the station would need to be moved close to the Ministry of Transport building, resulting in a narrow street. There are also adverse impacts with regard with 'Future suitability' as there would be less capacity within the station layout to accommodate future growth.

Group B matches the performance of Group C with regard to some headline criteria e.g. 'Economy', 'Regeneration/Wider Economy' and 'Integration', but limiting the construction to under the tracks means that the options does not perform as well in terms of 'Urban Environment' and 'Architectural Features', 'Pedestrian Accessibility/Connectivity', and 'Future Suitability'.

Group B outperforms Group A Option1 with respect to all of the criteria with the exception of 'Architectural Features' as construction under the tracks provides less opportunities to enhance aspects such as natural light and views from the station relative to the existing situation.

12.5.2 Stakeholder Assessment

A workshop was held with stakeholders to explain the MCA process and there was an opportunity for stakeholders to assess the options against the respective criteria. It should be noted that the assessment was based on 3 core options and did not include the variant of Group Option 2 (without optimisation of the tracks) – this option was added to the AECOM assessment following the stakeholder workshop.

The options were scored by 13 stakeholders in total. Table 12.6 presents the sum of all the scores for each option against the headline criteria. This shows that Group C has the highest number of points in total followed by Group B and Group A (Option 1), which has a negative score overall.

When comparing Group B and C, Group C was considered by stakeholders to be significantly better in terms of 'Urban Environment', 'Architectural Features', 'Integration' and 'Future Suitability'. The options were comparable in terms of performance in relation to 'Economy (transport user benefits)' and 'Pedestrian Accessibility/Connectivity'. Group A was considered by stakeholders to be likely to lead to a worsening relative to the existing situation against some of the criteria, particularly 'Economy (transport user benefits), Future Suitability' and 'Pedestrian Accessibility/Connectivity'.

Headline Criteria	Group A (Option 1)	Group B	Group C
Economy (transport user benefits)	-13	15	14
Regeneration/Wider Economy	1	17	18
Urban Environment	2	19.8	25
Architectural features	3.2	10	15.6
Integration	-0.6	21.6	28.7
Pedestrian Accessibility/Connectivity	-3.7	18.3	16.9
Future Suitability	-7	12	16
Total	-18	113.8	134.4

Table 12.6: Total Scores (all stakeholder responses) Source(AECOM)

Table 12.7 summarises the total scores for each option by stakeholder. This shows that 7 of the 13 stakeholders identified Group C as their preferred option (through the MCA assessment), with 5 stakeholders identifying Group B. One stakeholder assessment came out in favour of Group A (Option 1).

Option	Autotransporta direkcija	Centrāltirgus	Latvijas Dzelzceļš	Lidosta	Linstow	Pasažieru vilciens	Promenex	RB Rail	Rīgas Autoosta	Rīgas domes Pilsētas attīstības depar	Rīgas vēsturiskā centra sagla	Stockmann	Valsts kultūras pieminekļu aizs
Group A (Option 1)	1.0	-7.2	-5.5	-9.2	0.2	-14.5	-1.5	3.5	16.5	10.8	3.0	-8.3	-6.8
Group B	4.3	8.2	11.7	7.8	8.0	15.0	11.2	7.0	-18.0	17.1	13.2	13.3	15.0
Group C	5.0	13.0	5.5	20.7	7.2	3.8	20.0	17.2	-15.0	15.2	17.8	14.3	9.7
Preferred Option	C	C	B	C	B	B	C	C	A	B	C	C	B

Table 12.7 Total Scores for each option (by stakeholder) Source (AECOM)

Table 12.8 provides a full breakdown of the assessment scores by each of the stakeholders against all of the assessment criteria.

Option – Group A

Headline Criteria/Assessment Criteria	Total Weighted Score	Autotransporta direkcija	Centrāltirgus	Latvijas Dzelzceļš	Lidosta	Linstow	Pasažieru vilciens	Promenex	RB Rail	Rīgas Autoosta	Rīgas domes Pilsētas attīstības departamenta	Rīgas vēsturiskā centra sagla	Stockmann	Valsts kultūras pieminekļu aizs
Economy (transport user benefits)	-13	-1	-3	-3	-1	-1	-3	-1	1	3	2	-1	-3	-2
Pedestrian walk times	-13	-1	-3	-3	-1	-1	-3	-1	1	3	2	-1	-3	-2
Regeneration/Wider Economy	1	0	0	0	-2	0	0	-1	1	2	1	1	0	-1
Facilitating future development around the station	1	0	0	0	-2	0	0	-1	1	2	1	1	0	-1
Urban Environment	2	1	-0.5	-1.5	-1.5	1	0.5	0	1	2.5	1.5	1	-1	-2
Public urban space (Q'nty)	2.5	0.5	-1	-0.5	-0.5	0.5	0.5	0	0.5	1.5	1	0.5	0	-0.5
Public urban space (Q'lty)	-0.5	0.5	0.5	-1	-1	0.5	0	0	0.5	1	0.5	0.5	-1	-1.5
Architectural features	3.2	0.3	1	-0.7	0.3	0.3	-3	0	1	3	2.3	1	-1.3	-1
Natural light and ventilation	0.9	0	0.3	-0.3	0.3	0.3	-1	0	0	1	0.7	0.3	-0.7	0
Views from the station/Iconic Image	2.8	0.3	0.3	0.3	0.3	0.3	-1	0	1	1	1	0.3	-0.7	-0.3
Functionality	-0.7	0	0.3	-0.7	-0.3	-0.3	-1	0	0	1	0.7	0.3	0	-0.7
Integration	-0.6	0.7	-1	0.7	-1.7	0.3	-3	0.7	0.3	3	0.7	0.7	-2	0
Interchange with bus and coach services	-1.7	0	0	0	-1	0	-1	0	0	1	0.3	0	-1	0
Connections to taxis and Kiss and ride	0.9	0.7	-0.7	0.3	-0.3	0	-1	0.3	0	1	0.3	0.3	0	0
Private vehicle access and parking	-0.1	0	-0.3	0.3	-0.3	0.3	-1	0.3	0.3	1	0	0.3	-1	0
Pedestrian Accessibility/Connectivity	-3.7	0	-1.7	-2	-0.3	-1	-3	0.3	-0.3	3	1.3	0.3	-1	0.7
Internal (Station)	-0.2	0	-0.3	-0.7	-0.3	-0.3	-1	0.3	-0.3	1	0.7	0	0	0.7
External (to/from station)	-1.1	0	-0.7	-0.7	0.3	-0.3	-1	0	0	1	0.3	0	0	0
External (between land-use areas)	-2.4	0	-0.7	-0.7	-0.3	-0.3	-1	0	0	1	0.3	0.3	-1	0
Future Suitability	-7	0	-2	1	-3	0.5	-3	-0.5	-0.5	0	2	0	0	-1.5
Capacity	-3	0	-1	0.5	-1.5	0.5	-1.5	0	0	0	0.5	0	0	-0.5
Flexibility to	-4	0	-1	0.5	-1.5	0	-1.5	-0.5	-0.5	0	1.5	0	0	-1

Option – Group B

Headline Criteria/Assessment Criteria	Total Weighted Score	Autotransporta direkcija	Centrāltirgus	Latvijas Dzelzceļš	Lidosta	Linstow	Pasažieru vilciens	Promenex	RB Rail	Rīgas Autoosta	Rīgas domes Pilsētas attīstības departamenta	Rīgas vēsturiskā centra sagla	Stockmann	Valsts kultūras pieminekļu aizs
Economy (transport user benefits)	15	0	1	2	1	0	3	1	1	-3	3	2	2	2
Pedestrian walk times	15	0	1	2	1	0	3	1	1	-3	3	2	2	2
Regeneration/Wider Economy	17	1	1	2	2	1	2	2	1	-3	3	1	2	2
Facilitating future development around the station	17	1	1	2	2	1	2	2	1	-3	3	1	2	2
Urban Environment	19.8	2	1.5	2	1.5	2	2.5	2	1	-3	1.8	2	2	2.5
Public urban space (Q'nty)	10.5	1	1	1	0.5	1	1	1.5	0.5	-1.5	1.5	1	1	1
Public urban space (Q'lty)	9.25	1	0.5	1	1	1	1.5	0.5	0.5	-1.5	0.25	1	1	1.5
Architectural features	10	0	0	1	1.3	1	2.7	1	0	-3	2	0.7	1.3	2
Natural light and ventilation	1	-0.3	-0.3	0.3	0.3	0	1	0	-0.3	-1	0.3	0	0.7	0.3
Views from the station/Iconic Image	2.5	0	-0.3	0	0.7	0	0.7	0.7	0	-1	0.7	0	0.3	0.7
Functionality	6.6	0.3	0.7	0.7	0.3	1	1	0.3	0.3	-1	1	0.7	0.3	1
Integration	21.6	1.3	2.7	2.3	1.7	2	1	2	1.3	-1.3	2.3	2.3	2.3	1.7
Interchange with bus and coach services	7.7	0.3	1	1	0.3	0.7	0.3	0.7	0.3	0	1	0.7	0.7	0.7
Connections to taxis and Kiss and ride	8.3	0.7	1	0.7	0.7	0.7	0.3	0.7	0.7	-0.3	1	0.7	0.7	0.7
Private vehicle access and parking	6	0.3	0.7	0.7	0.7	0.7	0.3	0.7	0.3	-1	0.3	1	1	0.3
Pedestrian Accessibility/Connectivity	18.3	0	1	1.3	1.3	1	2.3	1.7	1.7	-1.7	3	2.7	1.7	2.3
Internal (Station)	5	-0.3	0.3	0.3	0.3	0.3	1	0.7	0.3	-1	1	0.7	0.7	0.7
External (to/from station)	6.8	0	0.3	0.7	0.7	0	1	0.7	0.7	-0.7	1	1	0.7	0.7
External (between land-use areas)	6.5	0.3	0.3	0.3	0.3	0.7	0.3	0.3	0.7	0	1	1	0.3	1
Future Suitability	12	0	1	1	-1	1	1.5	1.5	1	-3	2	2.5	2	2.5
Capacity	6.5	0	0.5	0.5	-0.5	1	1	1	0.5	-1.5	1	1	1	1
Flexibility to	5.5	0	0.5	0.5	-0.5	0	0.5	0.5	0.5	-1.5	1	1.5	1	1.5

Option – Group C

Headline Criteria/Assessment Criteria	Total Weighted Score	Autotransporta direkcija	Centrāltirgus	Latvijas Dzelzceļš	Lidosta	Linstow	Pasažieru vilciens	Promenex	RB Rail	Rīgas Autoosta	Rīgas domes Pilsētas attīstības departamenta	Rīgas vēsturiskā centra sagla	Stockmann	Valsts kultūras pieminekļu aizs
Economy (transport user benefits)	14	0	2	1	3	-1	-1	3	3	-3	2	2	2	1
Pedestrian walk times	14	0	2	1	3	-1	-1	3	3	-3	2	2	2	1
Regeneration/Wider Economy	18	1	2	1	3	1	0	3	2	-3	2	3	2	1
Facilitating future development around the station	18	1	2	1	3	1	0	3	2	-3	2	3	2	1
Urban Environment	25	2	2.5	1.5	3	2	2	3	3	-3	2.5	2.5	2	2
Public urban space (Q'nty)	13.5	1	1	1	1.5	1	1.5	1.5	1.5	-1.5	1	1.5	1	1.5
Public urban space (Q'lty)	11.5	1	1.5	0.5	1.5	1	0.5	1.5	1.5	-1.5	1.5	1	1	0.5
Architectural features	15.6	0.3	2	-0.3	2.7	1.3	0	2	3	-3	2.3	2	2	1.3
Natural light and ventilation	2.4	-0.3	0.3	-0.3	0.7	0.3	-1	0	1	-1	1	0.7	0.7	0.3
Views from the station/Iconic Image	6.6	0.3	0.7	0.3	1	0.3	0.3	1	1	-1	1	0.7	0.7	0.3
Functionality	6.8	0.3	1	-0.3	1	0.7	0.7	1	1	-1	0.3	0.7	0.7	0.7
Integration	28.7	1.3	2.7	2.3	3	2	2	3	2.7	0.7	2.3	2.7	2.3	1.7
Interchange with bus and coach services	10.1	0.3	1	1	1	0.7	0.7	1	1	0	1	1	0.7	0.7
Connections to taxis and Kiss and ride	10.2	0.7	1	0.7	1	0.7	0.7	1	1	0.3	1	0.7	0.7	0.7
Private vehicle access and parking	8.7	0.3	0.7	0.7	1	0.7	0.7	1	0.7	0.3	0.3	1	1	0.3
Pedestrian Accessibility/Connectivity	16.9	0.3	1.3	-1	3	0.3	0.3	3	2	-0.7	2	2.7	2	1.7
Internal (Station)	4.4	0	0.7	-0.3	1	0	0.3	1	0.3	-1	0.3	0.7	0.7	0.7
External (to/from station)	5.3	0	0.3	-0.3	1	0	-0.7	1	0.7	0.3	1	1	0.7	0.3
External (between land-use areas)	7.4	0.3	0.3	-0.3	1	0.3	0.7	1	1	0	0.7	1	0.7	0.7
Future Suitability	16	0	0.5	1	3	1.5	0.5	3	1.5	-3	2	3	2	1
Capacity	10.5	0	1	0.5	1.5	1.5	0.5	1.5	1	-1.5	1.5	1.5	1	0.5
Flexibility to	5.5	0	-0.5	0.5	1.5	0	0	1.5	0.5	-1.5	0.5	1.5	1	0.5

accommodate future changes																																										
Total	**-18**	**1**	**-7.2**	**-5.5**	**-9.2**	**0.2**	**-14.5**	**-1.5**	**3.5**	**16.5**	**10.8**	**3**	**-8.3**	**-6.8**	**113.8**	**4.3**	**8.2**	**11.7**	**7.8**	**8**	**15**	**11.2**	**7**	**-18**	**17.1**	**13.2**	**13.3**	**15**	**134.4**	**5**	**13**	**5.5**	**20.7**	**7.2**	**3.8**	**20**	**17.2**	**-15**	**15.2**	**17.8**	**14.3**	**9.7**

Table 12.8: Full Breakdown of Scores (by Stakeholder) Source (AECOM)

12.6 Work Package Summary

This work package effectively consolidates all the salient features of the scheme options through the established Multi-Criteria Approach as recommended by the EU guidance, and carries out two stages of screening of the schemes—once, to shortlist the types/ categories of the scheme options to select the most efficient/ applicable category for further evaluation; and secondly, to evaluate the sub-options form the selected category to come up with most beneficial recommendation for the RPTH improvement.

13 WP 2.6 – Feasibility Study of the Best Solutions and Selection of the Preferred Option

13 WP 2.6 – Feasibility Study of the Best Solutions and Selection of the Preferred Option

13.1 Selection of the Preferred Option

The preferred option is Group C. Appendix WP 2.4 – AIMSUN Development Report, provides illustrations of the alternative schemes.

The elaboration of the alternatives is based on grouping them into three different categories according to the development strategy. The following groups are analysed one by one with a list of PROS and CONS.

13.2 GROUP A: Minimum Intervention Proposal

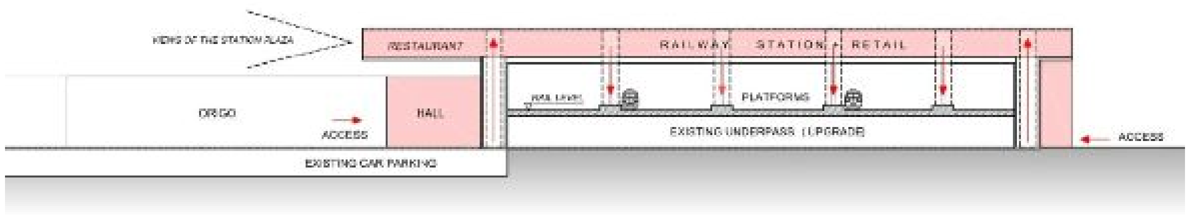

Figure 13.1 Group A. (Source: AECOM)

13.2.1 GROUP A

The proposal is based on building <u>only over the tracks</u> and keeping the embankment as it is, closing or upgrading the existing underpasses. The Railway Station would be an elevated station with good views and the Coach Station would be maintained where it is now, with the reconfigurations needed for the coach platforms affected by the proposed Rail Baltica tracks. The car parking would be limited and the walking distance between modes of transportation would be the maximum of the three proposals.

13.2.2 CONS

- **No construction below the embankment, but the tracks need to be altered.**
- **Longest walking distances. From Coach Station to Railway Station. Very high Pedestrian Walk times.**
- **No space for all modes of transportation**
- **The Multimodal Hub is no longer a Multimodal Hub, it would serve only as a New Railway Station.**
- **Coach station remaining where it is, there is no opportunity to regenerate the current Bus Station area into an improved and upgraded Public Space towards the riverside.**
- **Car Parking limited**

13.2.3 PROS

- **Most economic solution**
- **Good views from the new station**
- **Iconic Image – recognizable from outside**

13.3 GROUP B: Under the Tracks

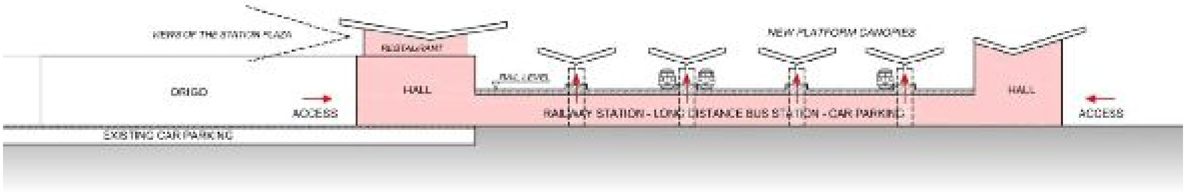

Figure 13.2 Group B. (Source: AECOM)

13.3.1 Group B

The proposal is based on building the new station below the tracks providing a Railway Station and a new Bus Interchange at street level and the possibility of a reduced Car Parking at the same level, all at the embankment 3. This option is not visible in the city and despite the economic effort and construction complexity of opening the embankment 3 the new hub is hardly a recognizable building from the outside. The new platform canopies would be the most visible elements from the city.

13.3.2 CONS

- **Construction complexity at the embankment**
- **No visibility from the city**
- **Not recognizable from the city**
- **No views from the station**
- **No natural light**
- **No natural ventilation**
- **Smaller Bus Interchange than Group C**
- **Smaller and worse quality Railway Station than Group C**
- **Very reduced Car Parking space possibilities**

13.3.3 PROS

- **Functional**
- **It can integrate all modes of transportation**
- **Possibilities to grow at street level at the next embankment having direct connection under the tracks**
- **Wide possibilities Regeneration of the riverside. Facilitation of developing around the station.**

13.4 GROUP C: Above and Under the tracks

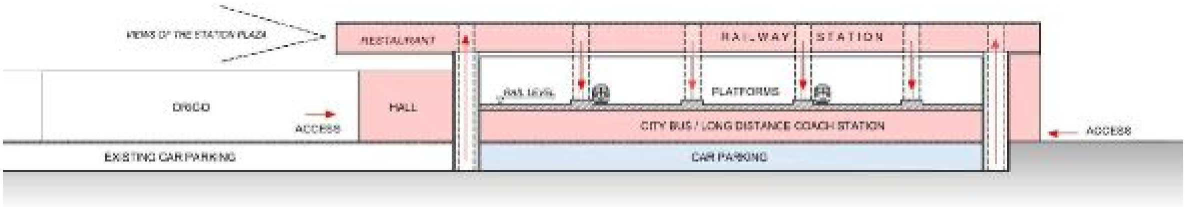

Figure 13.3 Group C. (Source: AECOM)

13.4.1 Group C

The proposal is based on combining the previous solutions. There will be an elevated station for the Railway Station with access from above the new platforms. A new Bus Interchange is placed at street level, emptying the embankment 3. It also offers the possibility of having Car parking at street level. This solution is the most efficient and interesting one, because it gathers all modes of transportation, minimizing the walking distances between them, it a visible architectural solution and compact with very direct vertical connections.

13.4.2 CONS

- **Construction complexity at the embankment**

13.4.3 PROS

- **Efficiency**
- **Minimized walking distances between the different modes of transportation**
- **Possibility of using less area of the embankments than Group A for the modes of transportation**
- **Urban planning, Landscaping and Relationship with the city**
- **Strategical Architectural Solution**
- **Functional**
- **Revaluation of the surroundings of the Multimodal Hub**
- **New possibilities to increase the commercial uses at the elevated station: luxury restaurants at the cantilevered volume, retail at the Railway Station and also New retail at street level serving the New Bus Interchange.**

14 WP 2.7 - Elaboration of the Best Engineering Solution of RPTH

14 WP 2.7 - Elaboration of the Best Engineering Solution of RPTH

14.1 Urban Planning

The first step in the analysis was to undertake an in depth urban study of the zone. This has been carried out to identify the urban constrains, understand the potential of the different areas and study the current situation of the area in relation to the future planned changes for Riga city.

14.1.1 Urban barriers and waterfront integrated into the city

13. janvāra iela creates a significant barrier between the Old City and the Market Area and there are almost no at-grade pedestrian crossings. The Road barrier is followed by the Railway barrier and the Coach platforms all the way to the canal. The main aim of the urban proposal will be to provide a clear connection for pedestrians from the city to the canal where a new public space could be created. The access would be through a permeable bridge structure that would replace the current longitudinal embankment. Currently the canal side is completely abandoned and functions as the back façade of the market area for loading and unloading. The aim here is to recover the water feature towards the city and regenerate the area using the potential of the natural landscape.

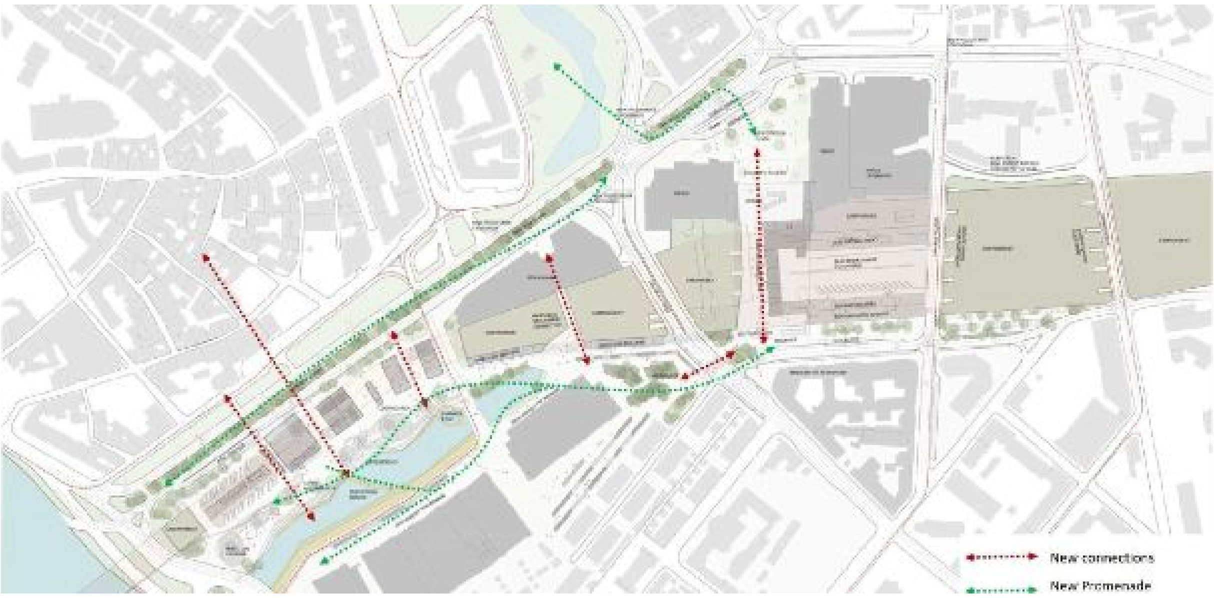

Figure 14.1 – Barriers in the study area (Source: AECOM)

14.1.2 Uses of the Urban Proposal

- **International Bus Station under the new viaduct – Bus Station, Waiting Area and Bus Platforms**
- **Leisure Area next to the waterfront. Theatrem, Exhibitions, Galleries, Cinemas, Sport Hall...**
- **Retail Area on the ground floor at mixed use buildings and on the waterfront. Cafés, restaurants terraces, small shops for tourists, arts & crafts market...**
- **Mixed use buildings – Offices on the upper floors + Retail on the ground floor.**
- **Urban Landscape integrating vegetation in the new plazas, wooden waterfront and summer pool, solarium toward the South, bike lanes etc.**

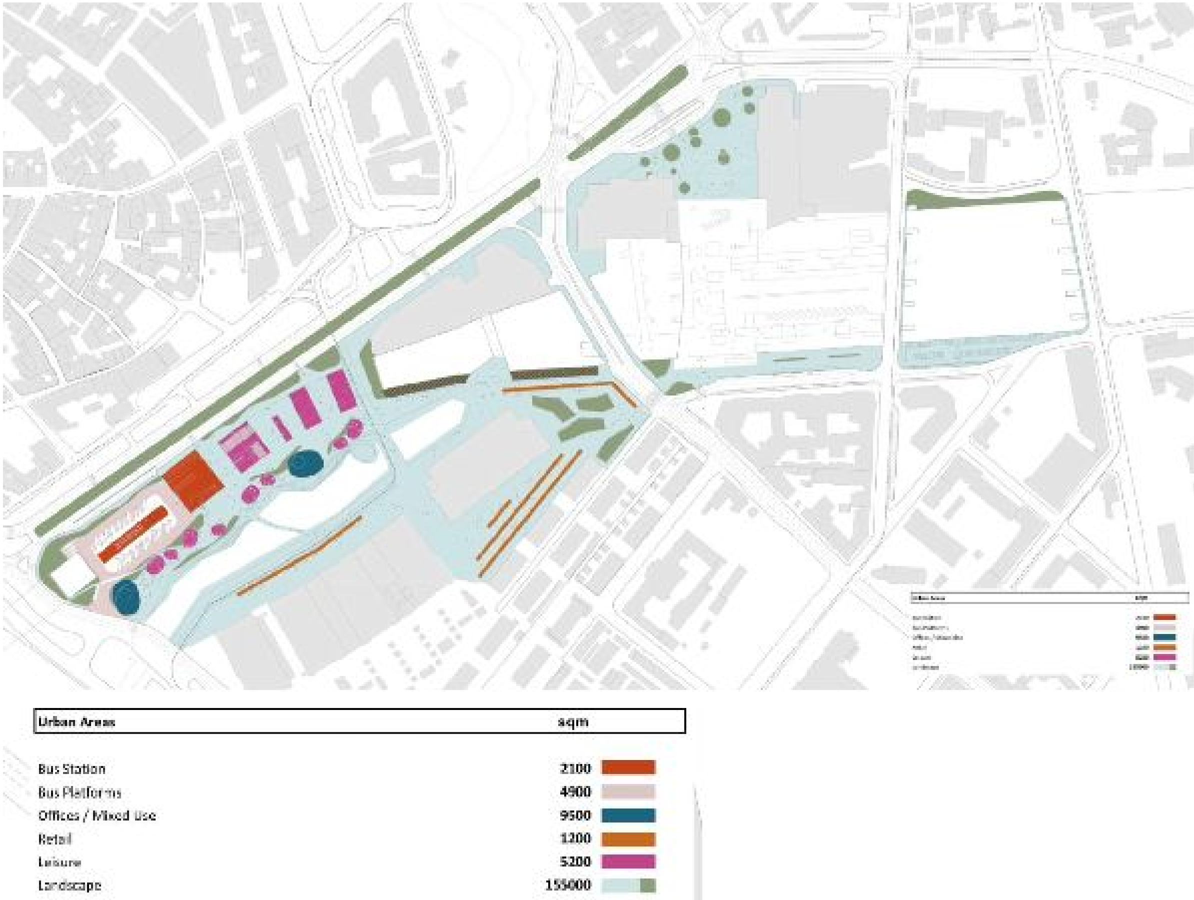

Figure 14.2 – Proposed landuse distribution in the study area (Source: AECOM)

14.1.3 Bus Strategy

The strategy for the buses is based on keeping some bus functionality at the embankment 1, below the new viaduct, as the minimum intervention in that area. Then, the East side of the Study Area would provide a new International Station comprising the Touristic Buses that would be strategically placed at this end so they are not only near to the new waterfront promenade, but are also well connected with the Market area and also near the Old City.

At the new Multimodal Hub there would be a Bus Interchange for mainly the Regional Buses that arrive to the Railway Station from the villages around the region, and offering some lines of microbuses and city buses, directly connected to the hub.

On the surroundings of the Multimodal Hub new city buses will be upgraded and approached to the terminal, together with new kiss and rides and taxi areas, in order to assure the minor walking distances for the passengers.

Figure 14.3 – Proposed bus movement strategy (Source: AECOM)

14.1.4 International Bus Station

That area would become a new International Bus Station. Since the current Coach Platforms and Coach Station are affected by the Rail Baltica new tracks and will have to be partially altered or removed, the proposal is based on the full demolition of the current station and platforms and provide the best quality for a bus station with a covered and protected waiting area directly connected to the outdoors and also to the covered platforms. This is conceived in such a way that doesn´t interfere with the new landscape related to the waterfront. A new enclosed station below the tracks houses the ticket area, toilets and other services needed. This is perfectly linked and related to the new boulevard´s pedestrian crossings from the Old City.

This new station is integrated underneath the viaduct and from both sides is covered by a long line of trees that hide the bus traffic towards the waterfront. So the terraces are away from the noise and smoke facing the water feature.

There are other alternatives from the minimal intervention, keeping most of the existing platforms and station, just upgrading and rebuilding the parts that get affected by the Rail Baltica tracks. Another possibility is renovating the waterfront area as much as possible and keep some bus functionality on this area for the touristic buses, they could be related to an Information point and very well connected with the new Public space. This would be our preferred option, so the public space directly connected with the Old city would be dedicated mostly for the new uses and promenades next to the water feature.

Figure 14.4 – Proposed International Bus Station (Source: AECOM)

On the other side, at 13. janvāra iela, there would be an access to a new private car parking that would be **placed under** the new bus station as shown in the diagram. There would be a kiss and ride related to the bus station and **the option** for taxi stops.

The parking underneath the International Bus Station can be from a minimum size of about 3.500 sqm (bel**ow the** platforms) to 5.500 sqm (below the platforms and the station). There is flexibility for the design of the car **parking, to** meet the needs for the city.

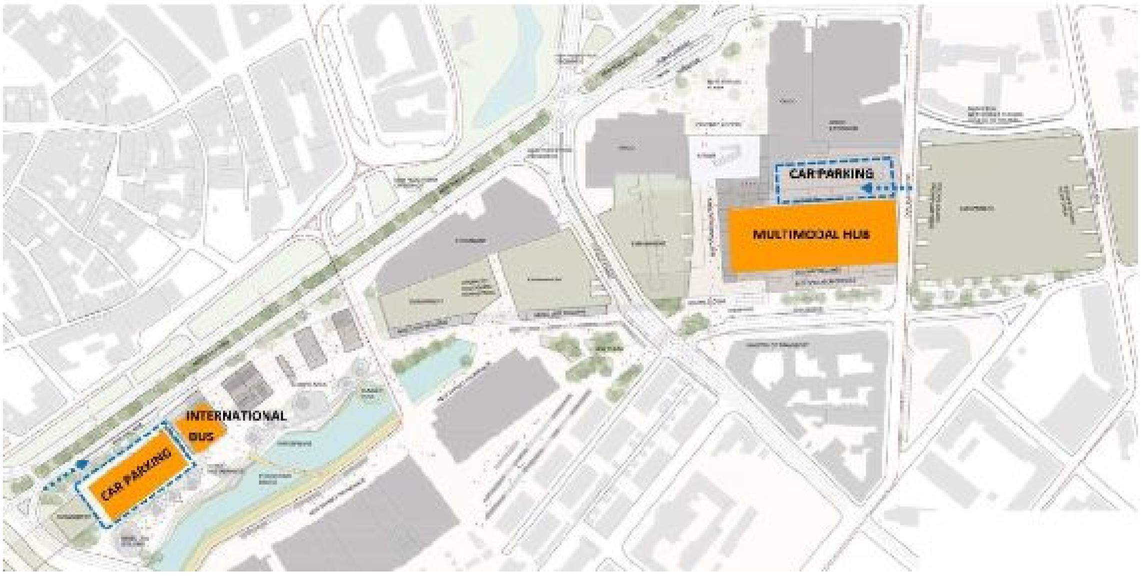

Figure 14.5 – Proposed International Bus Station (Source: AECOM)

14.1.5 Bike lane

There would be a signalized lane along both riversides for the bike network.

The bike lane rises up to the Daugava Railway Bridge allowing the possibility of crossing the river by bike. The new bike lane would be integrated in the design of the new bridge parallel to the existing one.

14.1.6 Waterfront Promenade: Cafe terraces, Pedestrian Bridge and Water feature.

At this area, a new green and pedestrian promenade would link the new International Bus Station with the Market area through a new pedestrian bridge. The waterfront area would be directly connected at grade with the Multimodal Hub in a natural pedestrian path without any urban barrier.

The pedestrian flow would be highly improved at this point, becoming very fluent and the new area would offer a very pleasant place to gather and walk. This will transform this area from its existing derelict character and image to a high quality of place of destination for residents and tourists alike. This one could be also used in summer for solarium, terraces and an outdoor swimming-pool. The canal would once again be completely integrated in the city and become an important element in Riga.

The new water feature of the canal must be designed to keep the same amount of surface facing the sun as the existing one. The canal edge could be modified in order to create a dynamic outdoor space getting closer to the water at some points and others away from it, but the amount of water surface should remain the same.

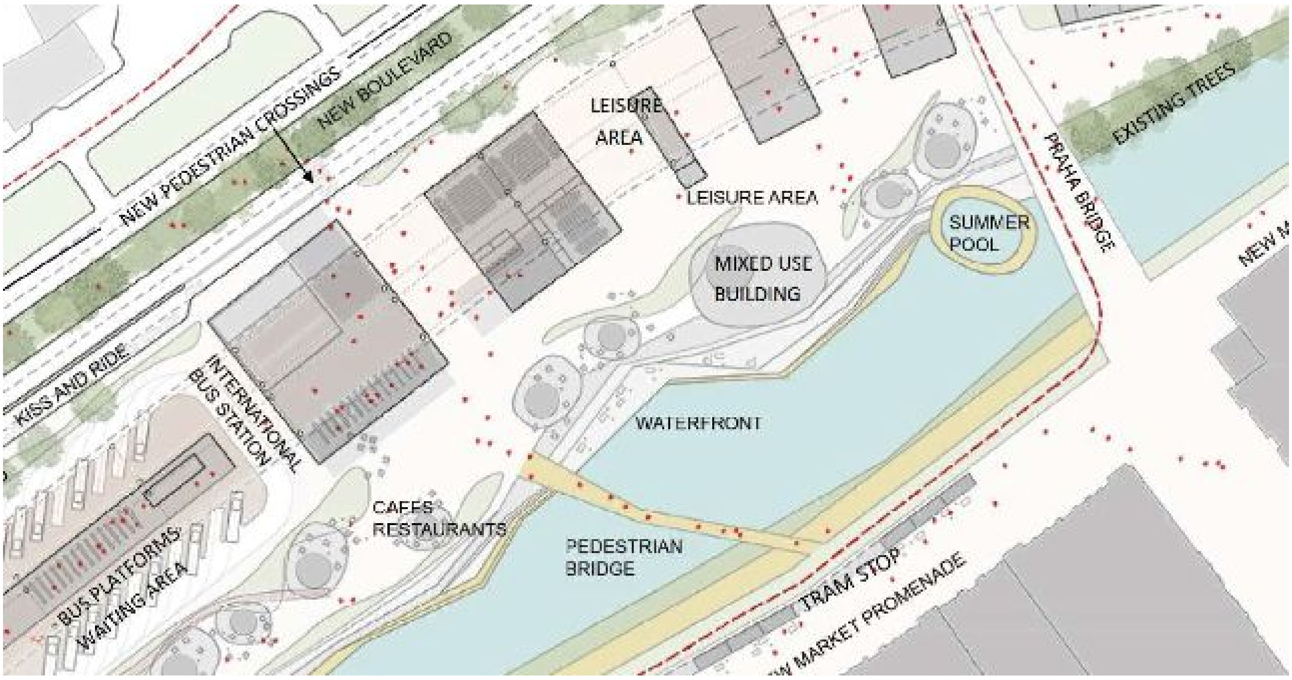

Figure 14.6 – Proposals for Waterfront Promenade (Source: AECOM)

14.1.7 Stockmann connection

There is an immediate possibility of connecting the new green area with Stockmann. The current connection would be upgraded and widen up to be more visible and inviting from the new area.

14.1.8 Mixed-Use New Building

A long medium-high building acting as a barrier of the railway alignment is proposed along the area where Titanik is placed. This building acts as a background blocking the views of the big scale Stockmann building and provides offices and retail use to the riverside area. The ground floor level is dedicated to restaurants, cafes and small retail with the possibility of expanding to the street with terraces.

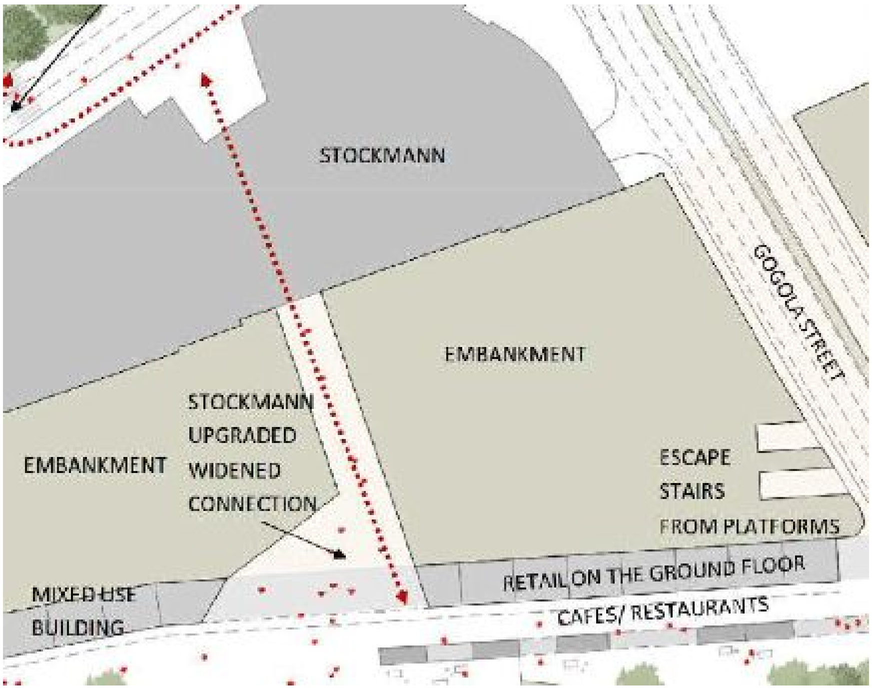

Figure 14.7 – Proposals for Stockmann connections and Mixed Use building (Source: AECOM)

14.1.9 Market riverside

At the Market river bank the existing lower level for loading and unloading would be covered by extending the street level and provide a pedestrian promenade. For loading, only the ramp at the East side would be used, and the one in the west would be closed, in order to provide continuity at the street level.

The flea market would become a new station plaza and the existing market would be relocated, preferably with an integration project providing new safer modular structures below a common roof, for example where Titanik car parking is now. The new market and relocated market will find a place in the urban regeneration of the area. The flea market is highly used by the citizens of Riga and can remain as a traditional space. The flea market would be upgraded, as well as the external areas around the historical buildings. They could all be upgraded as part of an integration plan.

14.1.10 Transforming the Existing vegetation

The existing vegetation in front of Titanik Car Parking is a potential piece of land, now degradated as a forgotten end, because it functions just as a too narrow walking path. These trees have been identified and the new design of the public space will increase the value of them offering a soft riverside at this part, so people will be able to sit on a lawn and new City gardens.

There are various approaches to how this upgrade can be achieved. The main components are adequate lights and attractive landuses along the passageways of the underpasses (similar to the existing tunnels running under the plaforms from Origo shopping centre), which can be achieved easily around a prominent interchange such as RPTH.

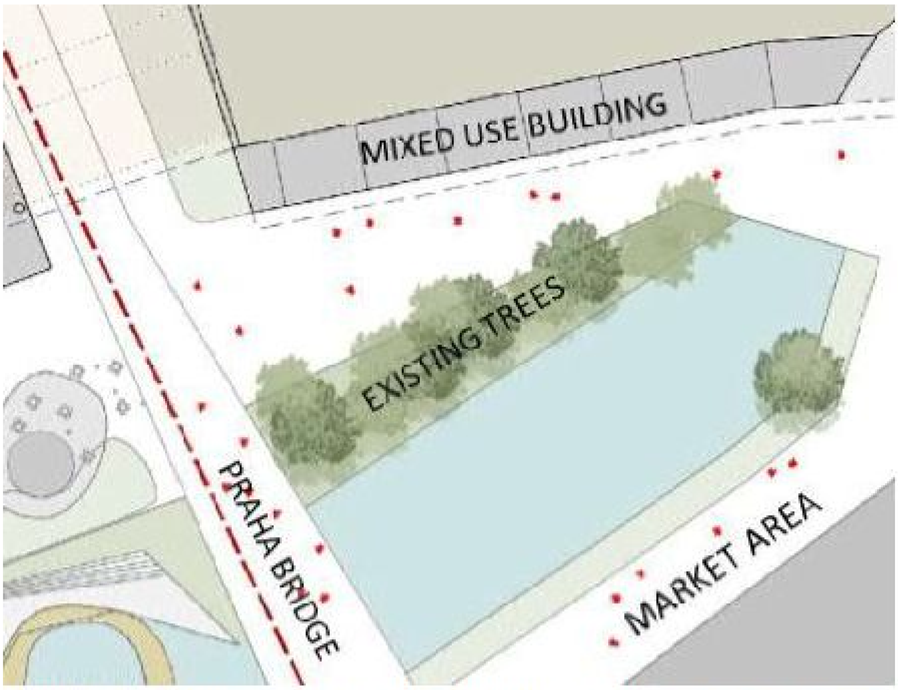

Figure 14.8 – Existing Vegetation Transformation Proposal (Source: AECOM)

14.1.11 Underpasses

The existing issues with the underpasses are that they are dark, unsafe, and though conflict-free, **offer uncomfortable** connections. We propose to use the existing infrastructure for new functions related to cultural uses.

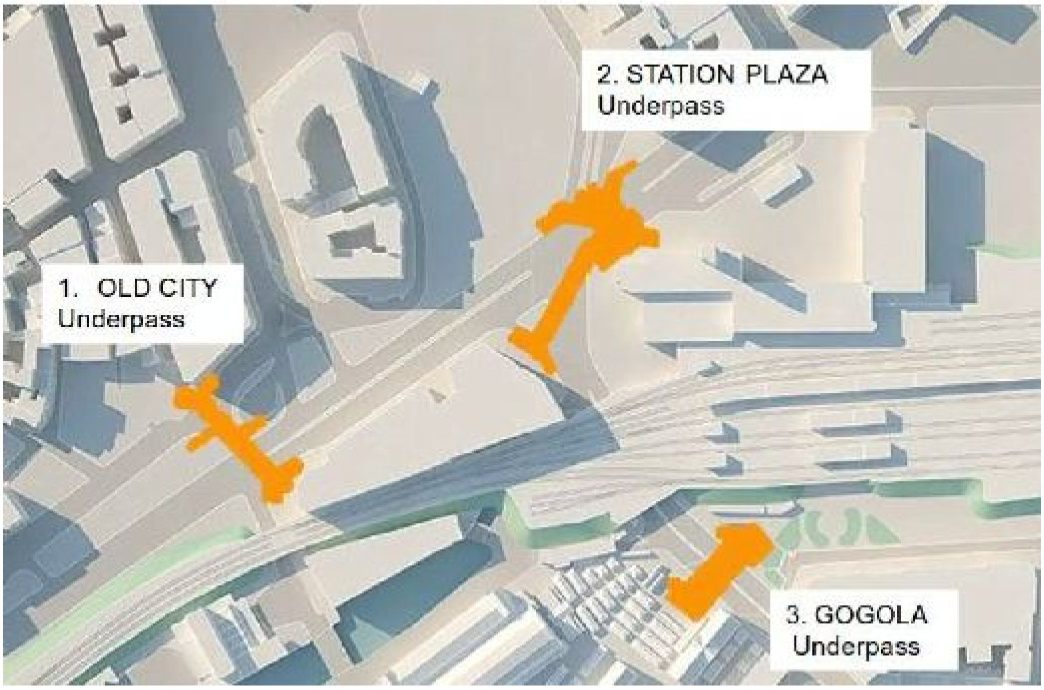

Figure 14.9 – Underpasses identified for facelift/upgrade (Source: AECOM)

14.1.12 New Boulevard and Pedestrian Crossings

13. janvāra iela is a very wide avenue and according to a traffic and capacity study the lanes can be reduced at some points allowing for narrower pedestrian crossings and the introduction of a green boulevard in the middle of the avenue.

Gogoļa iela is one of the road barriers that divides the market area and the multimodal hub. There is a requirement for a pedestrian crossing at grade.

Once the pedestrian crossings with the corresponding traffic lights are satisfying the strategic urban needs the city will improve considerably and let the movements more safe, direct and pleasant for the citizens of Riga.

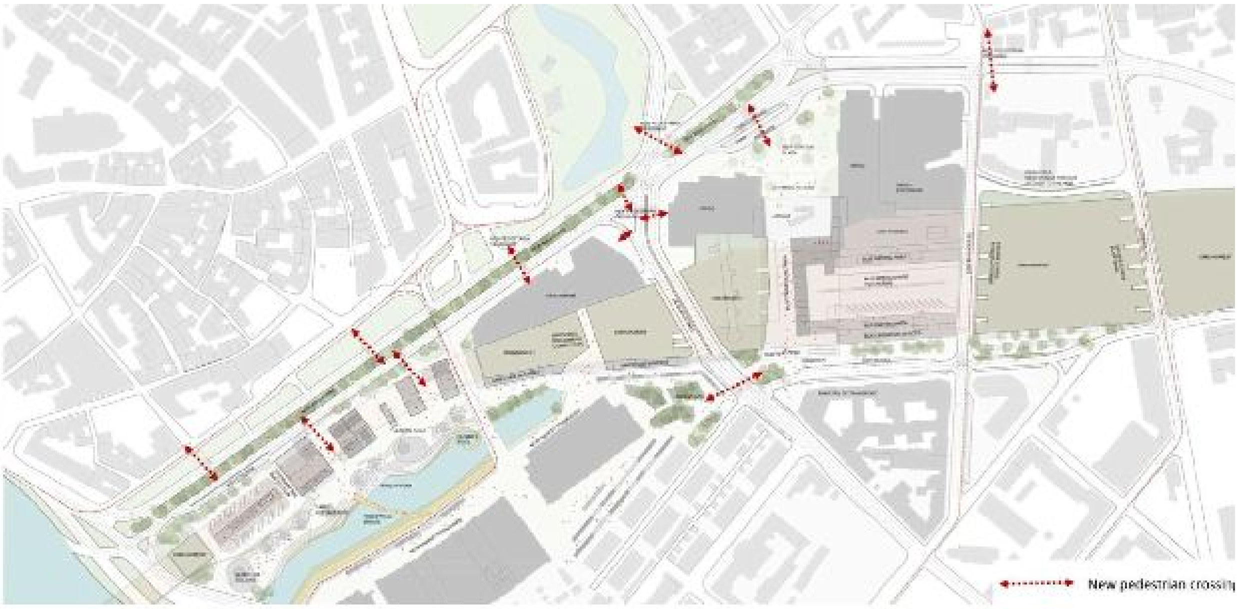

Figure 14.10 – Proposed new pedestrian crossings (Source: AECOM)

14.1.13 Viaduct

The viaduct has been proposed in such a way that the railway is as much as isolated and hidden as possible from the public area. It has a concrete enveloping that configures a very strong image towards the city, a recognizable new element and at the same time protects the pedestrians from the noise.

Figure 14.11 – Proposed viaduct configuration (Source: AECOM)

14.1.14 North Access Plaza

The North Plaza currently is blocked in the longest side by Satekles iela and the heavy traffic, so the unique accesses to the plaza are by both ends, one from Stockmann side and the other one by the only pedestrian crossing in the area linked to the City.

On the proposal this is solved by a better connection through the New Boulevard between the Station and the City. The pedestrians can access the plaza from a new point, having the front façade of the multimodal hub in front of them.

The design of the plaza combines the ramps and gradual stairs to reach the access level. The multiple circles frame the different ways of movement and some of them are raised and contain tree planting and reduced gardens and perimetral benches.

On the long side to the North there would be a place reserved for a Kiss & Ride just next to the plaza and a line of taxis in parallel at a new island for the bus stops, on the other side of this island the city buses can stop in a segregated lane.

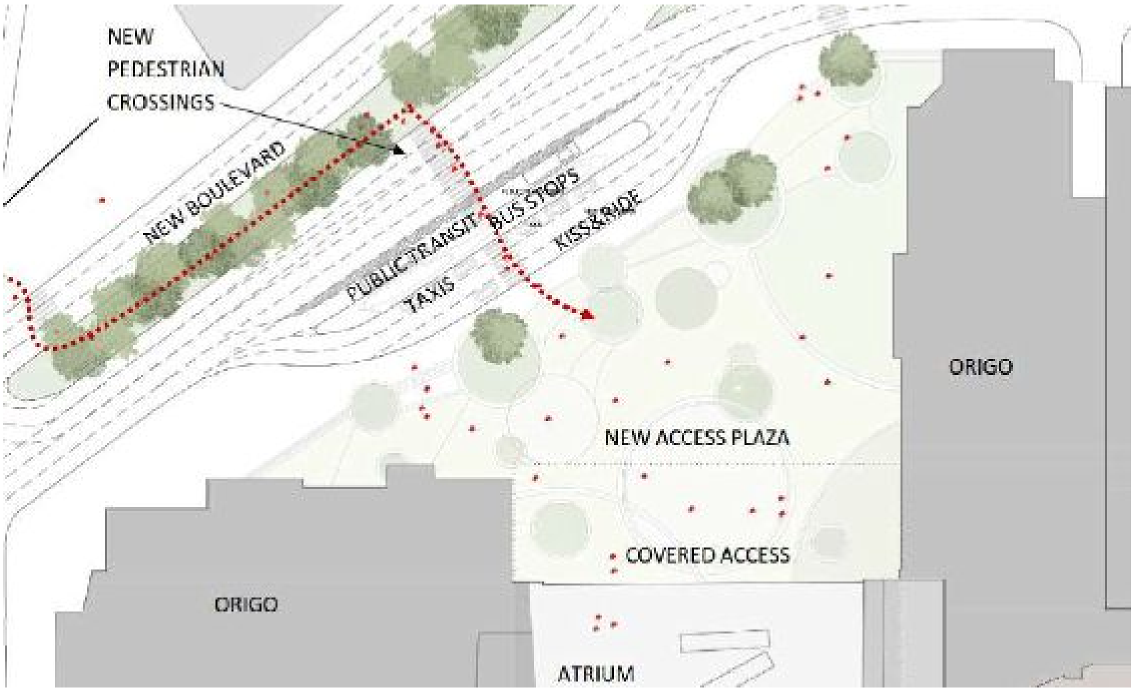

Figure 14.12 – Proposed north access plaza (Source: AECOM)

14.1.15 South Access Plaza

Gogoļa iela means a strong boundary between the Market area and the Station. Closing the underpass and providing with a pedestrian crossing at grade would improve the space quality of the area greatly. The street next to the Ministry will serve for City Buses to get as close as possible to the multimodal hub and a space just in front of the entrance for a Kiss and Ride.

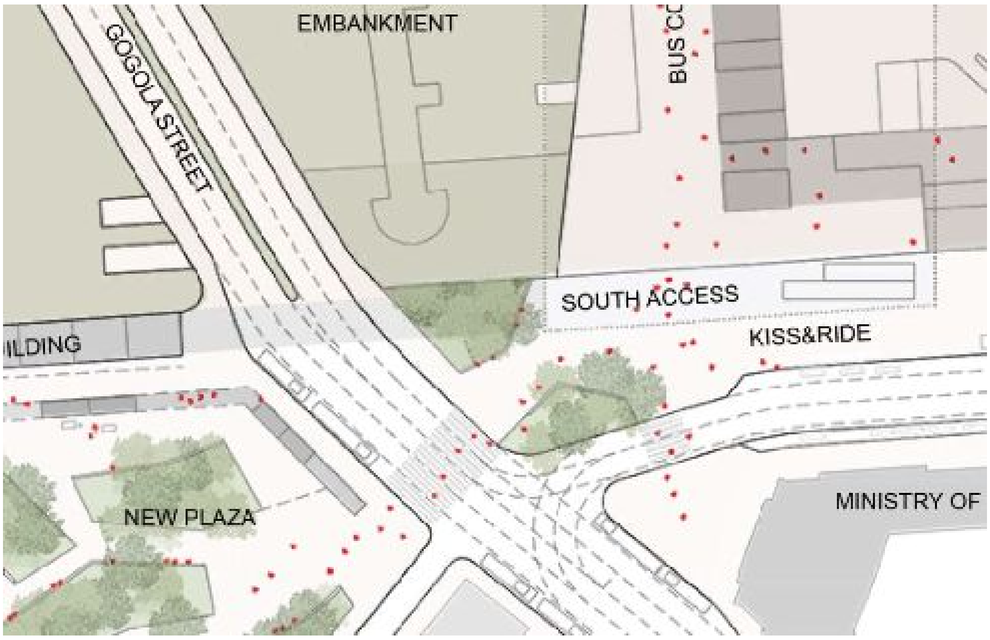

Figure 14.13 – Proposed south access plaza (Source: AECOM)

14.1.16 Options for Compromise

The different proposed interventions can be classified into different grades of costs.

Some of them are proposed as indispensable for the aim of the urban project (in red colour) they couldn't be taken out from the strategy. For example, the track platform construction, the viaduct, in order to offer a great connection between the two neighbourhoods of the City or the new multimodal hub placed under the tracks in connection with the existing station.

Other proposals are preferable to be undertaken but are not indispensable (in yellow colour) . These proposals would contribute to highly upgrade the City in an overall regeneration of the area. The waterfront, the elevated new railway station of the multimodal hub or the New boulevard are some of these ones.

There are other interventions that can be discarded or changed for another ones (in blue colour). They are highly recommended to complement the previous ones, but they can be developed later or slightly change the specific use that is proposed. The small buildings all over the waterfront that are serving with cafes, restaurants and retail can be conceived in another way. The mixed use building, which is recommended in order not to see the Stockmann building from the waterfront, have a barrier volume letting away from the railway. It is also proposed to upgrade the market plaza, using the Gogoļa underpass for another use. It is recommended to find another place for the current market, specially that should be integrated in the market area behind, with new infrastructures for this kind of market which now are in a degradated situation. It is also recommended to start a process of citizen participation asking the Riga people what uses the underpasses could have, as well as which kind of public space is desired for the City.


Figure 14.14 – Options for compromise (Source: AECOM)


Figure 14.15 – General view from South (Source: AECOM)


Figure 14.16 – General view from North (Source: AECOM)


Figure 14.17 – Proposed waterfront view (Source: AECOM)

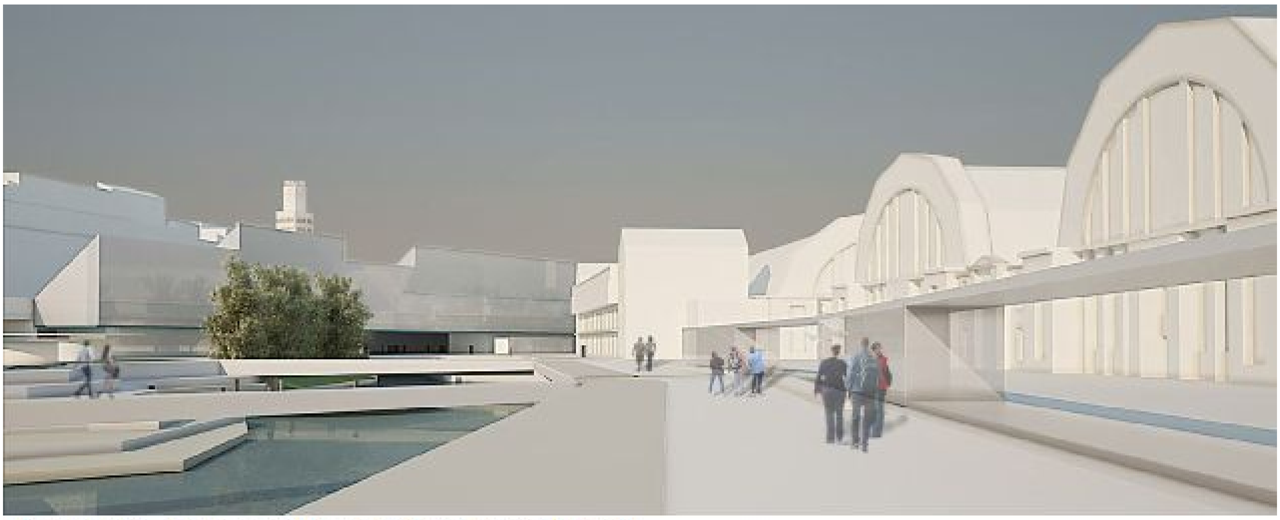

Figure 14.18 – Proposed market area (Source: AECOM)

Figure 14.19 – South Entrance to the Multimodal Hub (Source: AECOM)

Figure 14.20 – North plaza view (Source: AECOM)

Figure 14.21 – Views from the multimodal hub to the market area (Source: AECOM)

Figure 14.22 – Bus Interchange in the Multimodal Hub (Source: AECOM)

Figure 14.23 – International Bus Station Façade to the City (Source: AECOM)

Figure 14.24 – International Bus Station (Source: AECOM)

For full set of Urban Planning Drawings and 3D views, please see APPENDIX 2.7.2

14.2 Traffic Studies

The existing situation reflects a direct connection from the urban Riga highway (Krasta iela) to the Riga Centralija Station, with one – way streets as main connectors: Turgeņeva iela (Sothbound) and Puskina iela (Northbound).

Figure 14.25 – Existing main connections from Riga Centrālā stacija (Source: AECOM)

The proposal includes in both axis the streets Elisabetes iela – Timoteja iela (Southbound) and Dzirnavu iela (Northbound), to complete the connection to the new Multimodal Hub and provide a fast connection from/to Krasta iela to the Multimodal Hub

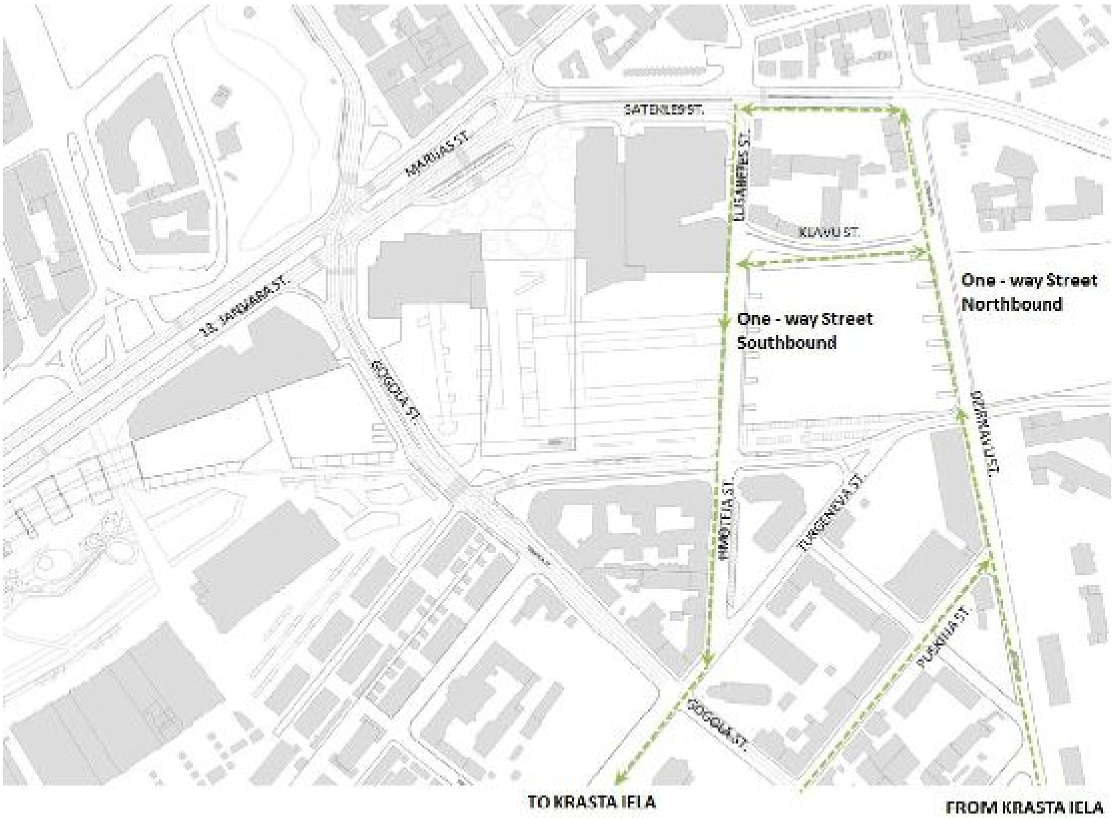

Figure 14.26 – Proposed street directions around Multimodal Hub (Source: AECOM)

14.2.1 New streets configuration

For Dzirnavu iela, the new configuration of the street includes one carriageway for private cars, shared with buses and trolleybuses; in addition, there will be implemented a new Tram line in this zone, which requires an adequation of the existing underpass. The carriageway width will be 4.0 m.

For Elizabetes/Timoteja iela, there will be a new connection through the embankment, allowing the access for the buses from Klavu iela/Satekles iela to the Multimodal Hub.

14.2.2 Junctions near to Multimodal Hub analysis:

For the junctions near to the Multimodal Hub, there has been studied the existing configuration to adapt the traffic to the future situation. Regarding existing widths and movements, it has been studied both junctions to integrate the new street design, and it has been made a conceptual design through the Road Layout software ISTRAM/ISPOL. The junctions studied are as follows:

Marijas iela – Satekles iela

Analzying existing constraints (existing lanes, public transit, traffic flows), it has been proposed a signalized junction with U-turn to keep the existing movements and 3.25 m lane widths, and providing a central reserve used as boulevard to improve the pedestrian connectivity between Old Riga Center and the Multimodal Hub.

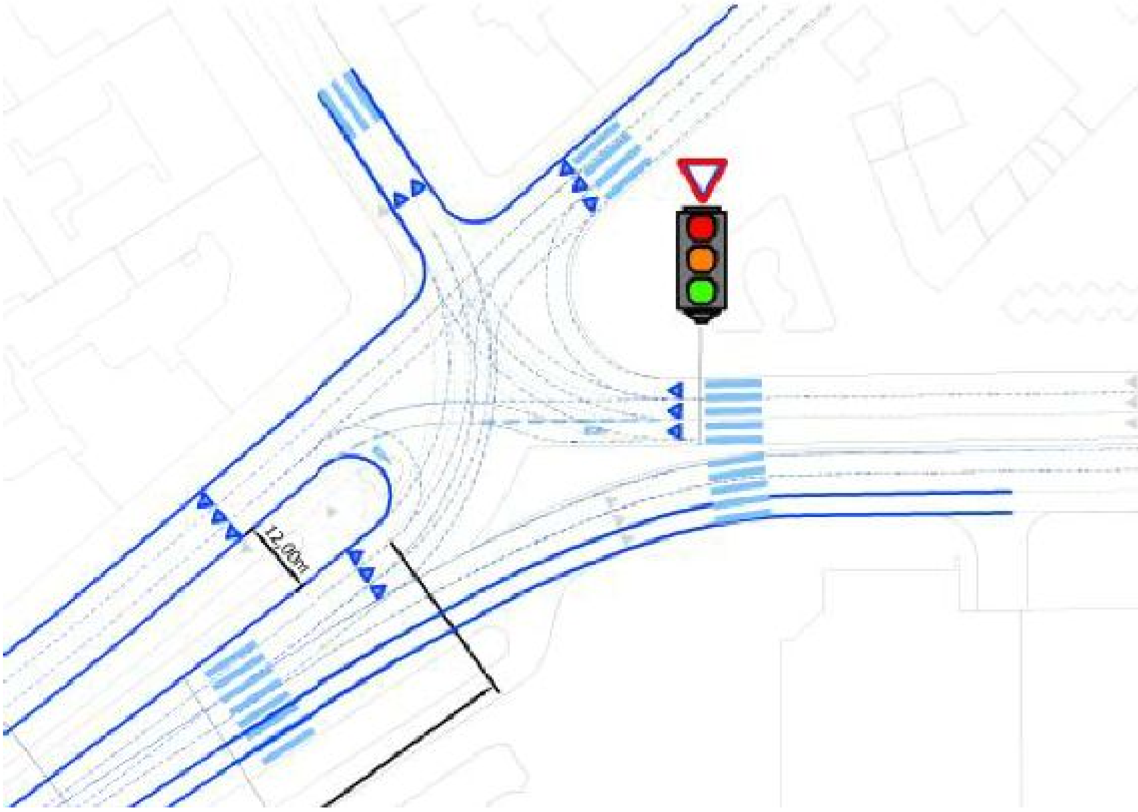

Figure 14.27 – Marijas iela – Satekles iela junction proposal (Source: AECOM)

For this section it has been provided a Capacity and LOS analysis of the weaving section between Gogoļa iela and Marijas iela, which results are included in the Appendix WP 2.7.4 Traffic Studies.

13.janvara iela – Marijas iela:

For this junction it has been proposed a signalized junction, with a unified platform for public transport in the North section with a 4-lane carriageway, applied also to the Eastbound movement, with a 3.25 m lane width. It provides enough space in the central reserve to provide the new boulevard, assuring all the movements in the junction through signalized stops.

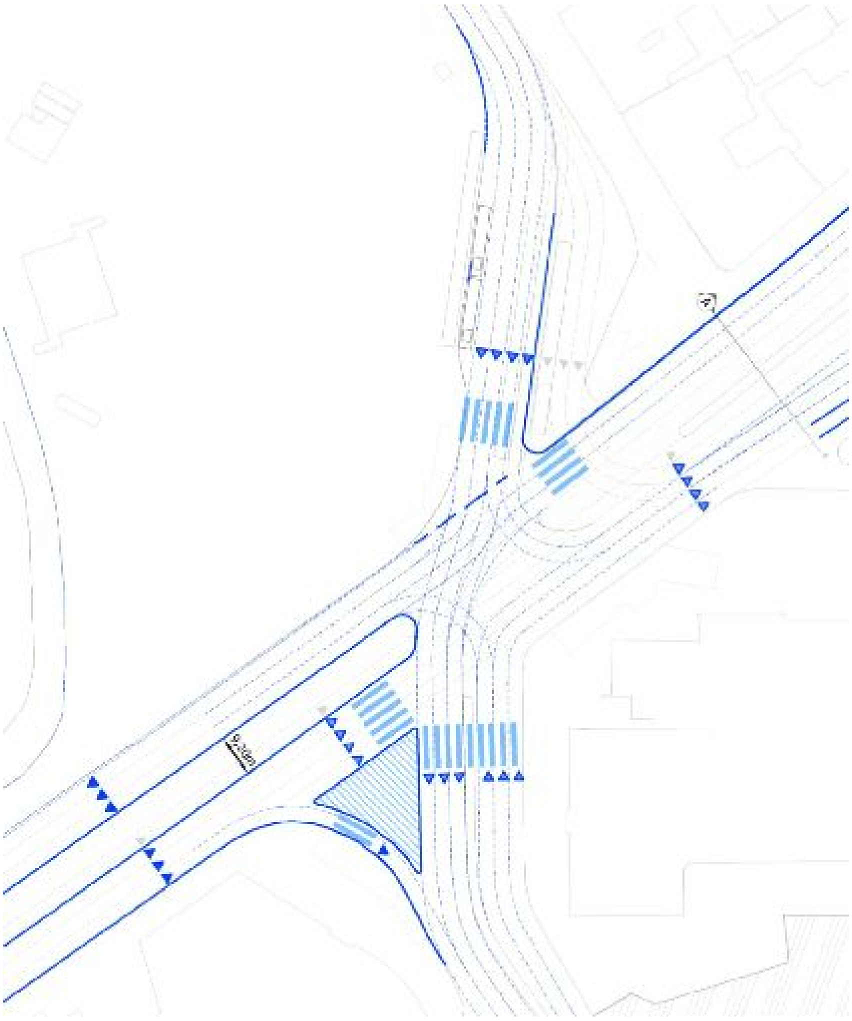

Figure 14.28 – 13. janvāra iela – Satekles iela junction proposal (Source: AECOM)

In Appendix WP 2.7.4 there are both cross section of the future situation in Satekles iela and 13. janvāra iela; showing the new conditions of the pedestrian connectivity between Old Riga historical center and both Multimodal Hub and Station Plaza, through the new Boulevard.

To provide points of safety from a pedestrian point of view, the non-grade crossings and underpasses of the existing bus and trolleybus stops, which are not accessible for disabled people have been removed. The proposal is a split stop; the first stop in Raina Bulvaris North, for bus routes in Westbound and straight direction, and the other in Raina Bulvaris South, for bus routes in Eastbound direction Both stops can be accessed by at-grade crossings, and its location provides a better traffic flow due to their separated routes concept.

Figure 14.29– Raina Bulvaris new bus stop proposal. Junction routes allocation (Source: AECOM)

To provide a proper connection to the Multimodal Hub for International Coaches, Klavu iela Street has been widened and conditioned to accommodate the international Buses.

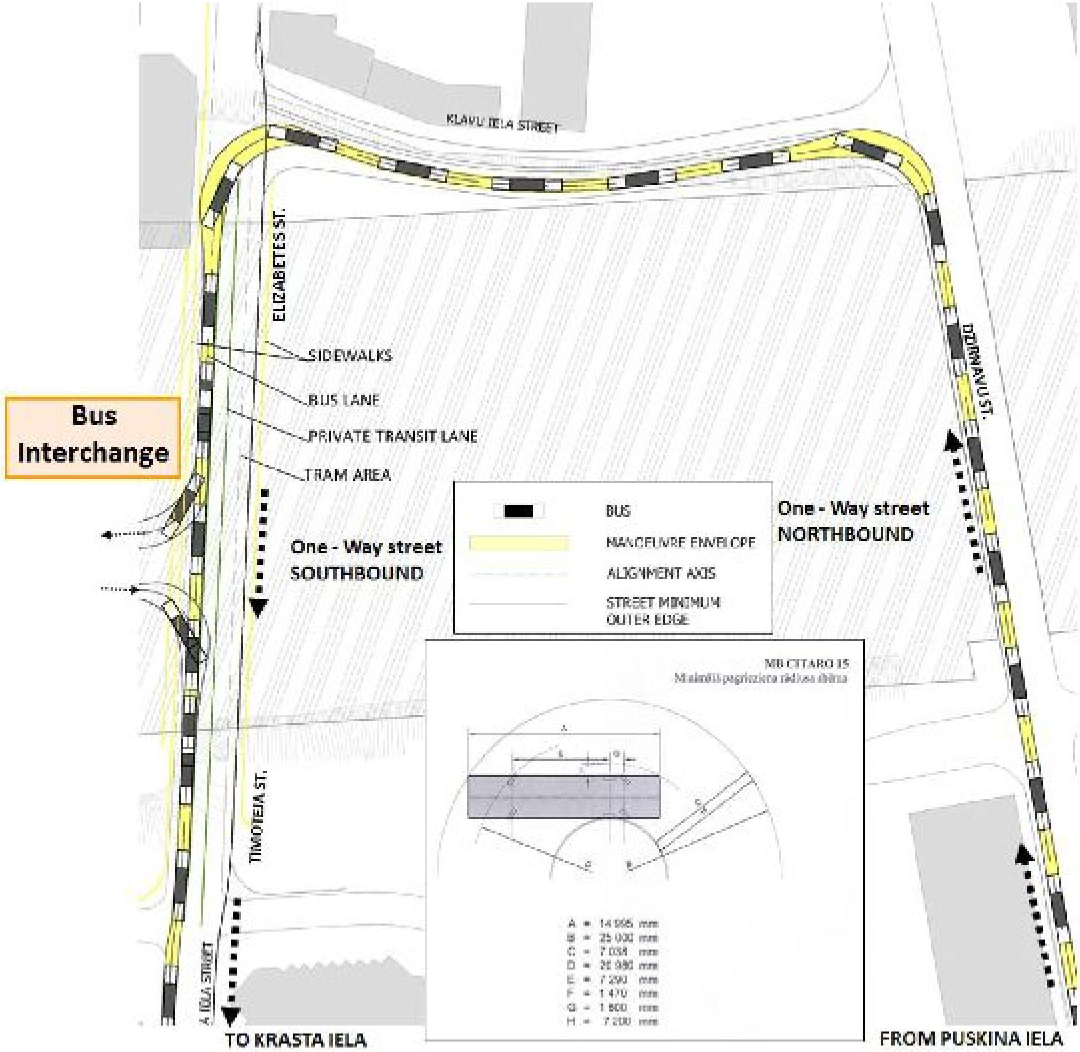

Figure 14.30 – New Klavu ielaStreet definition (Source: AECOM)

The new characteristics of the street are:

- **New Alignment adapted to Mercedes Benz Citaro 15 (Standard Design Bus according to *Rīgas satiksme,* Riga city public transport company).**
- **Widening in T-Junctions with Elizabetes & Dzirnavu streets (at least 5,50 m for the left carriageway).**
- **Connection between hostel and Mercure Hotel parkings**

To access the new Station in the Multimodal Hub, it has been analysed the swept path for this area, solving the conflict areas between exit and entry zones. It has been analysed through ISTRAM/ISPOL according StandartAutobuss I:

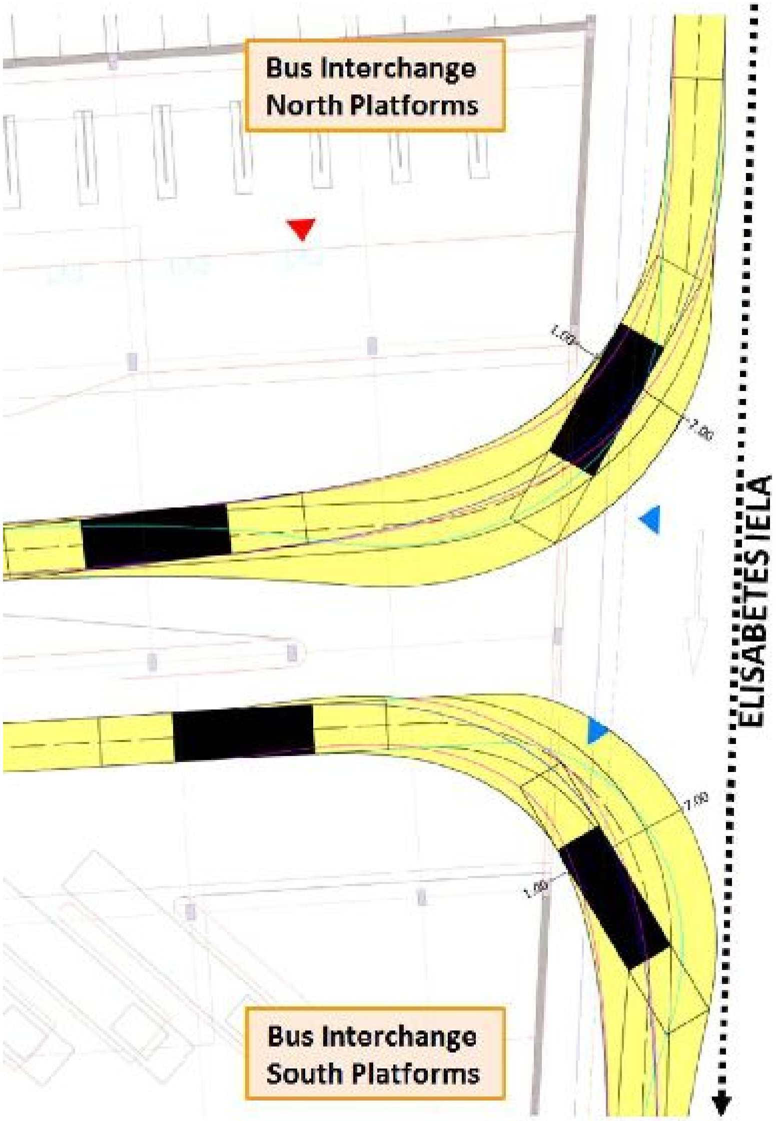

Figure 14.31 – Access/Exit from Multimodal Hub bus Station (Source: AECOM)

To accommodate the existing Public Transit Network, Taxi and Private Cars movements, there have been proposed different areas for each network.

14.2.3 Public Transit Network

It has been designed for North and South Multimodal Hub areas to assure the Buses, Trolleybuses and Minibuses network, with a sufficient area to park the buses and allow the travellers movements. The buses platforms have been designed according Mercedes Benz Citaro 15 (Standard Design Bus according to *Rīgas satiksme*, Riga city public transport company).

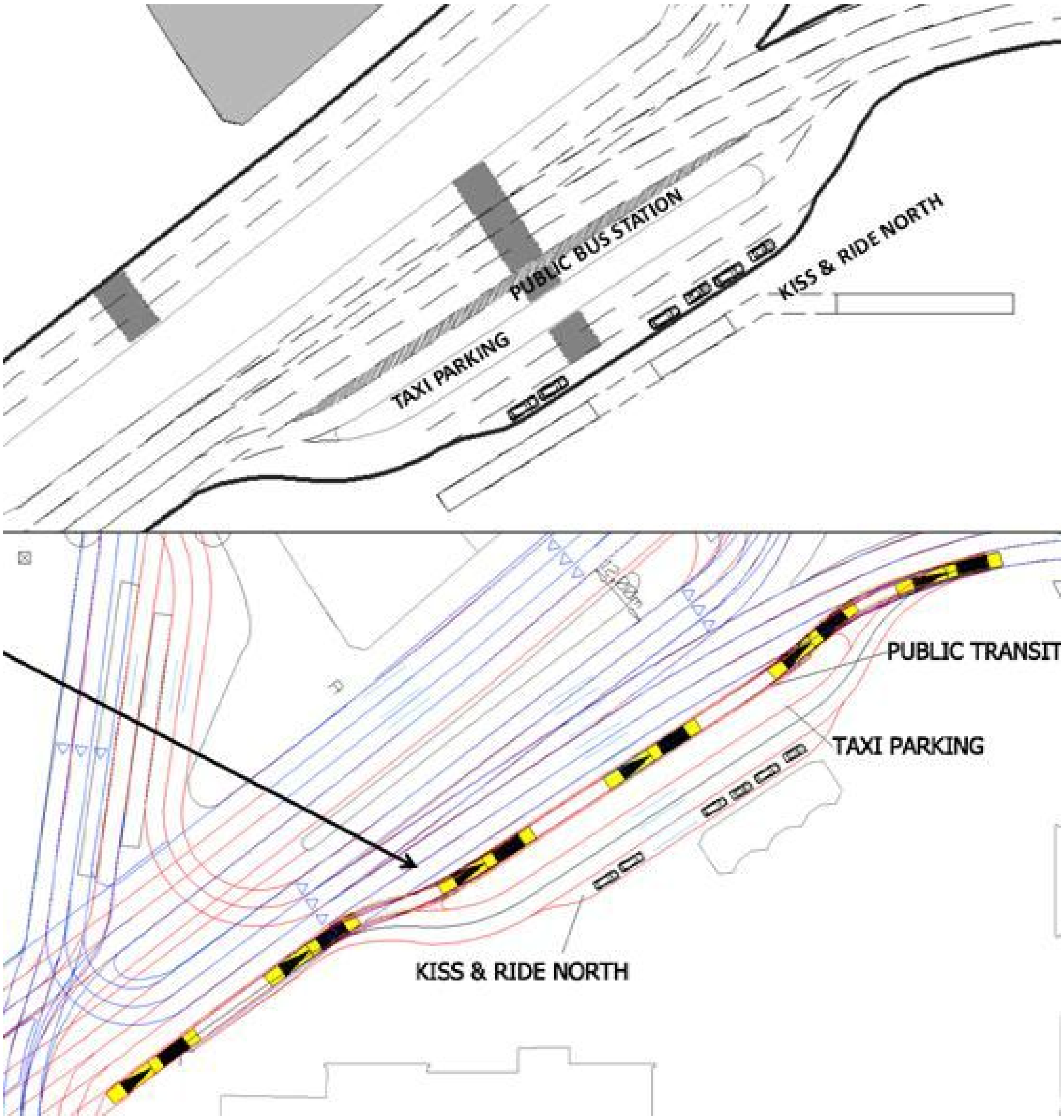

Figure 14.32 – Kiss & Ride North – Configuration and swept path analysis (Source: AECOM)

Regarding bus network connectivity to the City bus Depot placed in Abrenes iela, the layout proposal preserves the existing project mileage per 1 year, avoiding an increase of the length of transport through the affected streets Elisabetes iela, Turgeņeva iela, Dzirnavu iela and Abrenes iela. The proposal for Eastbound/Westbound movements from/to Abrenes iela is as follows:

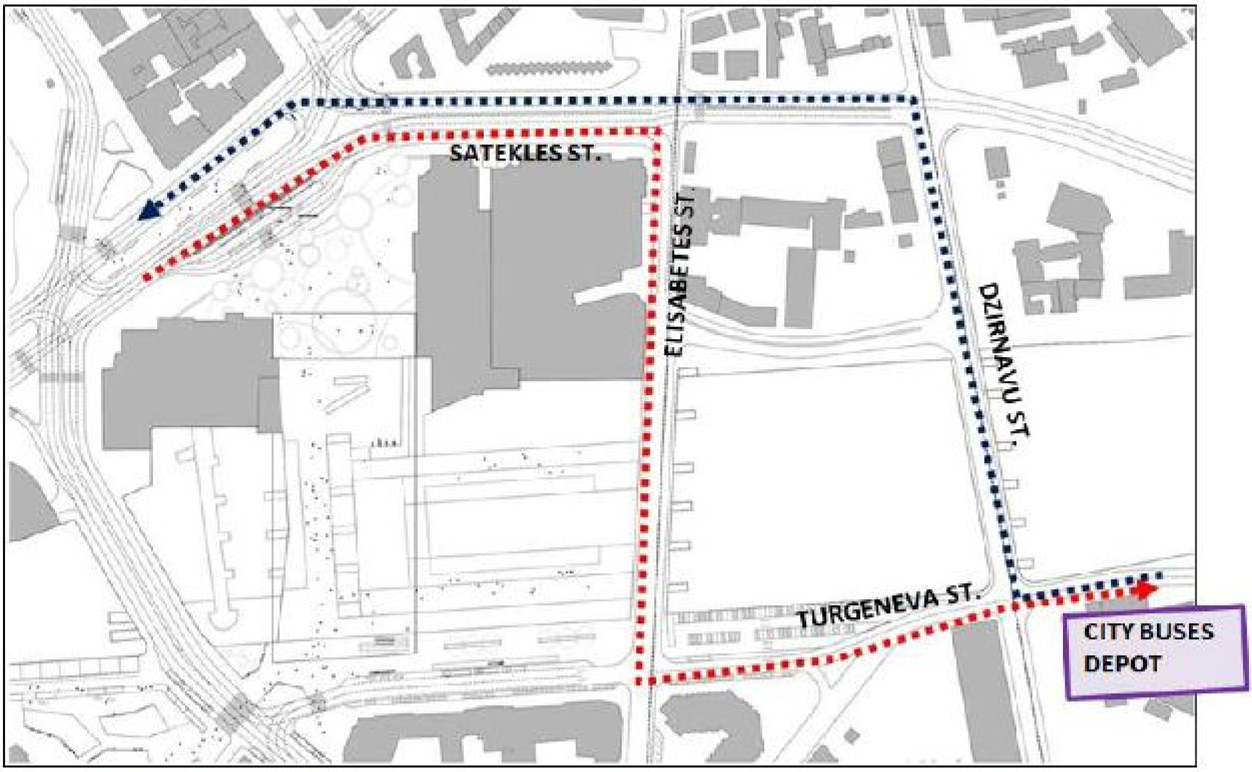

Figure 14.33 – Eastbound and Westbound movements from City Buses Depot in Abrenes iela (Source: AECOM)

In addition, the bus routes nearby *Centrāltirgus* have been upgraded to the new configuration proposed with the new Multimodal Hub, with the following proposal:

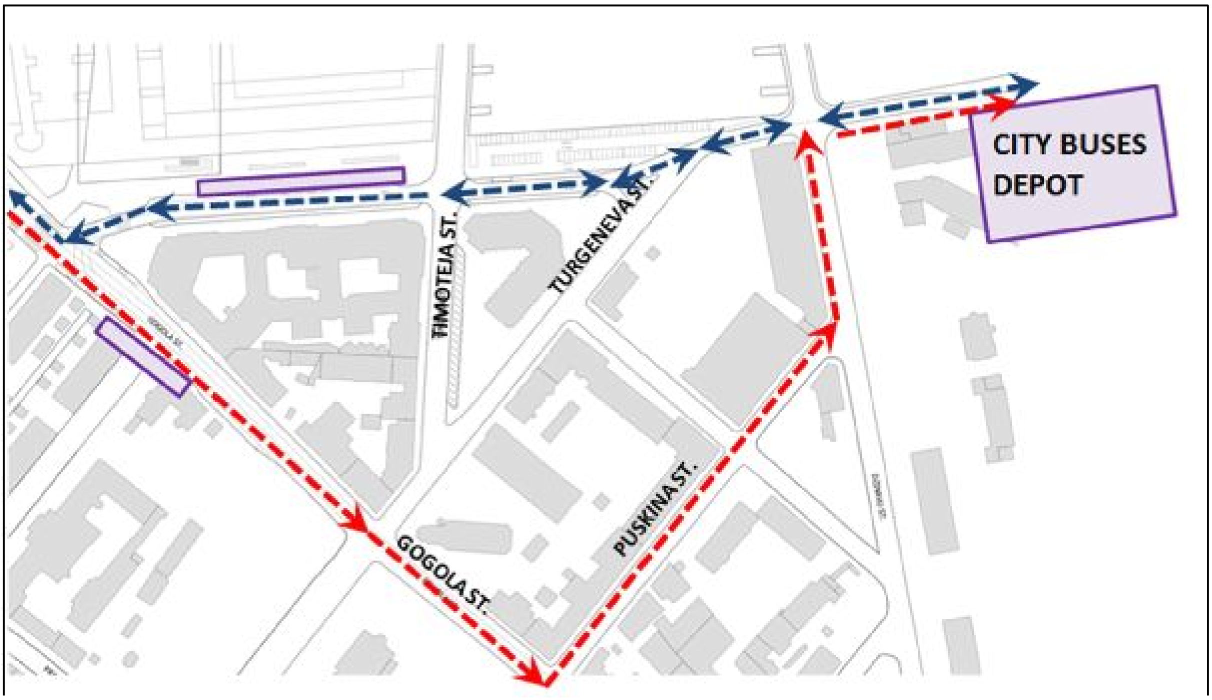

Figure 14.34 – *Centrāltirgus* movements from City Buses Depot in Abrenes iela (Source: AECOM)

According to the figure above, the proposal includes a separated bus traffic lane, which enables an overall bus stop in the Multimodal Hub south zone (before Gogoļa iela) with a lower chance of traffic conflicts and a higher available space to provide a proper bus stop in Turgeņeva iela. The proposal also maintains the existing bus network mileage.

14.2.4 Taxi Parkings

There have been disposed both Parking for Taxis, in the North of Multimodal Hub and in the new International Buses Station in 13.janvara iela, with enough space for 5 taxi parked near to the Station.

14.2.5 Kiss & Ride

To provide an adequate area to dropoff the travellers nearby the Multimodal Hub, there have been designed three areas of Kiss & Ride, which requires a shorter length than the Park & Ride areas due to the supposed fast stop of cars. There are three proposals of Kiss & Ride areas in the study area: North and South of the Multimodal Hub and in the new International Coach Station.

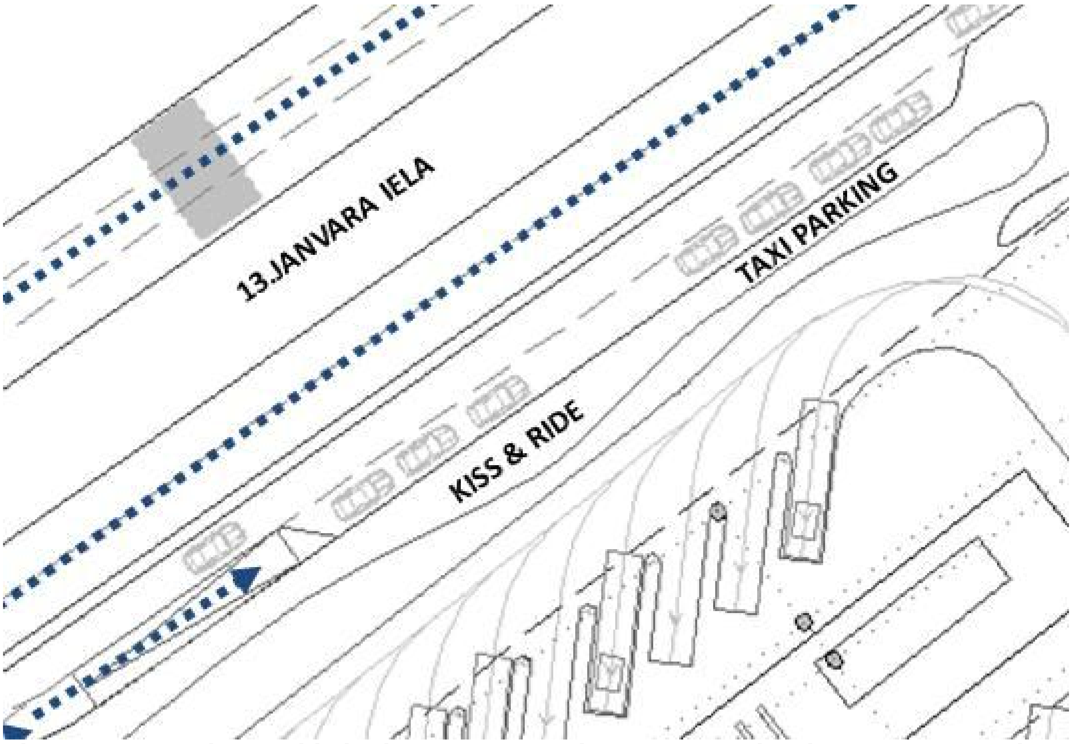

Figure 14.35 – Kiss & Ride in the new International Bus Station (Source: AECOM)

In the Appendix 2.7.3 there is a full analysis for each area (Public Transit, Taxi Parking, Kiss & Ride) allocated in Multimodal Hub and International Bus Station.

For full details of the Traffic Studies listed above, please see Appendix 2.7.4

14.3 Viaduct

Current situation shows an existing double track (Rail Baltica) with 4.10 m between axle tracks over embankment. The project requires a new double track (High Speed Railway) parallel to the existing one in which the distance between axle tracks increases to 4.70 m. Also, there are urban requirements to place some services underneath these tracks in this area what involves two viaducts, one for couple of tracks, need to be designed.

The viaducts have a length of 308 m with 9 continuous spans of 28.00 + 36.00 + 36.00 + 36.00 + 36.00 + 36.00 + 36.00 + 28.00. The plan view of viaduct is shown in Figure 14.36. The continuous proposed solution has many advantages in face of simple supported proposal such as reduction of deck height increasing the available gauge, elimination of the joints, reduction of piers dimension and elimination of pier cap which is required for the single beam solution. However, unlike the simple supported solution, and due to the length of viaduct, the continuous solution will require a expansion rail device in one of the abutment (free abutment).

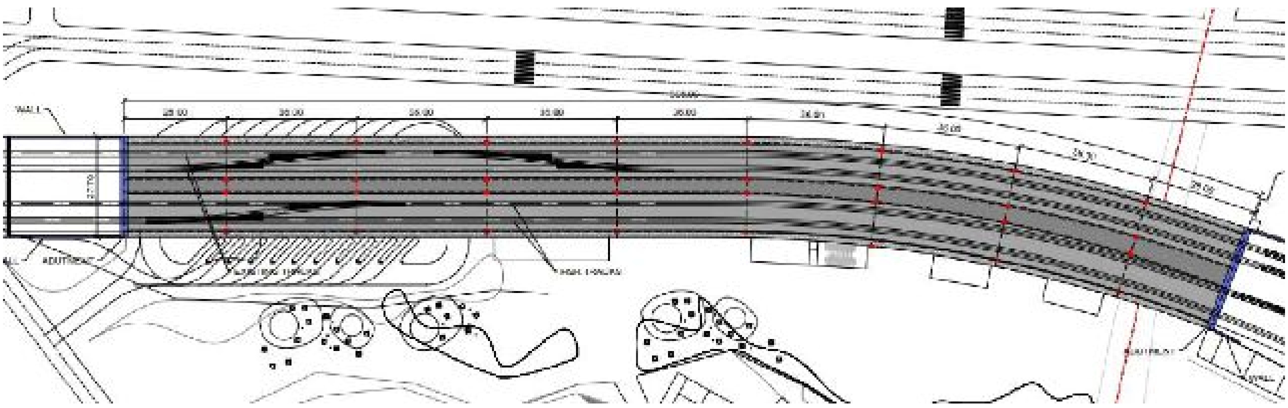

Figure 14.36 – Viaduct plan view (Source: AECOM)

Due to requirement of reducing the structural height (distance between Top of Rail and deck soffit) as much as possible, the most suitable solution in these cases is a cross section deck in U-shape. The U-shape offers several advantages both in terms of insertion into the city and in terms of cost. The rail level can be lowered due to the minimum distance between the rail and the bottom of the deck and, in this way, to increase tha clearances for the element below the deck and the visual impact is reduced because the web lateral beam works like noise barrier. This solution can be achievable using a composite or post-tensioned deck as shown in drawing RPTH-VIA-SEC-01.

The total height of the deck is estimated in 2.80 m giving a ratio H/L of 1/13 what is usual for continuous structures. Simple supported solution would require as ratio 1/10 approximately.

Piers are reinforced concrete and have a double circular shaft with a diameter of 1.30 m. In the top of them, pot bearings are provided. Foundation is deep with piles of 1.80 m diameter. This solution is chosen because the required dimension for shallow foundation might affect the construction process described below. The nearest piers from both viaducts will be braced with a steel beam in order to share the transverse loads. In this way, the dimensions of the piers are reduced.

The extreme spans are supported in the reinforced concrete abutments. One of them will be the fixed point which is in charge of collect the longitudinal forces from braking and friction. Next to the west abutment, there is another viaduct and in order not to affect the construction the distance between both abutments will be 32.00 m.

Retaining walls will be provided after both abutments until the underpasses located between viaduct and the Multimodal Hub station.

Construction process

The need of not to interrupt the traffic trains makes that the design contemplates that the construction process is by stages. It is summarized as follows:

1. Step – S1: diaphragm wall is built next to the existing tracks (Rail Baltica) and between the future piers of the viaduct.

2. Step – S2: foundation, piers and deck of the new double tracks (HSR) are built. Before diversion the traffic within new tracks, it is necessary to provide a temporary bracing between piers and diaphragm wall.

3. **Step – S3: once the traffic train is diverted, the existing embankment is removed and the foundation, piers and deck of the other tracks are built. The diaphragm wall is demolished and finally, the permanent bracings between piers from both viaducts are provided**

WIDENING UNDERPASSES

Due to the construction of the new tracks, the existing underpasses located between the viaduct and Multimodal Railway Station need to be extended.

The underpass which is next to the viaduct, the span length is 9.00 m meanwhile in one next to the station the span length will be 10.00 and so, the reinforced concrete frame structure will be designed similar to the existing structures.

For the viaduct structural drawings, please see Appendix 2.7.5

14.4 Multimodal Hub Building: Architecture

APPENDIX - WP 2.7.6 Multimodal Hub Architectural Drawings

Building Use Distribution – Street Level

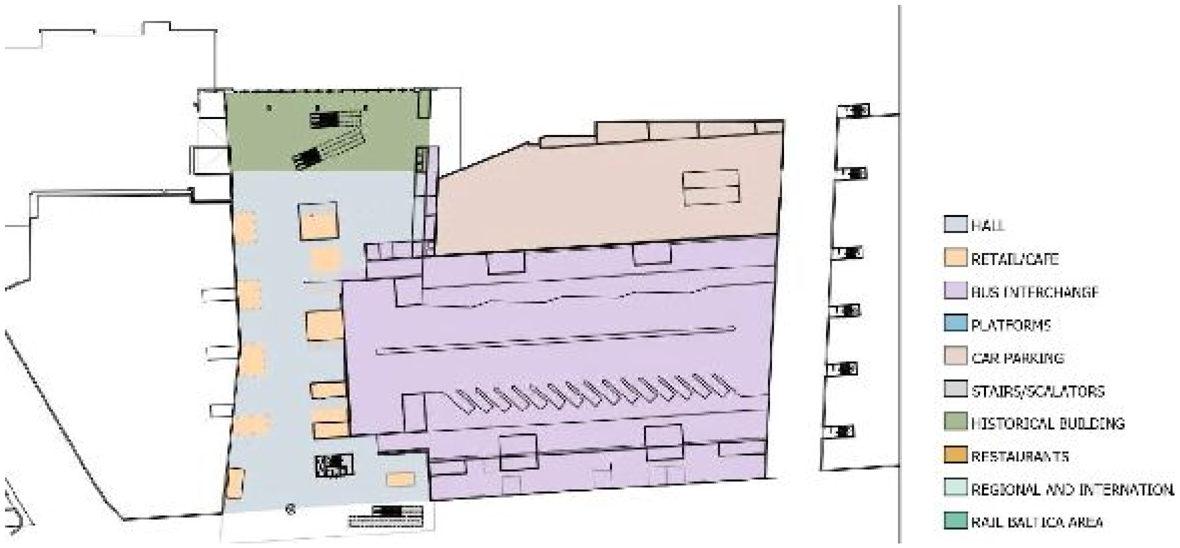

Figure 14.37 – Street Level - Bus Interchange and Parking (Source: AECOM)

North Access and Atrium

The North Access to the New Multimodal Hub remains across the historical glass façade. The outdoor space in front of this façade has the possibility of being a public area covered by a cantilevered volume from the new building sticking out to the Plaza, so it becomes recognizable from the City and offers a roofed high entrance.

Inside, the current Station is emptied from the small retail uses, recovering this space for a welcoming feeling space for the passengers, the main atrium (dark green color). From here, there are three long scalators that provide access to the Railway Bridge Station. These scalators stop in an intermediate floor where some space for public exhibitions is opened to the atrium. The number of scalators have been studied by the pedestrian modelling according to the real needs.

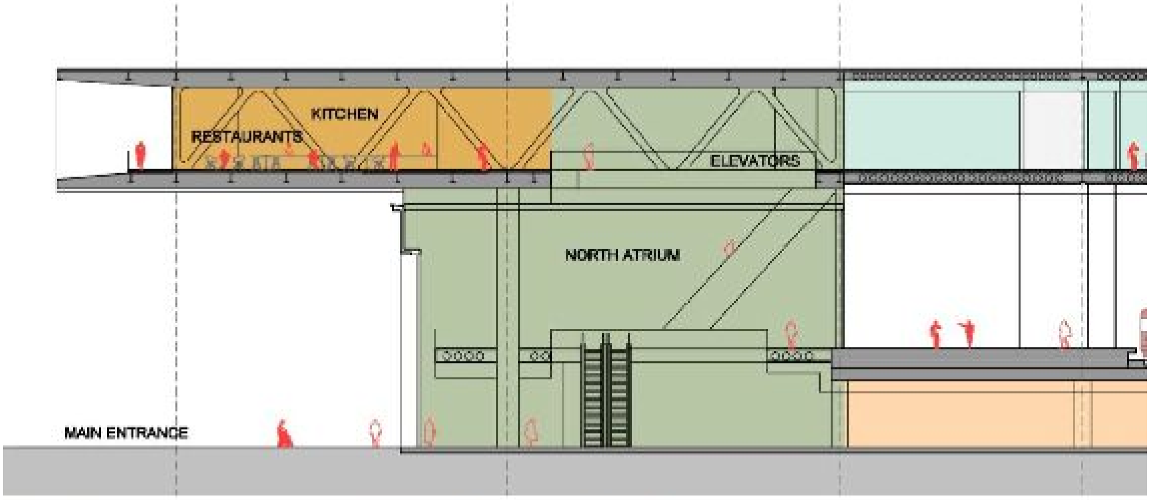

Figure 14.38 – North Access and Atrium (Source: AECOM)

There are some connections at the street level once the passenger enter the building:

Car Parking

First of all, on the left side there would be a ramp going down to the **Private Car Parking**, where there could be Car Rental and Parking services for private cars serving the multimodal hub. There are planned two levels of parking of the same area, since the Bus platforms area has a double height. (Brown colour in the diagram).

The access to the parking for the cars is from the new street just close to the embankment, the new street that is created for car/bus access to the Hub.

Bus Interchange Waiting Area

There is a direct connection to the **Waiting Area of the Bus Interchange** from the hall. This area, mirrored at the other side of the Bus platforms, has several acceses to the platforms along a glass interior façade. The area is served with toilets and small cafes. The automatic doors open to the different bus platforms. The waiting area is protected from the smoke and noise.

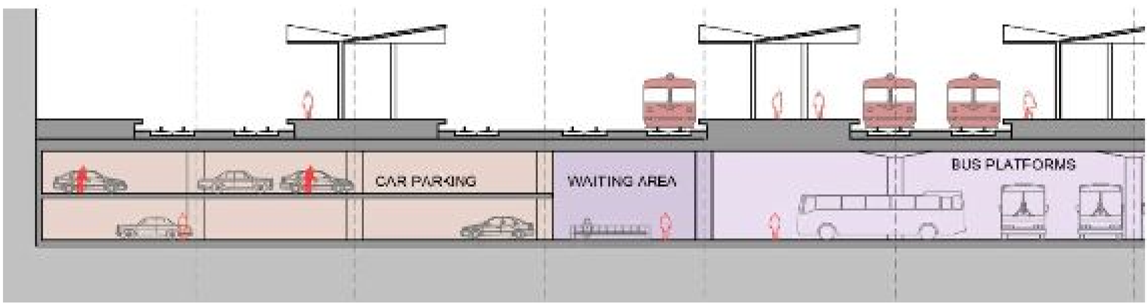

Figure 14.39 – Car Parking and Waiting Area (Source: AECOM)

Bus Interchange Commercial Area

The space straight in front of the hall connects the North access with the South access. At the embankment side some skylights could be opened, so natural light would illuminate the space. The skylights could be placed between the tracks, at the point where they start to distance from each other.

The long space has ticket offices next to both entrances and small Food & Beverage shops along the area.

On one side there are open cafes and on the other side ther are partially enclosed retail, toilets and escape stairs from the platforms.

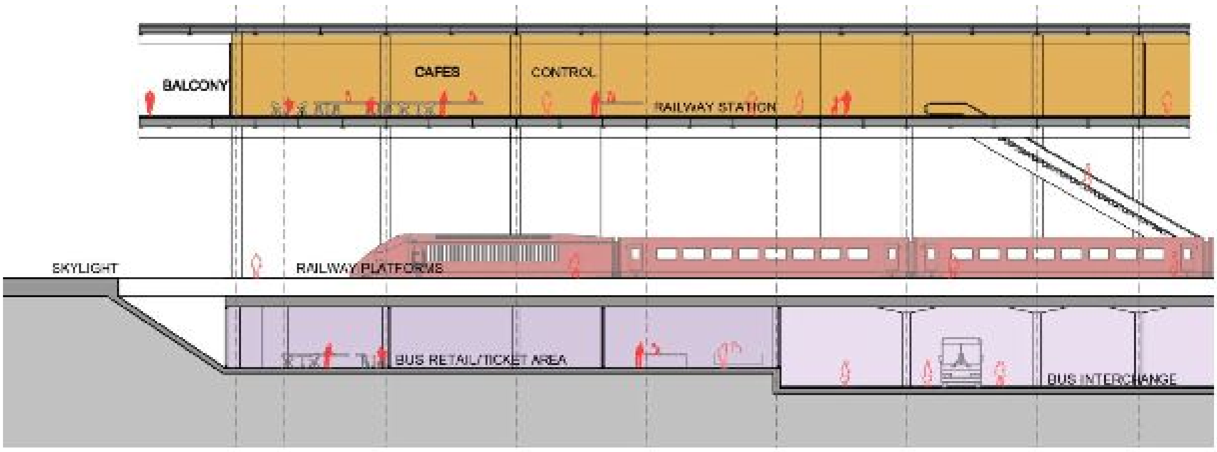

Figure 14.40 – Bus Long Retail/ Ticket Area from North access to South access (Source: AECOM)

Parking levels:

- The Main halls and commercial & ticket area are at the street level +0.00 m.
- The Bus Platforms and the Car Parking are at -1.40 m from the street level (+0.00).
- The Waiting area is 10 cm. above the bus/car level.

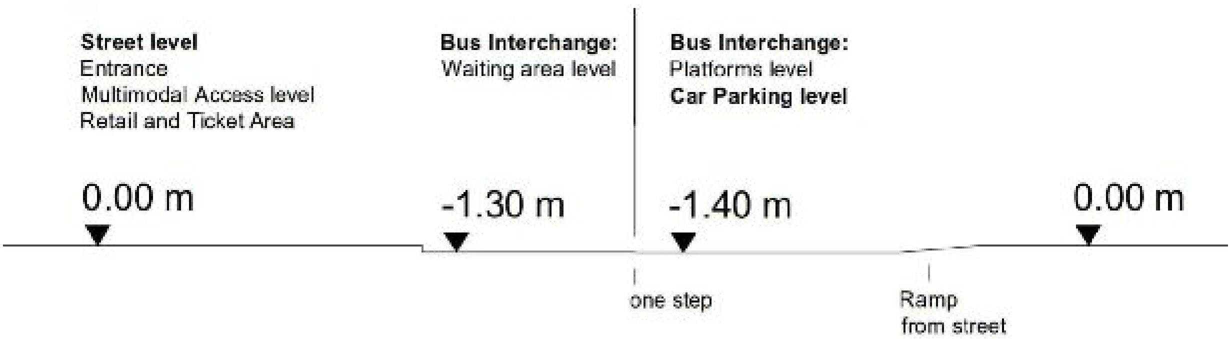

Figure 14.41 – Bus Long Retail/ Ticket Area from North access to South access (Source: AECOM)

South Access

The access from the South offers an semi-outdoor space between the two façades. There are two scalators to get to the top floor to the Elevated Railway Station, stopping in an intermediate level, as at the North atrium.

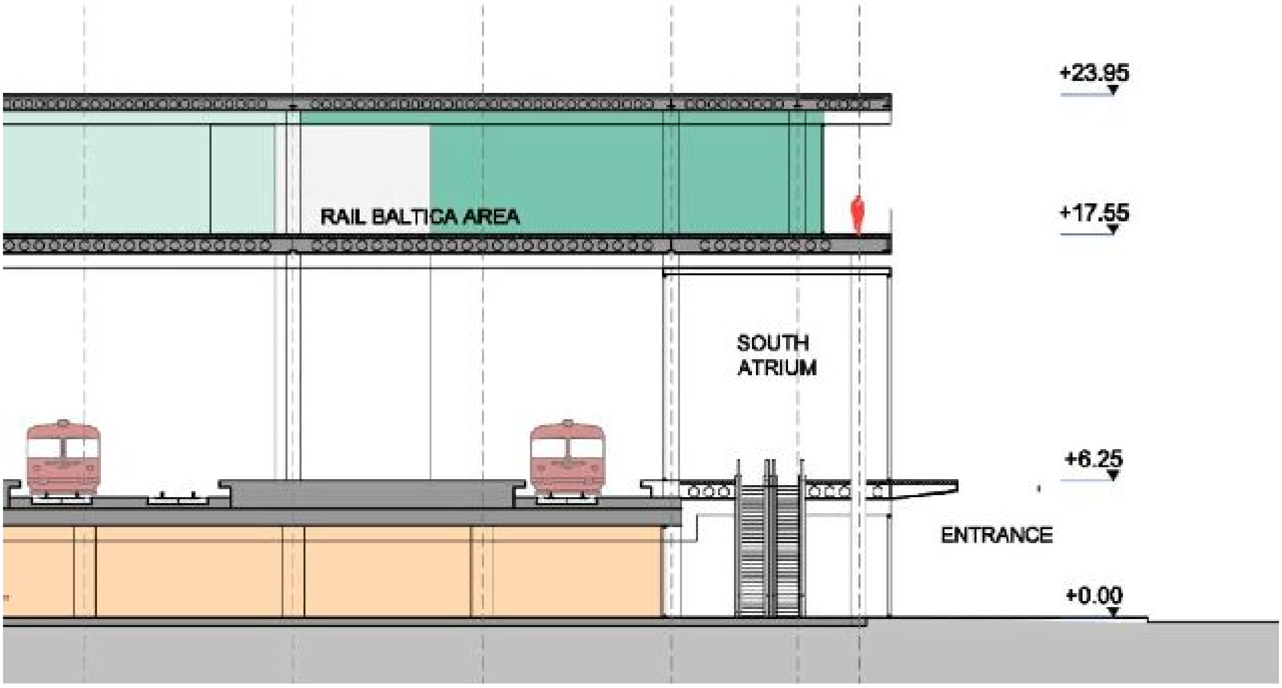

Figure 14.42 – South access (Source:AECOM)

Tunnel

There is a new street to access the Bus Interchange and Car Parking on the back side of the building. It is at the limit with the embankment, where the escape stairs from the platforms are placed.

The tunnel and the access to both car/bus areas are completely opened, but as it is a long tunnel under the tracks, an important system of smoke control is needed on this big areas in case of fire.

Railway Platforms Level

The platforms have a width of 10 m. Which is the minimum so the overall width of the new platform layout wouldn´t be too big, for urban reasons. Each platform has two escalators going down from the Railway Level above them.

Also, there is an elevator per platform and escape stairs going down to the street level from different places needed, especially at both ends of the platforms to facilitate the possibility to evacuate from either end of the platforms.

As explained in Section 10.3 – Platform Width Assessment, the minimum widths have been calculated according to the Network Rail Guidance (SCAG 2015) from the demands up to 2050.

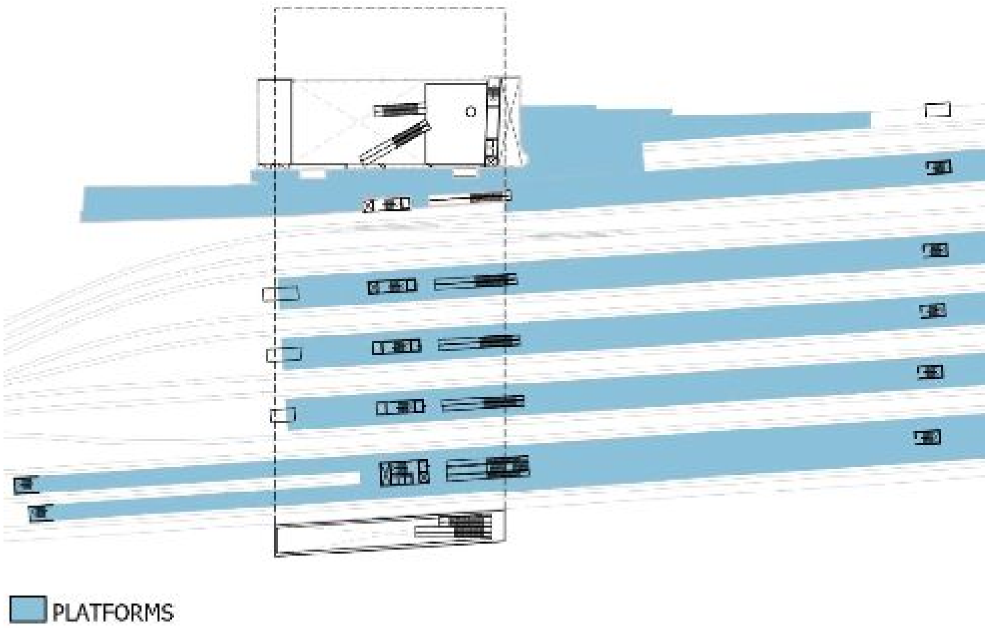

Figure 14.43 – Railway Platforms Level (Source: AECOM)

Elevated Railway Station Level

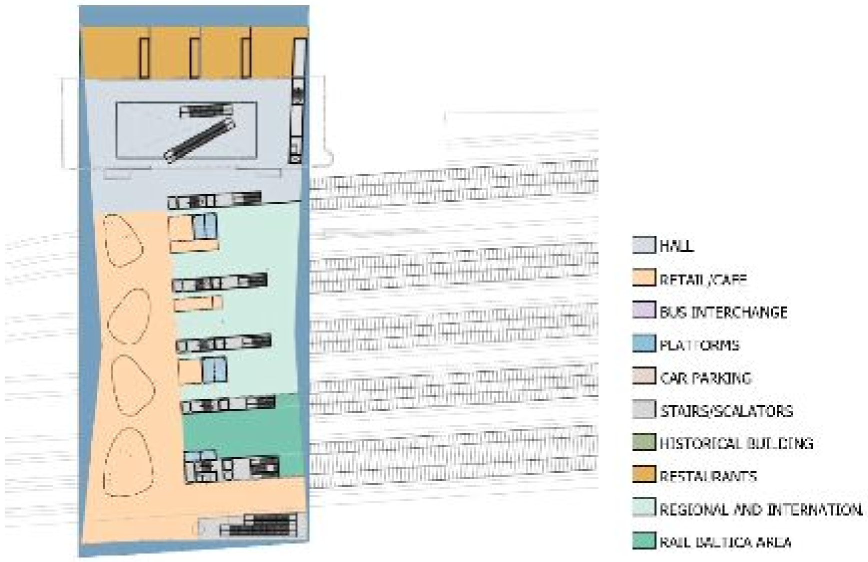

Figure 14.44 – Elevated Railway Station Level (Source: AECOM)

Railway Station Commercial Area

Once the passenger gets to this level from one of the atriums, there is a longitudinal public connection as on the street level from one side to the other of the multimodal hub. This wide and opened area along the long West façade has cafes and ticket offices related to the Railway Station and the Rail Baltica trains. The glass façace is set back in a diagonal letting an outdoor irregular shaped balcony to go outside and enjoy the great views and fresh air.

From this potencially commercial area with such a great position in the multimodal hub there are many possibilities for the cafes and small retail serving the passengers during the last minutes before taking the train.

Also this area can gather some interesting activities that allows non-passengers to go up and enjoy the views consuming other things, such as exhibitions (on the south part, next to the access), cultural events or a dinner in the luxury restaurants at the cantilevered area.

Vertical communications and Control

The access down to the platforms is possible from this common and public area by the different scalators, one for each platform, as explained. The vertical connection boxes are lined-up in the middle longitudinal band, so that they create a filter through the passengers can go across the control area, and the turnstiles. The restricted access separates from the Regional and International trains from the high speed Rail Baltica

Waiting areas

The waiting areas for the Regional and Regular International trains are connected and share some commercial uses and toilets. On the South side there is the Rail Baltica waiting area, with a diffrenet control system and separated from the other waiting area.

Cantilevered area

The cantilevered area houses a line of restaurants that have the best position in terms of interesting space. The big steel structure crosses the space with the diagonals of the truss, leaving a continuous space between the different restaurants and flying over the atrium, visible from below.

There is also a longitudinal and covered balcony to the outside, so people can be part of the life in the new plaza, and have great views towards the City.

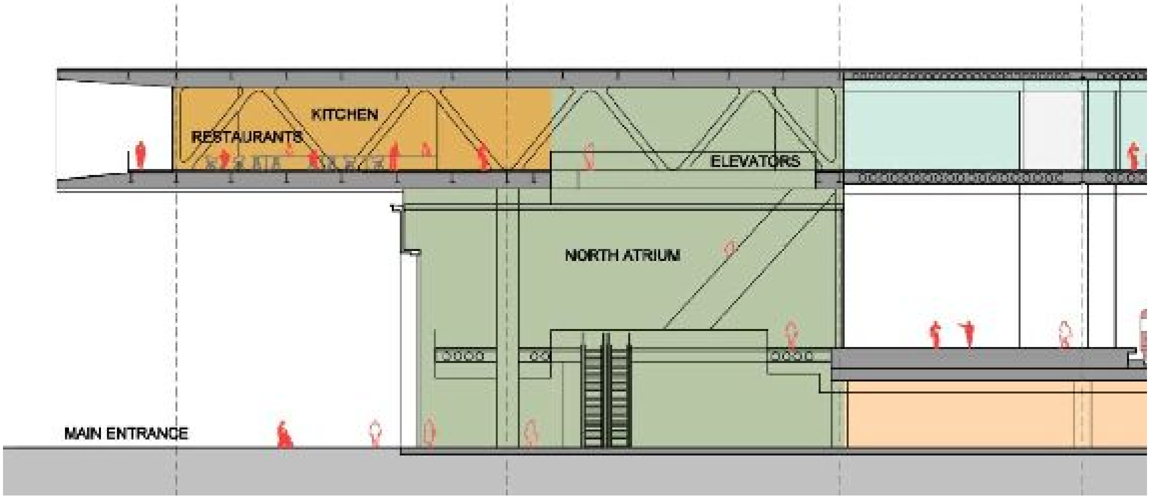

Figure 14.45 – Cantilevered area for restaurants(Source: AECOM)

14.5 Multimodal Hub Building: Structure

APPENDIX - WP 2.7.7 Multimodal Hub Structural Drawings

Multimodal Hub Building is divided in two areas: Railway station and car parking and bus interchange.

Car Parking & Bus Interchange

The car parking and bus interchange areas take up around 21.000 m^2 which implies 70% from total surface of the Multimodal Hub. The proposed solution for top and bottom level match in both areas but also, the car parking has an intermediate slab to increase the parking surface. The bottom level is placed to the street level and corresponds to the foundation level meanwhile the top level is up to +5.00 m.

These areas are made up of a concrete slab which has to support the train loads and it transfers the loads to the soil through concrete square columns. In longitudinal direction, the typical span length is 12.00 m but, in the transverse direction to the track axis, it is variable with 15.00 m as maximum in the bus interchange area. Due to the complexity of the spans distribution, solutions such as precast I beams or post – tensioned concrete slab are not viable in this case because they stop being competitive solutions from the structural and economical point of view. Therefore, this variability makes that the best solution for this slab is to provide a reinforced concrete slab of 0.75 m depth constant in typical spans but when the span length reaches 15.00 m, the depth is variable from 0.75 m to 1.15 m in the 2.00 m next to the columns as can be seen in the figure 14.46 below.

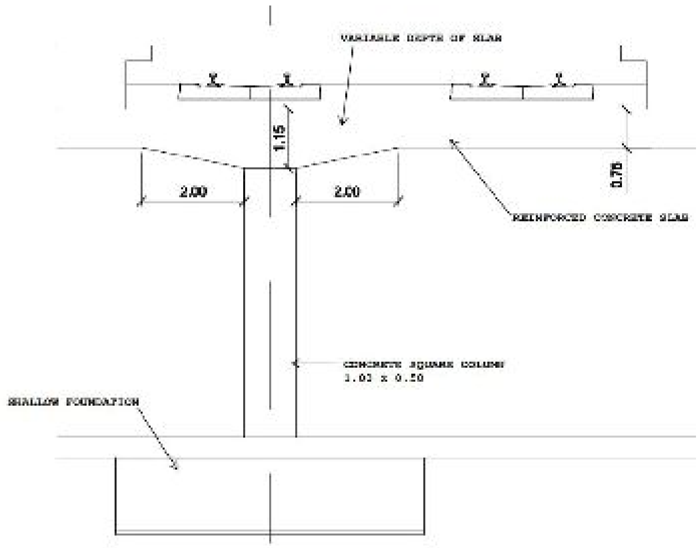

Figure 14.46 – concrete slab 0.75 m (Source: AECOM)

The solution of waffle concrete slab would be possible as well but this involves reduce the clearance in the bus interchange area and might not comply with the minimum requirements. An example of the solution is shown in Figure 14.47.

In order to allow the horizontal movements longitudinal and transverse, several expansion joints are provided: in the walls perimeter, in the alignment north to south that match with the west edge of car parking and in the alignment west to south matching with the south edge of car parking. It is tried to divide the structure in symmetric parts from the rigidity point of view not exceeding 120 m as máximum length. Also, to provide the longitudinal expansion joints reduces the possible transverse movements that might affect the tracks. The transmission of the large shear forces in the joint is possible because goujon cret system or similar is used. The most important advantage of this system is to avoid provide double column in the expansion joint. The system is shown in Figure 14.48.

Figure 14.47 – waffle slab concrete (Source: Internet)

Figure 14.48 – Goujon Cret system for expansion joint (Source: Internet)

As it is said before, the concrete slab is supported by concrete columns whose dimensions are 1.00x0.50 m and 5.65 m height. In the extreme sides of the slab, the support of the slab is materialized with perimeter walls of 0.50 m width. On the west and east sides, retaining walls are provided to support the embankment located in these areas.

In this phase of the project, the bearing resistance considered to design the shallow foundation has been 0.3 MPa. The maximum size of foundation is 6.00x6.00x1.40.

In case of the car parking area, one intermediate floor is provided to increase the parking surface. Due to the span length is up to 12.00 m, the solution is the post – tensioned concrete slab of 0.30 m depth. This system allows minimise the depth and gives a structural, constructive and economical solution very interesting and usually using.

An example of this type of solution is shown in the Figure 14.49.

Figure 14.49: ***Post – tensioned concrete slab construction*** **(Source: Internet)**

Building Station - Cantilever

The building station – cantilever area occupies 30% total surface of the Multimodal Hub. There are three levels on that: street level, railway station level and roof level.

Because of the railway station will be used by passengers traffic, the structural solution for the floor is composite slab with slim – floor supported in cellular beams. The load which has been considered in this case is 5 kN/m ^{2} plus 1 kN/m^2 for other possible loads as partition walls.

This type of floor has been chosen due to the large advantages that shown in face of another solutions. This is the best solution to be used where it is required not only the maximum technical and mechanical guarantees but also the speed in execution and final construction. The used presents large economic benefits because the average depth of the floor decreases which involves a reduction in the rest of the structural elements as supported beams, columns and foundation. There are other advantages during construction phase to be considered as acts like working platform making security and protection functions against the fall of objects and it is used formwork during pouring.

In building station, the length of span for the composite slab is 3.00 m meanwhile 3.50 m length is reached in the cantilever area. In this way, temporary intermediate shorings are not necessary during concrete pouring. This is one of the most important composite slab advantages in this project due to the need of not interrupt the train circulation.

The Figure 14.50 shown this chosen solution.

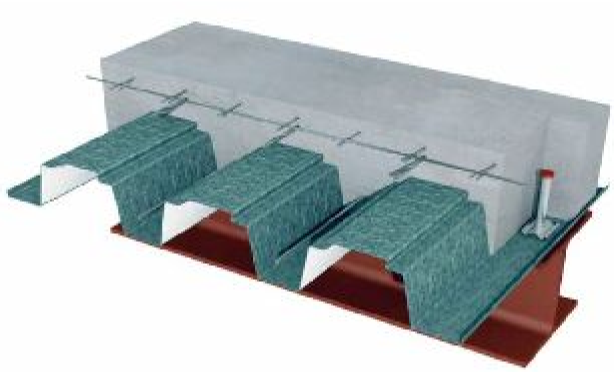

Figure 14.50: *composite slab with slim – floor* (Source: Internet)

As it is said at the beginning of this section, the composite slab is supported by cellular beams (refer to Figure 14.51) in longer direction and they are supported in hot – rolled profile beams in perpendicular direction to transfer the loads to columns. The cellular beams have variable lengths from 8.60 m minimum to 22.65 m maximum. When the length is 22.65 m the distance between beams is 2.25 m in order to keep the same type.

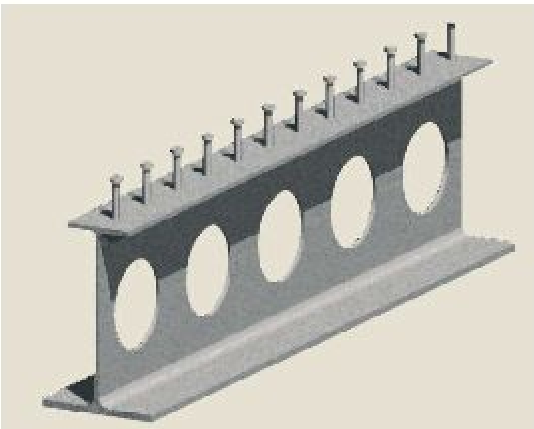

Figure 14.51: *cellular beam* (Source: Internet)

The cellular beams are lightened and this allows increase the span length, pulling spaces together. This flexibility goes together with the functionality of allowing technical installations (pipes and ducts) to pass through the openings. The lightweight appearance of cellular beams, combined with their high strength makes this solution more attractive to the new structural forms. Also, another advantage is that the optimisation of manufacturing methods (flame cutting, bending, etc...) now makes it possible to adapt to the requirements of project owners and guarantee rapid delivery of cellular beams.

The beam system is supported by filled composite columns as the Figure 14.52 shows that goes from platform level to the roof level being the height 17.70 m. The diameter of the columns is 700 mm with 15 mm steel thickness except in the limit of façade that it is 400 mm dia. The use of this type of columns provides the following advantages:

- High resistance due to both the steel and concrete will resist the external loading by interacting together by bond and friction.
- Increased stiffness, leading to reduced slenderness and increased buckling resistance.
- Edge protection is not needed.
- Formwork is not necessary because the profile steel makes of it. Also, these types of columns can be precasted what improves the times during construction.

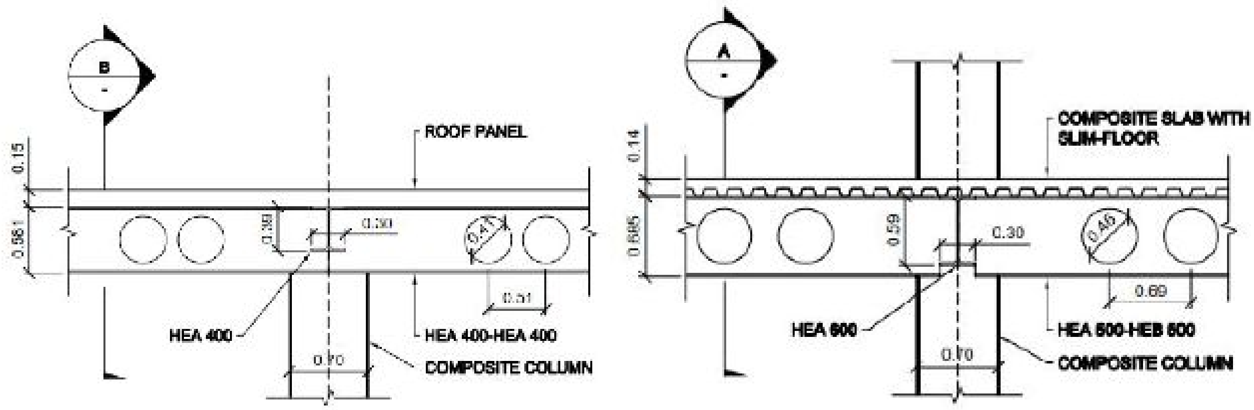

Figure 14.52: ***Roof and intermediate level details*** **(Source: AECOM)**

The cantilever area has been solved with a structural steel solution formed by the same composite slab with slim – floor as the building station supported in five steel structure truss type Warren. This solution allows have unobstructed spaces. This is the typical solution for similar cases where the cantilever length is very important as the maximum length is 28.00 m. This is shown in the Figure 14.53.

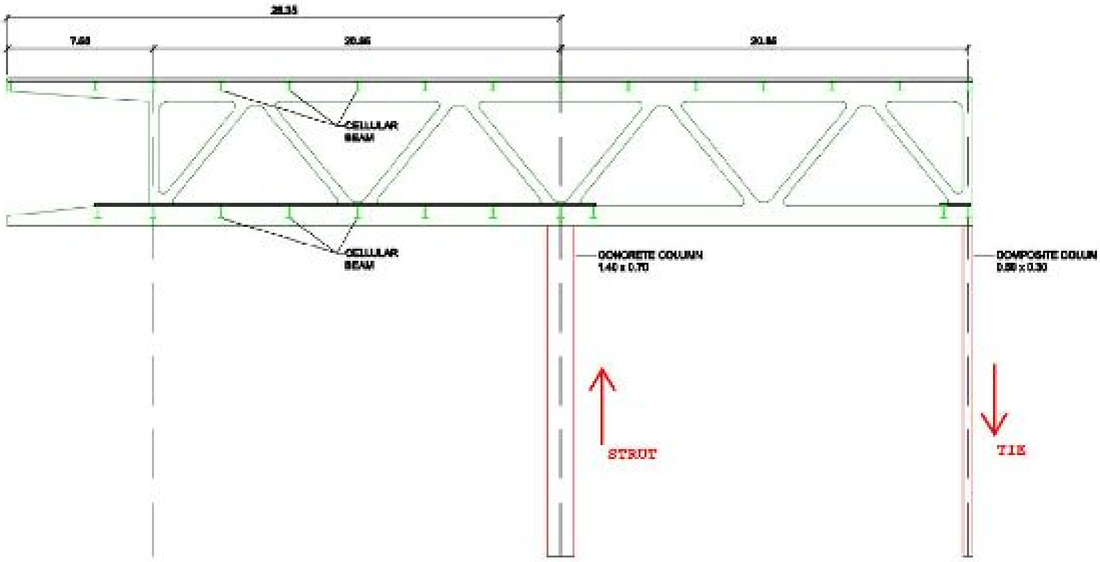

Figure 14.53: ***structure frame cantilever*** **(Source: AECOM)**

The total length of the structure frame is 48.65 m but only cantilever is 28.35 m. It is supported by two columns: **the front is** reinforced concrete with dimensions 1.40x0.70 m and the back is structural steel with dimensions 0.50x**0.30 m. From st**ructural point of view, the first column works as a strut meanwhile the second one works as a tie.

The building station is covered with roof panels (refer to Figure 14.54) with 150 mm depth. This allows to go to 4**.50 m length s**pan what involves reduce the number of supporting beams. They are cellular beams as the railway statio**n level.**

Figure 14.54: ***Roof panel*** **(Source: AECOM)**

Construction Process

The construction of this area is carried out in two stages. For that, a temporary diaphragm wall parallel to the axis tracks is built dividing the platform area in two parts. The red colour line shows the temporary in Figure 14.55.

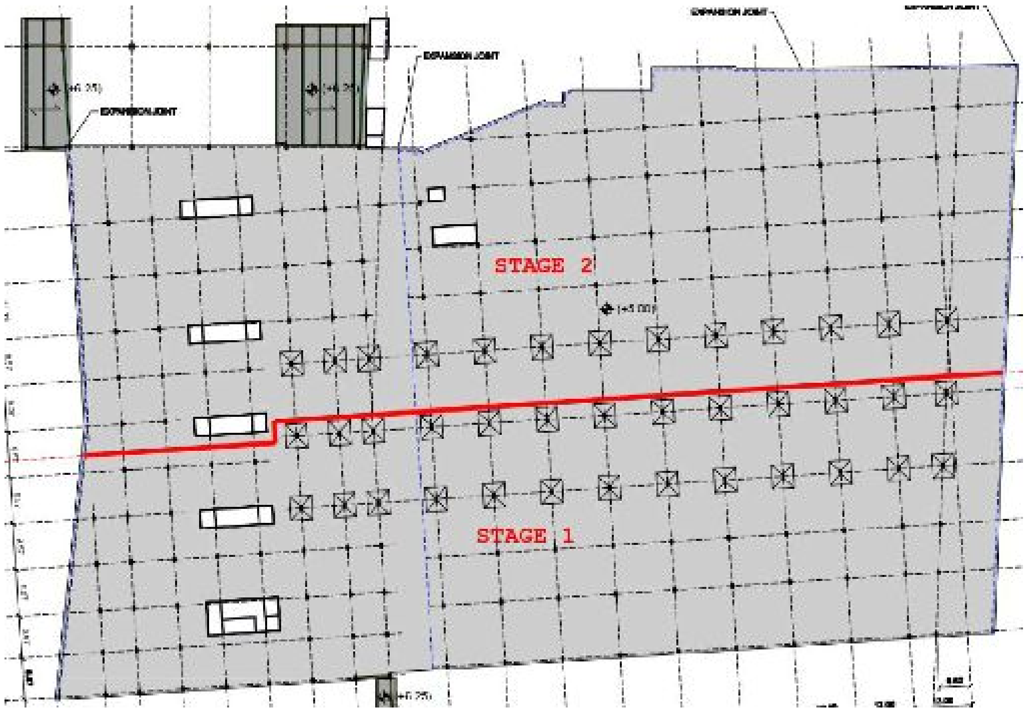

Figure 14.55: ***Diaphragm wall*** **(Source: AECOM)**

The construction stages are summarized as follows:

1. **Step – S1: The diaphragm wall is built along the alignment shown in Figure 14.55. After, the traffic train is diverted. It is proceed to excavate up to level -3.50 m and if it is required dewatering will be done.**

2. **Step – S2: foundation, columns and concrete slab from level +5.00 are built.**

3. **Step – S3: The traffic train is diverted to new tracks to proceed with the excavation on the other area. The excavation and dewatering, if it is required, are carried out. Before that, diaphragm wall is demolished.**

4. **Step – S4: foundation and columns up to level +1.55 m from the car parking are built. Also, the intermediate post - tensioned concrete slab is executed.**

5. Step – S5: The rest of columns, perimeter walls and concrete slab up to +5.00 are constructed. It is proceed with the finishing such as platforms and furniture and the full traffic trains is opened.

14.6 Multimodal Hub Building: MEP

Considering the particularities and size of the development, the MEP design must follow a way to be fully adaptable to potential phasing of the construction works, fast track, partial commissioning process and the future segregation of services and billing of multiple tenants of the common areas lettable spaces and retails

In addition, the MEP concept & strategies must consider the special requirements typical of bus stations in regards to CO & Smoke ventilation, and the RAMS (reliability, availability, maintainability and serviceability) requirements to be considered in rail projects, that could imply redundancy and resilience of services provided to critical rooms, with the consequent provision of additional space or infrastructure.

Energy Centre

The construction of an energy Centre building holding the main production equipment kits is recommendable. This independent building from the station could be visually integrated and acoustically protected easily than isolated and spread smaller production equipment kits along the station.

The energy Centre could also provide less OPEX to the landlord and more efficiently selected pieces of equipment considering the centralization of those. Synergies among different areas of the station would positively affect the efficiency of the

In general, the equipment to be housed at the building should be:

- **Cooling towers and water-cooled chillers for the production of chilled water for the cooling of the station together with the associated distribution pump sets. : More effective and reduced area required than the air-cooled chillers. Make up air water tanks need to be considered for the cooling waters provided with legionella treatment.**

- **Gas fired boilers for the production of low temperature hot water (LTHW) for the heating of the station. This is the most typical strategy for heating however considering that in that part of the world the district heating provided by the city (or any private provider) is common practice, this should be investigated. The benefits of connecting to a district heating provider are the reduction of space and CAPEX due to the fact that no boilers would be required, but just a heat exchanger at the energy Centre connected to the district heating connection point.**

- **Electrical utility company transformation Centre for the station, from where medium voltage rings would be distributed to other transformation centers located close to the main consumers. This strategy should be agreed with the electrical utility provided in due course. Direct access from the street would be required by the electrical utility company.**

- **Landlord transformers and SMDB for the main equipment electrical power housed at the energy Centre.**

- **Ideally the energy Centre should be provided with basement where to locate water tanks supplying potable water and firefighting water for the station, together with the associated distribution booster pumps.**

An accessible gallery connecting the Energy Centre with the different areas of the station would be recommendable in order not to affect the head room of parking of buses platforms areas.

Ventilation (Co & smoke)

Ventilation strategy, necessary equipment and risers for CO/smoke exhaust and make up air need to be carefully addressed in such a kind of building considering the huge population of vehicles not only for the buses but for the cars at the parking spaces and the trains entering into their platforms.

Three different modes of ventilation should be considered for the car parking levels and for the bus platforms.

- **Normal ventilation**

- **CO ventilation : to be activated when the CO levels are detected as dangerous**

- **Smoke ventilation : to be activated in the event of fire**

For allowing those modes, both make up air fans and exhaust fans need to be provided with VFD (variable frequency drivers) plus necessary sensors and commands from the building management system and fire alarm panel, and the relevant risers and/or opening need to be allocated and integrated at the structure and architectural, providing safe exhaust of CO and smoke far from public areas.

At the trains' platform, additional ventilation issues would need to be carefully considered as could affect the design of the canopies. The fire curve load of the train need to be provided to the designers in order to size fans and openings, and also the agreed strategy for evacuation in the event of a train carriage in fire close to the station. In some occasions, the strategy is the train in flames if close to the station should enter into it for the safe evacuation of the passengers. This issue should be considered since the very beginning into the design as would affect dramatically the relevant MEP services associated.

RAMS- critical rooms

RAMS (reliability, availability, maintainability and serviceability) targets need to be defined together with the rooms critical for the trains & rail infrastructure performance.

These targets have a direct impact into the resilience and redundancy of services, and need to be considered since the very beginning of the project, as they have also an impact into space, such as for example duplicate cooling equipment for critical rooms or duplicate electrical supply and water supply to avoid single point of failures that affect routes and risers and increase the space necessity for those equipment.

Special anti-freezing provision

In such a cold environment, special consideration should be taken for avoiding freezing of elements and/or areas.

Pre- action sprinklers system (dry pipes) should be considered for open areas such as parking levels and bus and train platforms.

Electrical tracing should also be considered for wet services and access external ramps, however if the abovementioned district heating provision is available, the return of it could b used for avoiding freezing. This strategy actually promoted by the district heating provider as increase the efficiency of the main head plant.

Strategy for AHUs/FCUs

Due to the limitation of the adequate length for ducts, the Air handling units (AHUs) treating different areas of the station are recommended to be located at the roof tops or basements areas as close as possible to the areas being treated by them, connecting to those through risers

It is recommended replicating the typical strategies applied to a shopping center for the common areas and retail areas of the station. Dedicated AHUs should be provided for the common areas while fresh air AHUs should be provided for the retails. CHW and HW provision will be provided at the retails where the tenants would connect their fan coils (FCUs) units once they do the fit-out.

For the offices areas, fresh air AHUs and FCUs should also be provided.

Sustainable strategies that could be implemented

- **Grey water recovery**
- **PV panels**
- **Thermal solar panels**
- **Building shadows analysis**
- **Envelope energy analysis**
- **Basement exposed concrete thermal energy exchange with the fresh air to be pumped up to the AHUs – "Canadian well"**

- **LEED official certification- as a minimum following LEED parameters into the design**
- **Efficient lighting and lighting control**
- **Storm water tank holding irrigation water**
- **Efficient irrigation systems (if applicable)**
- **Green roof covers**

Energy Center estimation

- **Cooling : all the areas excluding the car parking (6,510 m2) and the bus platforms (7,719 m2) .**
  - **Total cooled area : 20,780 m2**
- **Heating : Provided for all the areas, considering that the car parking and the bus platforms are going to be pre-heated**
  - **Total heated area : 20,780 m2**
  - **Total pre-heated area: 14,229 m2**
- **Electricity : provided to the whole station**
  - **Area considered for the electrical load estimation : 35,009 m2**

There is a need of a level above ground laterally ventilated of 1,800 sqm approximately with 500 sqm opened directly to the exterior at the top of the cooling towers. On this floor would be:

- **Cooling towers**
- **TX**
- **Generators sets**
- **Boilers**
- **On the roof floor and non-opened to the exterior (1,800 -500 = 1,300 sqm) the solar and/or photovoltaic panels could be placed.**

And a basement of the same areas 1,800 sqm, where there would be:

- **water cooled chillers**
- **Pumps sets for CHW and HW**

Water tanks (fire fighting, potable water and make up water for the cooling towers) and pump associated.

The depth of this basement should be minimum 4 m of interior height.

14.7 Multimodal Hub Building: Fire Protection

APPENDIX - WP 2.7.8 Multimodal Hub Fire Protection Diagrams

Principles

This is an outline fire and life safety strategy for Riga Multimodal Hub project in Latvia. This note along with the appended drawings is intended to present the design principles.

As yet no code hierarchy or basis of design has been agreed. The design principles of the fire and life safety strategy provided herein are based on the following assumed code hierarchy:

- **LBN 201-15 – for all non-train station public areas covering: structural design, compartmentation, fire protection, fire department access & facilities.**
- **NFPA 130:2014 – for all public areas of the train station with LBN 201-15 to supplement.**

This code hierarchy will need to be confirmed with the Authority Having Jurisdiction (AHJ). The design principles will then have to be reviewed in accordance with the agreed code hierarchy should it differ.

Building classification

Mixed use with separated occupancies, i.e. each occupancy is a fire compartment:

Area	Type of Structure
Car Park	VII
Bus Interchange	IV
Train Station	IV
Restaurant	IV
Offices	V

The main type of use for the structure as per LBN 201-15 is Type IV.

Description

The proposed demises within the development, for the purposes of the fire safety design, have been nominated as;

- **Sterile Circulation – grade level circulation space connecting the final exits, Bus Interchange, Car Park, and stair & escalators serving the Ticket Hall**
- **Car Park**
- **Bus Interchange**
- **Offices**
- **Train Platform**
- **Ticket Hall – upper level circulation space connected to the Sterile Circulation via the open escalator & enclosed escalators (forming a three storey atrium)**

See the following figure which illustrates the location of each demise.

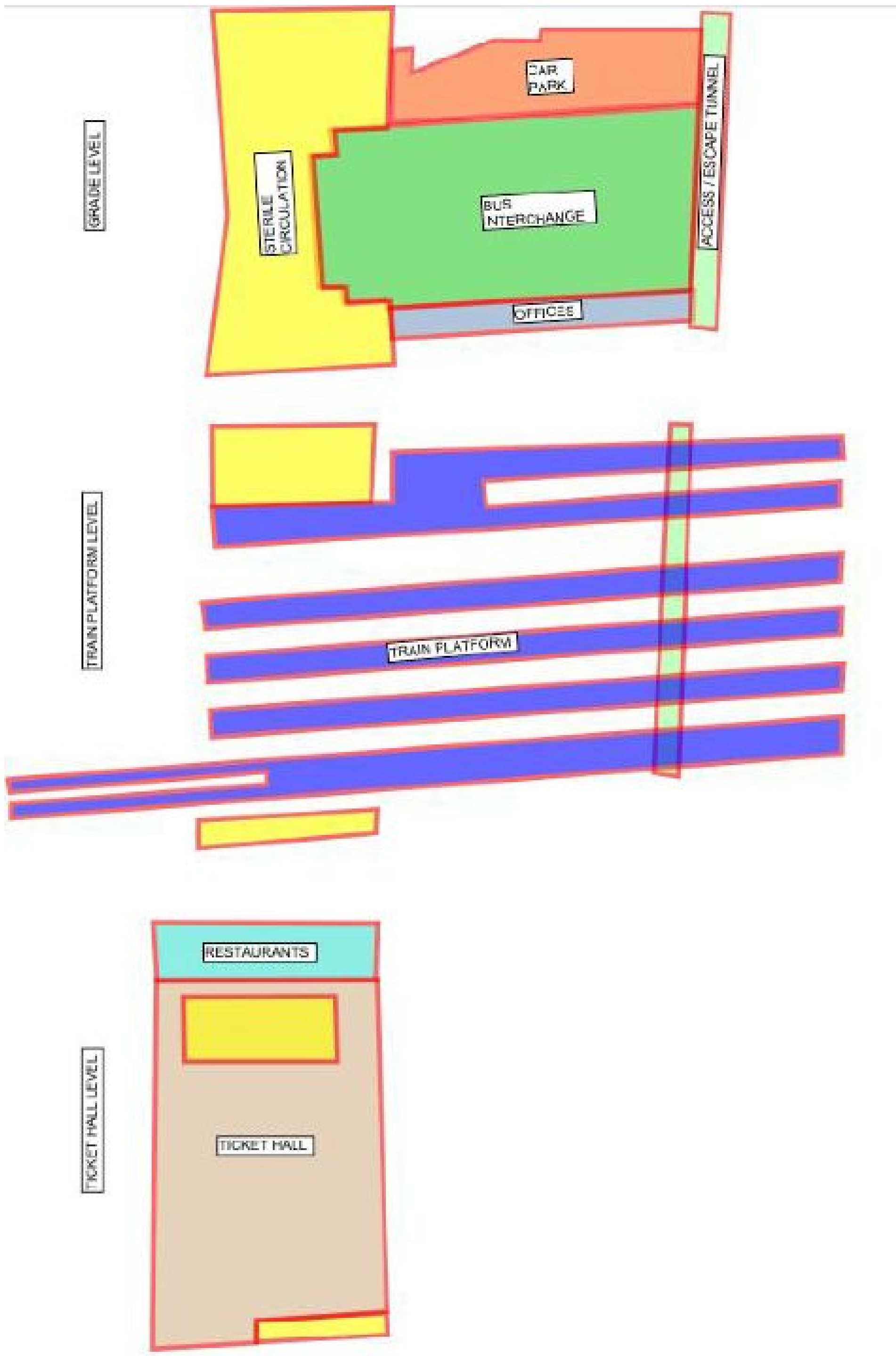

Figure 14.56 - Arrangement of Demises (Source: AECOM)

Means of Egress – Evacuation Strategy

A progressive evacuation strategy is proposed to be adopted, implying occupants from one demise can evacuate into another demise.

To assist progressive evacuation strategy, the fire alarm system will need to be unified for all demises. In event of a fire in one of the demises, a warning signal will be sent to adjoining demises that a fire has occurred elsewhere to alert people. In the demise of fire origin a full evacuation will occur when fire alarm activates.

The Sterile Circulation space will adopt a fire sterile strategy. Fire protection systems, such as sprinklers, smoke management and fire compartmentation, will provide tenable conditions in this area for the time needed to evacuate the whole building. Isolating fire risk areas – such as kiosks & concessions – from the main circulation area will enable this space to be considered a ´point of safety´ such that adjacent spaces can evacuate via the Sterile Circulation space. In doing so, a fire at grade level will not impede escape from, e.g., the Ticket Hall, Bus Interchange, Train Platform, or, the Car Park. From the Sterile Circulation space there are many final exits onto the two external public ways.

The Car Park, Bus Interchange & Train Platform will have an alternative escape route into the Access / Escape Tunnel proposed – see Appendix - WP 2.7.8 Multimodal Hub Fire Protection Diagrams. Day to day the Access / Escape Tunnel will be used by cars & buses to access the building. In the event of a fire, the vehicle security controls will restrict traffic movement and the tunnel will be used for evacuation. The progressive evacuation strategy will mean that only one demise will need to use this route at any one time, so the capacity will be sized based on the largest possible occupancy and not all demises added together – bringing efficiencies to the design.

Offices will have individual final exits onto the public way.

The Train Platform populations will be afforded numerous evacuation routes – positioned to meet the travel distance recommendations. These routes will be sized based on the proposed line ridership figures & train populations – both of which will need to be confirmed & agreed with the rail operator. Based on the information provided, the following three evacuation routes are proposed;

- **Into the Sterile Circulation space at grade level**
- **Into Access / Escape Tunnel serving the Car Park & Bus Interchange**
- **Into the existing pedestrian tunnel located to the east of the platforms**

An additional set of escape stairs will lead from the western most point of the southern two platforms direct to the outside and away from the building.

The Ticket Hall means of egress will be defined once the code hierarchy and basis of design has been agreed. Until then, there are three options to evacuate people from this space;

- **Option 1 – Escape in the Sterile Circulation space, via the circulation stairs. Sterile Circulation space considered a point of safety. Fire protection measures ensure tenable conditions maintained at all times.**
- **Option 2 – Escape on to the Train Platform, via the escalators. From here they will join the platform population and reach the outside via either the Sterile Circulation or the alternative route via the Access / Escape Tunnel.**
- **Option 3 – Should Options 1 & 2 not be feasible, then dedicated escape stairs at either end of the Ticket Hall will be provided, enabling people to escape direct to the outside and away from the building.**

Note: It is not common to utilise escalators for evacuation – certainly no reference is made to this in the Latvian fire code (LBN 201-15). However, NFPA 130 – the specialised transit system fire standard – does utilise escalators. This

approach has been considered herein, but will need to be agreed with the AHJ. A number of fire safety features will need to be adopted for these elements to be considered as means of egress.

Horizontal Means of Egress

- **Doors / Corridors**
  - **A minimum clear opening width of not less than 1000 mm when less than 50 people served;**
  - **A minimum clear opening width of not less than 1200 mm when 50 - 250 people served;**
  - **A minimum clear opening width of 1200mm will be increased by 500mm for each extra 100 people above 250 people.**
- **Fare Gates**
  - **A minimum clear opening width above 1000mm of not less than 530mm.**
  - **Where wheelchair users are expected, the clear opening width shall be not less than 915mm.**

Vertical Means of Egress

- **A minimum clear width of not less than 700 mm when less than 5 people served;**
- **A minimum clear width of not less than 1200 mm when 5 - 250 people served;**
- **A minimum clear width of not less than 1400 mm when more than 250 people served.**

Travel distances

Type of Use	Dead-end, m	Travel in Single Direction, m	Travel in Alternative Direction, m
Platform (NFPA 130)	-	25	100
Type IV – Bus interchange	22.5	45	90
Type V – Offices	22.5	45	90
Type VII – Car park	45	90	180

Areas of Refuge

Every escape stair will need to include areas of refuge (AoR) for mobility impaired people (MIP). Evacuation elevators will be considered as an alternative or an additional means of egress for MIP.

Structural Fire Resistance

As the building construction type is Type IV, the maximum allowed compartment size is 10,000m^2, given the fire stability level of the structure is U2a and automatic sprinklers system is provided throughout the building.

Primary structural elements will have structural fire resistance in accordance with LBN 201-15:

Building Element	Fire Resistance, minutes
Primary Structural Frame	60
Bearing Walls – Interior	60
Bearing Walls – Exterior	60
Floor-Ceiling Assemblies	60
Roof-Ceiling Assemblies	60
Nonbearing walls – Interior	0
Nonbearing walls – Exterior	0*

*** Where exterior wall is a party wall with adjacent building, it should achieve 60 minutes fire resistance.**

Façade adjacent to the external staircase (and escalator if its use in event of a fire is agreed and approved by AHJ) should achieve 60 minutes fire resistance.

The Ticket Hall slab being above the Train Platform level can be exposed to a potential train fire. The structural protection of the slab will be confirmed by structural engineers. The protection method will reflect the use and hazard from a train fire beneath. The structure will need to be studied further to determine the most suitable method of resisting fire.

The Access / Escape Tunnel being an escape route for Car Park, Bus Interchange and Train Platform occupants will require fire separation from these spaces. Hence 60 minutes fire resistance enclosure will need to be considered.

The atrium connecting the Sterile Circulation on the ground level with the Ticket Hall floor will be open in a non-emergency scenario. In event of a fire anywhere in the building, smoke curtains will enclose the atrium at the Ticket Hall level. It will be considered to provide smoke management system in the atrium. The replacing air will be supplied on the ground level.

Fire Protection Systems

- **Automatic smoke detection and alarm system throughout the building.**
- **Public announcing and voice alarm system to improve direction of the evacuation of the occupants.**
- **Automatic sprinkler system throughout the building – car park coverage to be reviewed as the design progresses.**
- **Smoke management system**:
  - **Bus Interchange – combination of environmental and smoke extract systems – to be used to maintain tenable conditions in the Bus Interchange and prevent smoke compromising Access / Escape Tunnel. This will be coordinated with MEP.**
  - **Car Park – jet fans will be considered (floor to ceiling heights will need to be confirmed). This will be coordinated with MEP.**
  - **Escape stairs – pressurization will be considered in escape stairs connecting Sterile Circulation and upper levels. Stair discharging into Access / Escape Tunnel are proposed to be non-pressurised on the basis that the tunnel will be provided with smoke management system, hence acting as smoke-free lobby.**
  - **Atrium – smoke management system at the top of the atrium.**

- o **Access / Escape Tunnel – Day to day ventilation in combination with smoke management – to be used to keep the tunnel as free of smoke shared means of egress.**

- **Emergency Lighting and evacuation signage.**

Outstanding Information

The following information is outstanding and will need to be incorporated in the fire and life safety strategy at the early stages of the design development:

- **Use of NFPA 130 for public areas of the train station (platform, ticket hall, sterile concourse) to be confirmed**
- **Use of escalators during an evacuation from the train station**
- **Consultation with Municipality required at conceptual stage to agree principles**
- **Train design fire to be confirmed**
- **Train populations to be confirmed**
- **Line ridership populations to be confirmed**
- **Staff numbers, training, fire safety management to be confirmed**
- **Carry down procedures of mobility impaired people to be confirmed**
- **Bus Interchange ´repair´ use to be confirmed**
- **Ticket Hall populations, F&B ratio, Back of House strategy to be confirmed**
- **Local requirements for fire department access & facilities to be confirmed**

14.8 Track layout consideration from a urban point of view

APPENDIX WP 2.7.9.Track layout

14.8.1 Rail BalticaTracks added to Existing Layout

The Rail Baltica tracks would increase the width of the Railway area considerably. The distance to the Ministry of Transport would be lower than minimum. The free distance until the water feature would be highly reduced.

This is the minimum intervention according to train operations and cost, but the maximum impact on the urban surroundings.

It is not recommended as it affects the area considerably, and one of the main aims of the project which should be the reduction of the urban barriers would be not reached but on the contrary it would increase the width of the railway barrier. Moreover, specially the Ministry of Transport would be highly affected by the proximity of the Rail Baltica tracks.

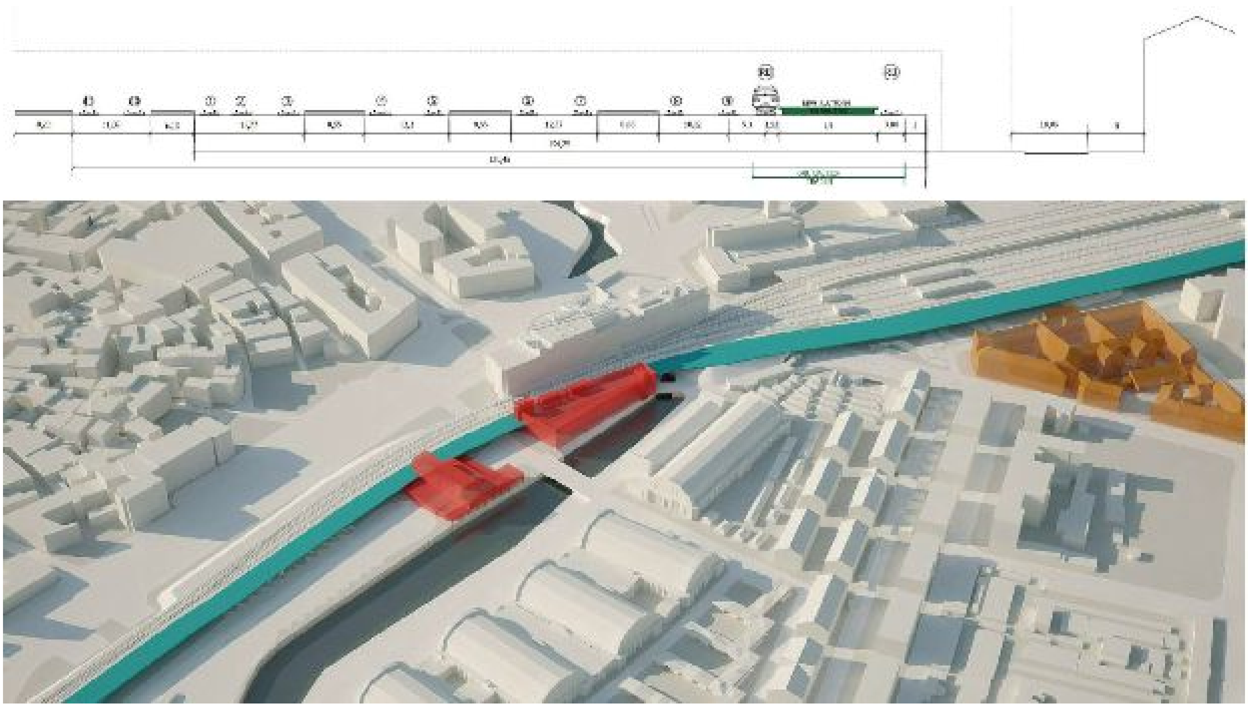

Figure 14.57. Rail BalticaTracks added to Existing Layout (Source: AECOM)

14.8.2 Track layout Preferred Options

APPENDIX - WP 2.7.9 Track Layout

There are two options for the track layout according to the best Railway Operations. One leaves the track 9 for Freight, as the cross section 1 is showing. And the option 2 leaves the track 2 for Freight as shown in cross section 2.

This last option is the one developed in the multimodal hub building. The architectural and structural drawings of the multimodal hub are based on option 2.

Both solutions have the same overall width, which is 114m. As shown in the drawings.

There is a minimum impact in the possible solution of the station. The station would function the same way and the use distribution and structure would be easily adapted to the other track layout.

OPTION 1: (Cross section 1) Track 8 for Freight – preferred option for Train Operations and developed in the Track Layout Drawings.

OPTION 2: (Cross section 2) Track 2 for Freight - developed in the multimodal drawings

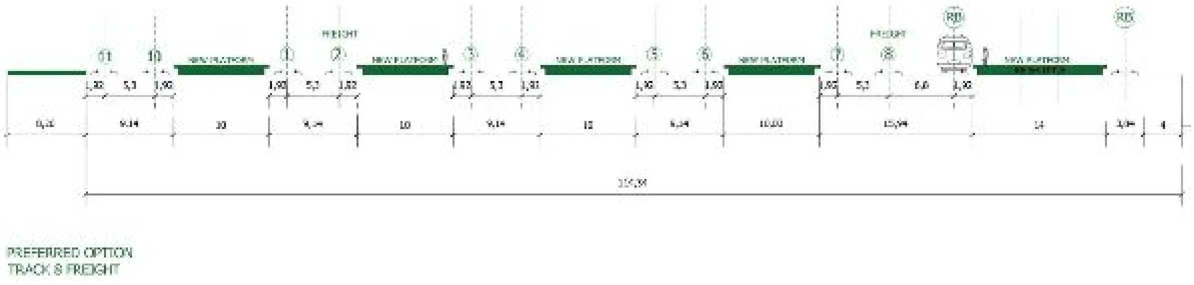

Figure 14.58. Cross section 1 of the Preferred Option: Track 9 for freight (Source AECOM)

Note: On this options the track 2 is mixed for fright and passengers.

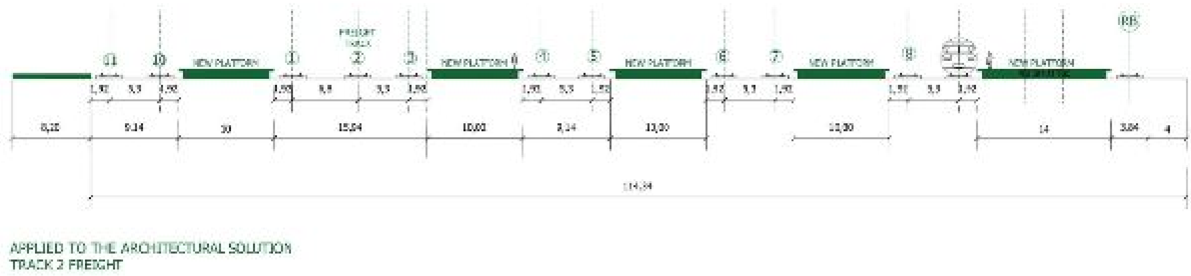

Figure 14.59 Cross section 2 of the Developed Option in the Architectural Drawings: Track 2 for freight. (Source AECOM)

Geometrical parameteres for the alignment of the new track configuration:

The existing track parameters are:

- **Turning Radius at the Entrance to Station: 400 m**
- **Turning Radius at the Exit to Station: 600 m**
- **Minimum Radius of the existing tracks at the Entrance to the Platforms: 220 m**

The new track parameters are:

- **Radius of 220 m at the tracks: 1, 2/3 (passenger and freight) speed: 20 km/h. Arrival to Platforms.**
- **Radius of 250 m at the tracks 8/9 (passenger and freight) speed: 20 km/h. Arrival to Platforms.**
- **Minimum Radius for Rail Baltica tracks: 400m. Speed: 80 km/h.**

Track Layout Drawings can be found in Appendix – WP 2.7.9 Track Layout.

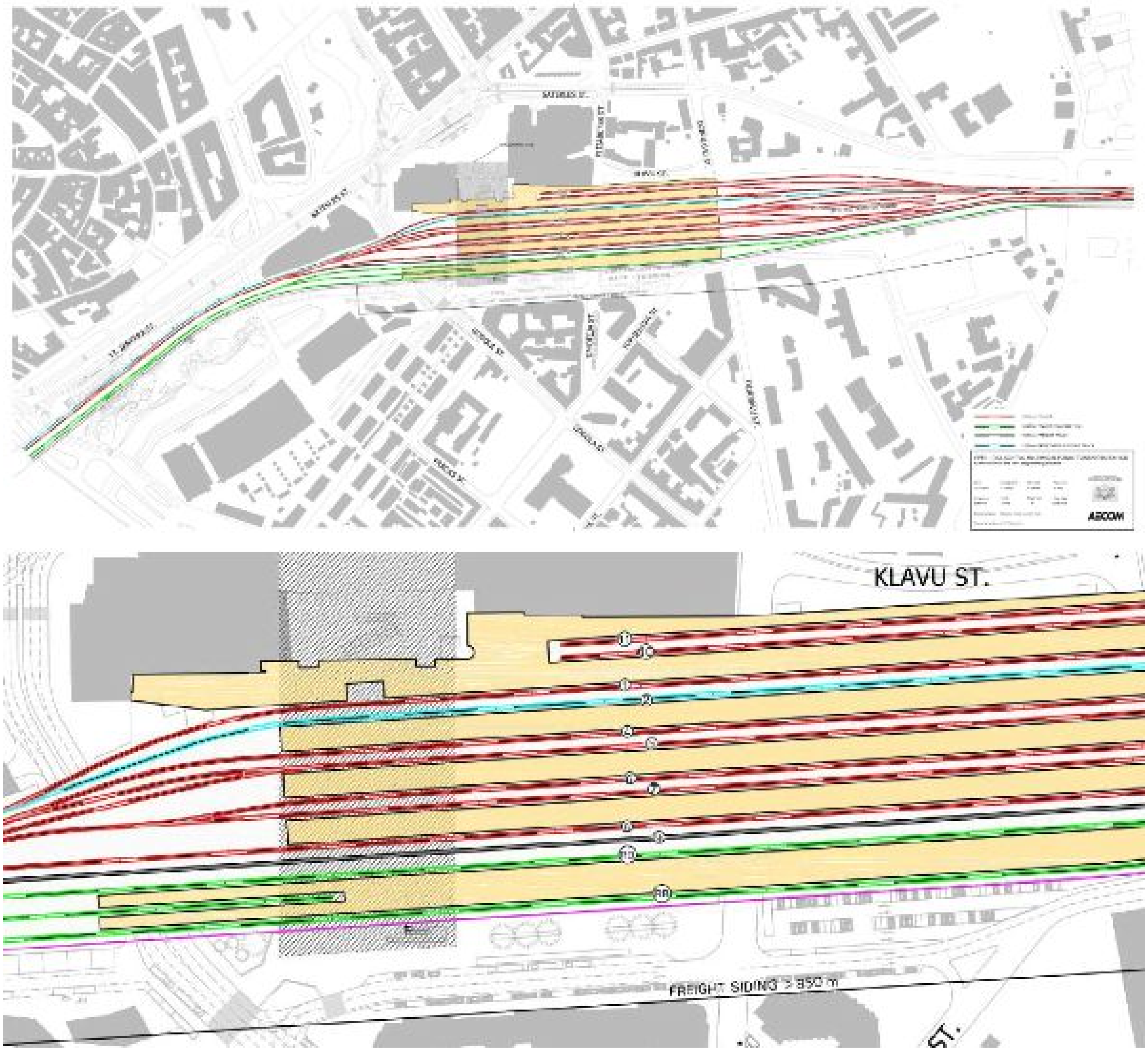

Figure 14.60 Track Layout Plan (Source AECOM)

Figure 14.61 Track Layout Structure Plan (Source AECOM)

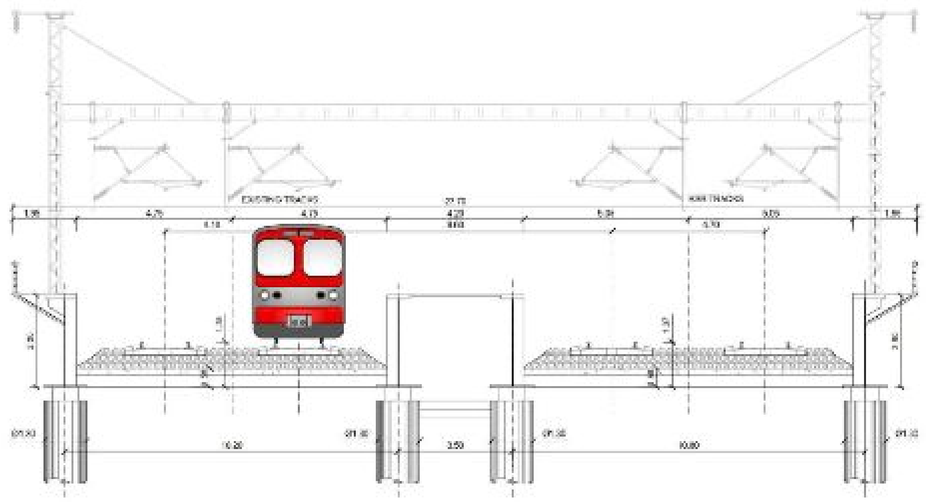

Figure 14.62 Tracks Typical section (Source AECOM)

TRAIN PARKING AREA PLANNED ON THE NEW TRACKS:

- **On tracks 4 and 5 (1520 mm) an area free for parking of 170 m is planned.**

- **On the track 9 (1520 mm freight track) a longer area for freight siding of 850 m is planned.**

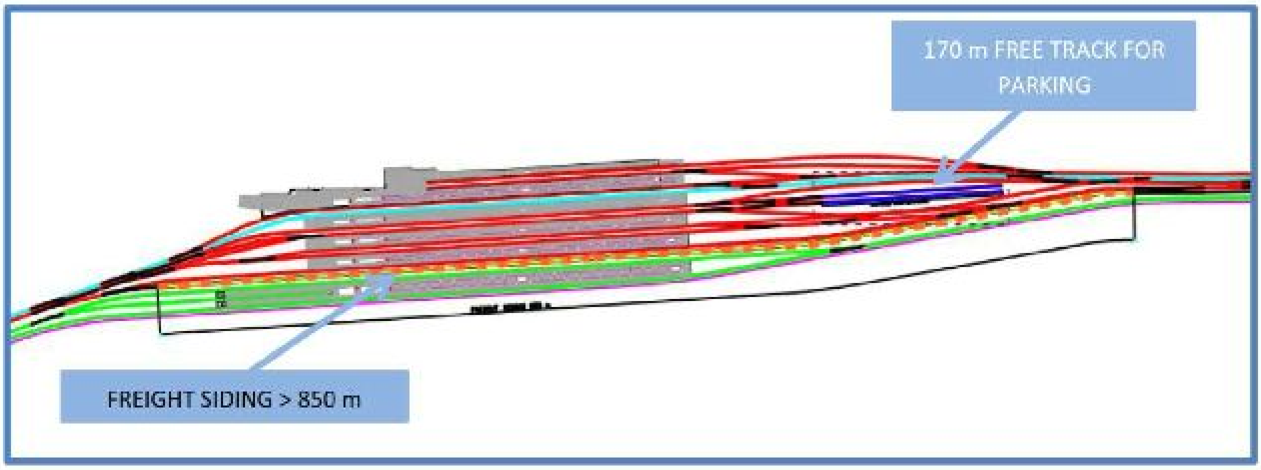

Figure 14.63 Parking track and freight siding (Source AECOM)

14.8.3 Phasing drawings with Track layout Option 1

Note that the Phasing drawings of the Multimodal Hub Building have been studied with the track layout that assigns track 8 for freight.

OPTION 1: (Cross section 1) Track 8 for Freight – preferred option for Train Operations and developed in the Track Layout Drawings; located in Appendix - WP 2.7.9 Track Layout, together with the Phasing Costs and Viaduct Phasing drawings.

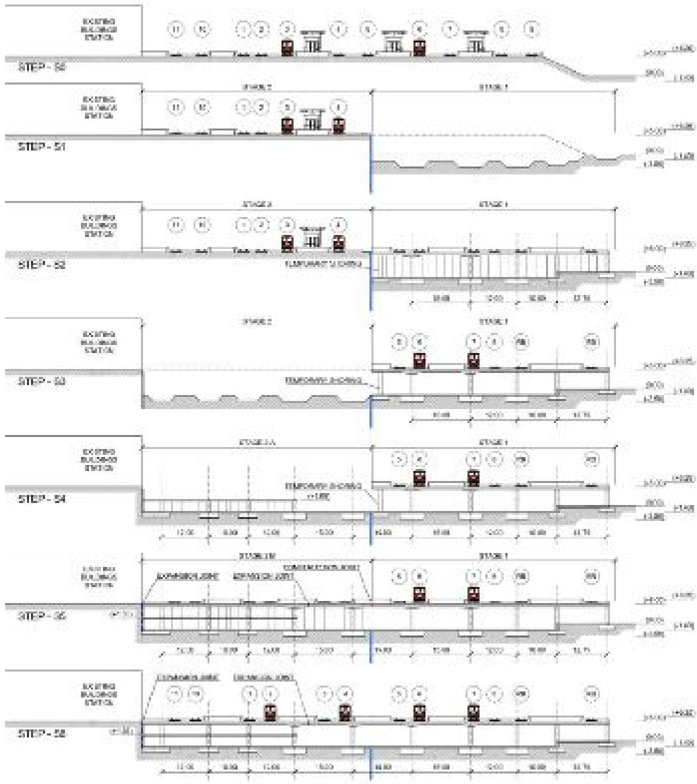

Figure 14.64 Cross sections of the Multimodal hub Phasing (Source AECOM)

14.8.4 Affected buildings by Rail Baltica tracks on the preferred options

Due to the proposed Rail Baltica tracks it has been determined that the Titanik Car Parking will have to be significantly altered or removed. This intervention could free the land next to the water and could provide a wider path for pedestrians, solving the current problem of connectivity at that point. The Coach platforms and current Coach Station would also be affected by the Rail Baltica tracks and would have to be reconfigured.

There are established two levels of alteration, the orange colour represents an impact that could be undertaken by partially reconfigurations or upgrading, although the recommendation is a complete demolition of the affected element. And the significantly affected elements in a red colour hatch by the Rail Baltica tracks, that would need to be demolished by all means.

Figure 14.65 Existing Coach Station affection by Rail Baltica tracks (Source: AECOM)

The Titanik Car Parking, on the other side, is significantly affected and would need to be demolished **completely.**

Figure 14.66 Existing Titaniks Car Parking significant affection by Rail Baltica tracks (Source: AECOM)

There are other buildings compromised, not by Rail Baltica tracks but by the Multimodal Hub development and the urban improvements. The affected ones are the Casino in the North plaza, affected with the new design that frees the new connections and brings a new atmosphere to the access plaza. And the existing Station hall, which right now is full of small kiosk and there is not a feel of being at a Station Hall. The proposal empties the space giving a high void with scalators to get to the above level of the platforms tracks.

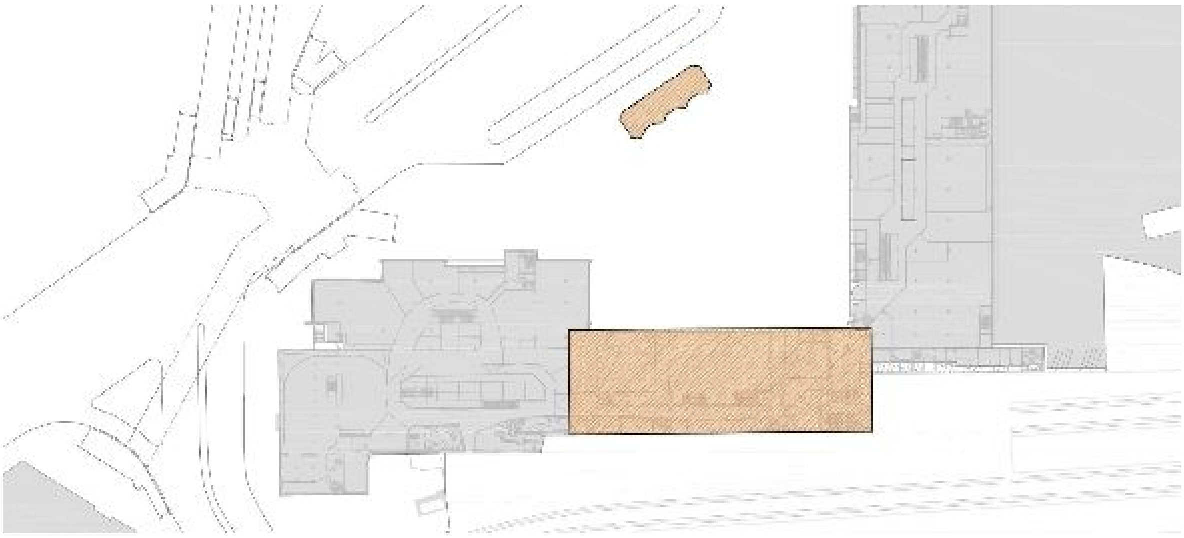

Figure 14.67 Existing Station Hall and Casino (Source: AECOM)

15 WP 3.1 - Elaboration of an Action Plan

15 WP 3.1 - Elaboration of an Action Plan

15.1 Implementation Plan

A project implementation strategy and phasing plan has been developed for the project which has been graphically presented in Appendix-WP-3.1.1 of this report. The main highlights of the implementation plan are:

- The total construction duration is envisaged to be 6 years
- It has been recommended to divide the embankment excavation and the surface level construction in two halves — northern and southern
- The southern part of the surface level is proposed to be commenced at the beginning which has four distinct parts of implementation
- The northern part of the surface level is proposed to be commenced subsequently which has two distinct parts of implementation
- The elevated parts of the station will have to constructed in the third phase
- The riverside urban development will be the last phase of the development

In this implementation plan, the RPTH has been considered as a whole for safety and comfort of the station users and the public using the surrounding facilities. That said, some of the parts of this whole, such as the the riverside development, could be constructed in a separate phase beyond 2022, although it is not advised to postpone its completion.

In addition, a specific implementation plan has been developed for the project taking into account 3 options of development in the study area, including a graphical plan definition and the phasing of cost estimates for each alternative; it is also included in Appendix WP - 3.1.1. Phasing & Programme of works.

15.2 Procurement Plan

The procurement plan for the Riga Public Transport Hub (RPTH) has to be based on the implementation plan, the Client´s structure (given the variety of stakeholders), and on the funding structure.

The RPTH involves the following stakeholders that are likely to require contractual relationships, either independently or in partnership, with services providers: Rail Baltica

- Latvian Railways
- The City of Riga
- International Bus Terminal
- Other private stakeholders such as Origo Retail Centre (TBC in further stages of the project).

All the above stakeholders are responsible for a part in the project, and will therefore need to be assisted in the procurement and contract implementation stages.

There is a variety of potential funding sources – EU related funding opportunities are identified below and discussed further in WP3.2.

- Connecting Europe Facility (CEF);

- **Cohesion Fund (CF) which is especially relevant due to the fact that the station is part of the Trans-european Transport Network; and**

- **European Regional Development Fund (ERDF), for which the RPTH could potentially qualify under the low-carbon economy priority;**

Finally, and referring to the above section "implementation plan", the physical and temporary separation of the different stages of construction can be confirmed as follows:

- **PHASE A: Construction of the Station at Street Level, Viaduct and the new tracks;**

- **PHASE B: Construction of the Elevated Station and Riverside Urban Development; and**

- **Stakeholder investments.**

The different stages of construction could be subject to different contracts, therefore to different tendering processes, or they could be divided into packages based on the nature of works or supplies required (i.e. Civils vs M&E contracts).

All the above funding opportunities involve one or several stakeholders, and the procurement plan will therefore need to be in line with the funding structure, the implementation plan, and the final Client.

15.3 Procurement Strategies

The procurement strategy of the RPTH will depend on the funding. As we have seen in 15.1. Implementation Plan , most parts of the RPTH qualify for European funds, with up to 85% (the maximum co-finaning rate) of costs being eligible.

The European funds are managed (fully or partially) the European Bank for Reconstruction and Development (hereinafter "The Bank"), which means that the Bank's procurement policies and rules will apply. The following paragraphs capture the main strategies (best practice) available with regard to tendering:

15.3.1 Open tendering/Design Competition

Open tendering, with or without pre-qualification, is the most common procurement strategy. In an open tender, all interested suppliers or contractors (for services, works, supplies) are given adequate notification of contract requirements and all such tenderers are given an equal opportunity to submit a tender.

The RPTH is a large and complex project, not only for its size but also because of the various stakeholders involved in it, and the need to provide service to the city at all times. In addition, the project has been defined as a project of national significance and is also considered a project of significance by the City of Riga and therefore requires a specialized design competition phase and heightened public involvement in the project review and approval process. The resources and resilience of the contractors, suppliers and/or service providers are key for the project - this is why, as part of the open tendering process, a pre-qualification would be beneficial for the Client(s).

15.3.2 Given the nature and complexity of the project, the desire of having a leading multimodal hub service provider and the numerous stakeholders involved in RPTH, there is a possibility that the technical specifications for certain areas are not completed in advance. In such a case, a two-stage procedure should be used. This means that, in the first place, design competition submissions are invited (subject to technical or commercial adjustments) and a design author is awarded the project. The second step is to engage in competitive dialog with the design author to provide technical documentation and author supervision for the implementation of the project.

15.3.3 Competitive dialogue

Competitive dialogue is a procedure which may be used for particularly complex contracts, for which the client is not objectively able to prepare formal tender documents like in the open or restricted procedures. This competitive dialog

process should be used with the design competition winner to further define a specific scope of services and commensurate fee.

Would the Client decide to procure the whole or a part of the RPTH through PPP, this would be the procedure to be used. Indeed, PPP projects will often fit in the category of "particularly complex contracts" for which the competitive dialogue procedure (CDP) has been designed, but the European Council Directive 2004/18/EC (the *Procurement Directive*), designed as a framework for PPP procurement, does not provide for exclusive use of CDP method for PPP procurements, and a simpler procurement could be used.

Note that, according to a recent publication of the European PPP Expertise Centre (EPEC), the Procurement Directive has been translated into national laws of Latvia, although there is no practical application yet of PPP in such projects.

15.3.4 Selective Tendering (Restricted procedures)

This kind of procedures is similar to those for open tenders except that the client pre-selects qualified firms, who will be invited to submit tenders. This happens when the products are highly specialized and/or complex, or when there are a limited number of firms able to meet the contract requirements.

In the case of the RPTH project, this scenario is likely to happen, although for the time being we will assume that it is not the case.

15.3.5 Negotiated procedures

Negotiated procedures allow clients to consult candidates of their choice and negotiate the terms of the contract with one or more of them. The selection of candidates either follows an international notification (including publication in the OJEU), or is directly established by the client. In the latter case, the client, to the extent possible, should invite at least three qualified candidates from at least two different countries to negotiate.

15.3.6 Direct Contracting

This procurement strategy is not recommended, but could arise if the first round of tenders generates an unsatisfactory response.

15.3.7 Shopping procedures

Shopping procedures may be agreed to by the Bank for contracts of a small value for (a) readily available off-the-shelf items; (b) standard specification goods; and (c) routine and other minor works. Shopping is a simplified form of competitive purchasing that only requires written price quotations from at least three suppliers or contractors, including foreign suppliers or contractors wherever possible.

The project is at an early definition stage which does not require such a procurement strategy, but in later phases this strategy could become relevant and adequate.

15.3.8 Local Competitive Tendering

The RPTH will be developed over 4 to 5 years. This could have positive consequences for the procurement of some services as works are scattered over time and the cost of such services are lower if sourced locally. It is therefore possible to consider Local Competitive Tendering, a practice recognized by The Bank.

Similarly to the Shopping Procedures, this strategy is not relevant at this definition stage but could become relevant as the definition grows.

15.3.9 Independent Tendering for Utility Companies

It is potentially the case that some utilities, privately owned and operated autonomously, follow competitive tendering procedures in accordance with their own procedures, subject to such procedures being acceptable to The Bank. In the case of the RPTH, this doesn´t seem to be the case.

15.4 Recommended Procurement Plan

15.4.1 Separation of professional responsibilities

Given the complexity of the project, the basic proposition is a separation of operational and construction responsibilities. This is recommended as two rail systems will co-exist, and that some services, such as the Riga Airport Connection, are key for the city and require therefore full control of financial and resource risk of the contractors.

This project, in addition to being complex, also has a high added value in terms of impact on the city and the urban realm. The architectural design should therefore be trusted to a separate provider. A “design competition” should be set separately and prior to the rest of contracts. Notwithstanding this, the complexity of interfaces needs to be managed by sound and strong project management consultancy services, that could be procured in a separate contract.

15.4.2 Separation into physical packages

As outlined above, it is recommended that the operational and construction responsibilities should be separated. Given the complexity and scope of each responsibility, a separation of each responsibility into packages is also advised. Indeed, this will ensure a significant reduction of the timing, resource and financial risk –and secure proper citizen services during completion of the works.

15.4.3 Preliminary Procurement Plan proposal

Considering Best Practice and the Implementation Plan and the above procurement strategy options, the following procurement strategies are suggested:

Package	Promoter / Client	Proposed Strategy
Design Management/Program Management (Civils, M&E, technical assistance during construction)	Rail Baltica / City of Riga	Consultancy services Open / Restricted tender
Design Competition (architecture)	Rail Baltica RPTH	Consultancy services open tender / pre-qualification/ design competition and competitive dialog
Utilities Diversion contracts (D&B)	Utility Companies	Open / Independent
Construction Civils (Phase A&B.1)	Rail Baltica / City of Riga / Riga Bus Station	Open tender / restricted tender
Construction M&E (Phases A&B.1)	Rail Baltica	Open tender / restricted tender
Construction Phase B.2	Rail Baltica / City of Riga / Riga Bus Station	Open tender / restricted tender
Stakeholders Investments	Several / PPP	Negotiated, Direct or Shopping procedures

Table 15.1: Procurement Strategies (Source: AECOM)

Note that the above proposal is preliminary. The different contracts and procurement strategies should be discussed and agreed with the Client at the beginning of the Procurement Stage.

Similarly, the promoters/clients are indicative at this stage. Potential partnerships not envisaged here could happen due to funding and organisational reasons.

15.4.4 Description of Procurement Plan

Tender phases

This section provides a high level description of a typical open tendering process for construction works totally or partially funded by the EU. Consultancy Services would require a slightly different process, not described here.

It is recognized that this process may not be applicable to all packages that could be defined and agreed, but it is common enough to be applicable to most contracts awarded in the RPTH framework.

Pre-tendering Phase	Needs Assessment Planning and Budgeting Definition of requirements (in case of Open Tendering) Definition of procedure Assisting in relationship with Authorities Production of Deliverables for Tender Process
Pre-qualification Phase	Invitation to Pre-qualification Evaluation Invitation to Tender
Tendering Phase	Invitation to Tender Evaluation Award De-briefing to unsuccessful candidates
Post-Tendering Phase	Contract Management Order and Payment
All Phases	Risk Assessment

Table 15.2: Tender Phases (Source: AECOM)

Procurement Programme

ID	Task Name	Duration	Start	Finish
1	**Pre-tendering Phase**	**88 days**	**Wed 01/06/16**	**Fri 30/09/16**
2	Definition of Process	44 days	Wed 01/06/16	Sun 31/07/16
3	Definition of Criteria	44 days	Wed 01/06/16	Sun 31/07/16
4	Tender Dossier Deliverables	45 days	Mon 01/08/16	Fri 30/09/16
5	**Pre-qualification Phase**	**45 days**	**Mon 03/10/16**	**Fri 02/12/16**
6	Invitation to pre-qualification	0 days	Mon 03/10/16	Mon 03/10/16
7	Candidates tendering period	16 days	Mon 03/10/16	Mon 24/10/16
8	Proposals evaluation	26 days	Mon 24/10/16	Mon 28/11/16
9	Short-listing	0 days	Fri 02/12/16	Fri 02/12/16
10	**Tendering Phase**	**106 days**	**Mon 05/12/16**	**Mon 01/05/17**
11	Invitation to tender	0 days	Mon 05/12/16	Mon 05/12/16
12	Tender process	40 days	Mon 05/12/16	Fri 27/01/17
13	Evaluation of tenders	65 days	Mon 30/01/17	Fri 28/04/17
14	Award	0 days	Mon 01/05/17	Mon 01/05/17
15	**Post-tendering Phase**	**43 days**	**Tue 02/05/17**	**Thu 29/06/17**
16	Contract management setting up	43 days	Tue 02/05/17	Thu 29/06/17
17	Order and Payment	34 days	Mon 15/05/17	Thu 29/06/17

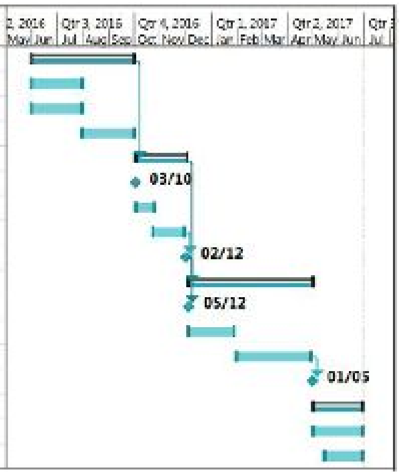

Figure 15.1: Procurement Programme (Source: AECOM)

15.4.5 Description of tasks

The tasks herein described are those captured in section “Tender phases” above, with more detail for a better understanding.

As identiifed above, this is proposal based on EU guidance and best practice, and gives the minimum standard to follow.

Pre-tendering Phase (4 months approximately)

In this phase, that happens at the end of the Design of the Project, the appointed consultant needs to prepare the necessary steps of the procurement:

- **Needs assessment:**
  - **Define and agree the scope of works for each client**
  - **Considering the above, develop the design of the Project and prepare sufficient calculations, drawings, schedules and specifications to enable the preparation of Tender Documentation in respect of the Works.**
- **Definition of the process:**
  - **Define and agree the packages, seeking the best interests for the promoter(s) and the tax-payer money**
  - **Define and agree the procurement process (restricted / open / local) for each package**
- **Definition of requirements:**
  - **Define and agree the Invitation to tender process**
  - **Define and agree the selection criteria (both technical and financial)**
  - **Define and agree the criteria weightings**

- **Planning and Budgeting:**
    - **Prepare the planning of the procurement process, ensuring the appropriate time for candidates to prepare and for the Clients to evaluate the tenders**
    - **Provide information to enable bills of quantities to be prepared for the Works.**
    - **Provide information to enable the schedule to be prepared for the Works**
- **Assisting in relationship with Authorities/stakeholders:**
    - **Assist in the preparation of interface with any appropriate statutory authority for planning consents and approvals.**
    - **Assist in interfacing with stakeholders, especially in case of co-funding from the Private Sector**
    - **Define, agree and prepare contract documents**
- **Production of Deliverables for Tender Process:**
    - **Assemble the Tender Documentation**
    - **Assist in relationship with funding**

The pre-tendering phase is very active in terms of approvals. The time allocated for this phase needs to take the approval processes into account.

Pre-qualification Phase (2 months approximately)

- **Invitation to Pre-qualification: issue of the pre-qualification documents (either standard or specific for the Client)**
- **Evaluation of candidates:**
    - **advise the Client as to the suitability for carrying out the Works of persons and firms to be invited to tender for any contract involving the Construction, supply and/or installation of all or part of the Works**
    - **advise the Client as to the relative merits of tenders, prices and estimates received for execution of all or part of the Works.**
- **Invitation to Tender:**
    - **seek the Client´s consent to proceed to invite the potential services providers to tender (shortlisting);**
    - **de-brief unsuccessful candidates**
- **Production of Deliverables for Tender Process: Assemble and issue the Tender Documentation to shortlisted candidates**

Note that the publication of the public procurement notice marks the start of the formal procurement process. The Authority must comply with all requirements related to the publication of notices in the Official Journal of the European Union (OJEU).

Tendering Phase (5 months approximately)

- **Invitation to Tender:**
    - **issue of the tender documents**
    - **in case of a restricted or negotiated procedure, assist the Client in selection or negotiations (technical, financial, legal, etc)**
- **Evaluation**
    - **Assist the Client in analysing the offers**
    - **Assist in response to queries**
    - **Produce, if needed, analysis reports about the different candidates containing evaluation grids, scoring, etc**
- **Award: seek the Client's consent to proceed to the Mobilisation, Construction and Completion Stage for the awarded candidate.**
- **De-briefing of unsuccessful candidates.**

The invitation to tender documentation should contain all the information that bidders will need to bid. It is important that advisers devote sufficient time and effort to develop the documentation in enough detail to ensure comparability of the bids and reduce the need for debate and clarification before the PPP contract is signed.

The tender documentation, which is usually extensive in detail and volume, will normally include (but not be limited to):

- **detailed information memorandum about the project;**
- **a summary of the key commercial principles, including the obligations of each party and risk allocation;**
- **detailed output specifications and the minimum required technical design and technical features;**
- **the level of commitment required from the candidate's lenders and investors;**
- **a full draft PPP contract (which, in some countries, would be based on mandatory standard contract terms or on required guidelines of some kind);**
- **instructions to bidders concerning all the information they must submit and the detailed procedures for submission;**
- **the evaluation criteria; and**
- **requirements for bid bonds or equivalent security.**

All the above services will last until successful candidates are awarded and unsuccessful candidates are de-briefed.

Post-Tendering Phase (2 months approximately)

- **Contract Management:**
    - **Preparation of all the necessary amendments (if any) to adapt the best offer to the contract chosen by the client, especially in terms of scope and responsibilities**

  - **Finalisation of final contract documents relating to accepted Tenders**
  - **Manage any changes to initial responsibilities**
- **Order and Payment**
  - **Setting up the contractual relationship of order and payment**

This final step of the procurement sets the ground for the next phase, which is the Works Phase, and who has a specific contract management related activity.

15.5 Risk and Integrity Principles

The risk management and the integrity principles of the whole tendering process(es) are based on the OECD guidelines. Such principles are summarized below.

15.5.1 Pre-tendering Phase

In this phase, the key risks are the cost and the time. This means that, while defining the needs, it is important to determine de adequacy of all works of the tender, evaluate their approximate cost objectively according to the state-of-the-art, and define their programme accurately. The risks of over and under-estimating the projects are very high and need to be mitigated properly in collaboration with the client and funding entities.

Another key risk is the clarity of documentation. All deliverables must be appropriately documented in terms of reports, schedules and calculations. Instructions need to be very clear to tenderers, especially in terms of Technical Requirements and scope of works.

15.5.2 Pre-qualification and Tendering Phases

These two phases have similar risks, mainly related to the selection methods; therefore they are considered together in this section.

Given the variety of stakeholders involved, especially as some could have private interests, it is important to keep the process as open and transparent as possible. The type of procedure suggested, the open tendering, mitigates this risk to a certain extent. This measure can be enhanced by the "Design Competition" which means wide publicity of the tender.

Timing must be appropriate for all candidates to prepare themselves consciously for the tender and the chosen criteria must be as objective as possible in order to reduce the risk of skew assessment by the evaluators, and the.

Finally, given the procurement strategy suggested for most contracts of the RPtH, the transparency in treating all candidates evenly and providing the necessary information in time will also mitigate the risks in this phase and ensure transparency in the process.

15.5.3 Post-Tendering Phase

The open tendering procedure, even in its "two-stage tendering" procedure form, reduces the risks related to supply of material and the risks of uncontrolled scope amendments.

Once the Contract is in place, the management of such contract can lead to a series of risks, for both the client(s) and the contractor(s), and to lack of transparency.

In other to mitigate the risk at a contract management level, it is advised to use standard and fully internationally recognized construction contracts during this stage such as the FIDIC "Red Book" for construction services or the FIDIC "Yellow Book" for Systems services.

15.6 Work Package Summary

This work package discusses a range of options for procurement of this complex and multi-disciplinary project. The pros and cons of each approach is outlined in this chapter and a recommended way forward has been suggested for tendering and procurement in a phased and transparent manner. There have been some principles discussed on risks and integrity aspects, at various stages of the procurement, which, if adhered to, will keep the procurement process straightforward and simple.

16 WP 3.2 – Elaboration of RPTH investment and financing plan

16 WP3.2 – Elaboration of RPTH investment and financing plan

16.1 Overview

This section sets out the costs of the project and the current position regarding EU funding in Latvia and with respect to the project. Further potential EU funding opportunities are identified and an initial allocation of the project costs is presented with respect to funding bodies/stakeholders.

16.2 Project Costs – Preferred Option

The project costs have been estimated with respect to the categories shown in Table 16.1.

Category	Summary of Components
Rail Infrastructure	Works to tracks and platforms for Rail Baltica and the local rail network. Includes structures costs e.g. bridges and viaduct.
Multi Modal Hub	All costs relating to the new building, including the Bus Interchange, parking and relevant structures.
City Planning	Utilities, land acquisition, and landscaping.
Transportation	Amendments to the road network, tram network, trolleybus network and bike network around the station.
Other Buildings	Leisure, retail and office buildings, upgrades to the Market and construction of the International Coach Station.

Table 16.1 Summary of Scheme Components by Category

Table 16.2 shows the breakdown of the total estimated cost by stage and category. The total estimated cost for all of the scheme components is €184.8m. This includes an allowance for management costs and a 10% contingency has been included. Unit costs used to derive the cost estimate have been derived based on experience from similar projects delivered. The price base is 2015 (costs exclude VAT and design costs).

Phase		RAIL INFRASTRUCTURE Cost, €	MULTIMODAL HUB Cost, €	OTHER BUILDINGS Cost, €	CITY PLANNING Cost, €	TRANSPORTATION Cost, €	MANAGEMENT/ CONTINGENCY Cost, €	TOTAL COST PER CONSTRUCTION STAGE Cost, €
PHASE A	STAGE A.1: SOUTH HALF UNDER CONSTRUCTION	21,424,552	-	11,546,416	13,515,250	1,733,947	6,752,898	54,973,063
	STAGE A.2: NORTH HALF UNDER CONSTRUCTION	21,424,552	-	11,546,416	10,812,200	13,871,580	6,752,898	64,407,646
PHASE B	STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION	-	30,086,298	3,298,976	-	866,974	6,752,898	41,005,145
	STAGE B.2: RIVERSIDE URBAN DEVELOPMENT	-	7,521,574	6,597,952	2,703,050	866,974	6,752,898	24,442,448
	TOTAL COST BY DISCIPLINE Cost, €	42,849,104	37,607,872	32,989,760	27,030,500	17,339,475	27,011,590	184,828,301

Table 16.2: Project Capital Costs by Stage and Category (Source: AECOM)

The capital construction costs have been profiled by year in Table 16.3 based on the implementation plan – the majority of the expenditure is therefore expected to be incurred between 2018 and 2022. It should be noted that the costs below have a base year of 2015 and an appropriate level of inflation will need to be applied to the costs to clarify the funding requirement.

The only part of the project without which the RPTH could function is the riverside development, which comprises €24,442,448 of the project costs. There is therefore potential for this element to be implemented post 2022, but it is recommended that this should be implemented in conjunction with the other scheme components, subject to funding availability.

Year	Capital Cost	%
2016	1,612,982	0.9
2017	3,452,747	1.9
2018	35,175,536	19.0
2019	40,395,557	21.9
2020	53,273,496	28.8
2021	44,385,746	24.0
2022	6,532,238	3.5
Total	184,828,301	100.0

Table 16.3: Project Capital Costs by Year (Source: AECOM)

16.3 2015 Price Base, costs exclude VAT and design cost total

The costs for design and studies have been estimated at the overall project level at €5,360,021 bringing the total estimated cost for the project to €190,188,321 (exc VAT).

16.4 Project Costs – Alternative Options

AECOM was asked to consider the implications of variations to the phasing and construction programme in relation to the project costs. The alternatives are as follows:

- **Alternative 1: Construction in Embankment 3.1 area + Gogoļa Bridge demolition. This includes the demolition of the existing Gogoļa iela bridge, and the re-construction in the Embankment 3.1 and new bridge area**
- **Alternative 2: Construction of Embankments 3.1 & Embankment 2 + Gogoļa bridge demolition. This includes the construction of Embankment 2, the re-construction in the Embankment 3.1 and new bridge area.**
- **Alternative 3: Embankment 4 (including Dzirnavu brige). This includes the demolition of the existing Dzirnavu iela bridge, and the re-construction in the Embankment 4 area and new bridge.**

In summary, all of the variants identified above increase the project costs, with Alternative 3 resulting in the largest increase relative to the preferred options. The total costs of the alternatives (exc VAT and design costs) is a follows:

- **Alternative 1: €191,028,191;**
- **Alternative 2: €196,579,849; and.**
- **Alternative 3: €198,051,296**

The split by stage and component is shown in Tables 16.4 to 16.6.

Phase	RAIL INFRASTRUCTURE Cost, €	RAIL INFRASTRUCTURE Cost, €	MULTIMODAL HUB Cost, €	OTHER BUILDINGS Cost, €	CITY PLANNING Cost, €	TRANSPORTATION Cost, €	MANAGEMENT/ CONTINGENCY Cost, €	TOTAL COST PER CONSTRUCTION STAGE Cost, €
PHASE A	STAGE A.1: SOUTH HALF UNDER CONSTRUCTION	24,108,487	-	11,546,416	13,515,250	1,733,947	6,950,903	57,865,003
	STAGE A.2: NORTH HALF UNDER CONSTRUCTION	24,108,487	-	11,546,416	10,812,200	13,871,580	6,950,903	67,299,585
PHASE B	STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION	-	30,086,298	3,298,976	-	866,974	6,950,903	41,213,150
	STAGE B.2: RIVERSIDE URBAN DEVELOPMENT	-	7,521,574	6,597,952	2,703,050	866,974	6,950,903	24,650,453
	TOTAL COST BY DISCIPLINE Cost, €	48,216,974	37,607,872	32,989,760	27,030,500	17,339,475	27,843,610	191,028,191

Table 16.4: Project Capital Costs by Stage and Category (Source: AECOM) – Alternative 1

Phase		RAIL INFRASTRUCTURE Cost, €	MULTIMODAL HUB Cost, €	OTHER BUILDINGS Cost, €	CITY PLANNING Cost, €	TRANSPORTATION Cost, €	MANAGEMENT/ CONTINGENCY Cost, €	TOTAL COST PER CONSTRUCTION STAGE Cost, €
PHASE A	STAGE A.1: SOUTH HALF UNDER CONSTRUCTION	26,511,802	-	11,546,416	13,515,250	1,733,947	7,147,159	**60,454,575**
	STAGE A.2: NORTH HALF UNDER CONSTRUCTION	26,511,802	-	11,546,416	10,812,200	13,871,580	7,147,159	**69,889,157**
PHASE B	STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION	-	30,086,298	3,298,976	-	866,974	7,147,159	**41,399,407**
	STAGE B.2: RIVERSIDE URBAN DEVELOPMENT	-	7,521,574	6,597,952	2,703,050	866,974	7,147,159	**24,836,710**
	TOTAL COST BY DISCIPLINE Cost, €	53,023,604	37,607,872	32,989,760	27,030,500	17,339,475	28,588,638	**196,579,849**

Table 16.5: Project Capital Costs by Stage and Category (Source: AECOM) – Alternative 2

Phase		RAIL INFRASTRUCTURE Cost, €	MULTIMODAL HUB Cost, €	OTHER BUILDINGS Cost, €	CITY PLANNING Cost, €	TRANSPORTATION Cost, €	MANAGEMENT/ CONTINGENCY Cost, €	TOTAL COST PER CONSTRUCTION STAGE Cost, €
PHASE A	STAGE A.1: SOUTH HALF UNDER CONSTRUCTION	27,148,792	-	11,546,416	13,515,250	1,733,947	7,196,526	**61,140,932**
	STAGE A.2: NORTH HALF UNDER CONSTRUCTION	27,148,792	-	11,546,416	10,812,200	13,871,580	7,196,526	**70,575,514**
PHASE B	STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION	-	30,086,298	3,298,976	-	866,974	7,196,526	**41,448,773**
	STAGE B.2: RIVERSIDE URBAN DEVELOPMENT	-	7,521,574	6,597,952	2,703,050	866,974	7,196,526	**24,886,076**
	TOTAL COST BY DISCIPLINE Cost, €	54,297,584	37,607,872	32,989,760	27,030,500	17,339,475	28,786,105	**198,051,296**

Table 16.6: Project Capital Costs by Stage and Category (Source: AECOM) – Alternative 3

16.5 EU Funding – Current Position

Maximising EU funding is clearly key in terms of delivering the project in full. This section sets out the current position in terms EU funding in Latvia and with regard to the Rail Baltica elements of the project.

Funding for European Structural and Investment Funds (ESI), which covers both CF and ERDF is allocated with respect to the 12 Thematic Objectives set out in Europe 2020 Strategy, which is the EU's 10 year jobs and growth strategy, launched in 2010.

Objective 7 'Promoting sustainable transport and removing bottlenecks in key network infrastructures' is key in terms in terms of this project. This is supported by the European Commission – Latvia Partnership Agreement for 2014-2020, which identifies that modernisation of the transportation infrastructure of Riga city and its surrounding areas (as the most important transport node) is especially in focus.

Our understanding is that €1,159.8 million has been earmarked to Latvia (from both the ERDF and CF pots) under Thematic Objective 7: 'Promoting sustainable transport and removing bottlenecks in key network infrastructures' over the period 2014-2020. Of this, €924.3 million is identified from the CF and €235.5million from the ERDF. Funding under Thematic Objective 7 represents 26% of the total for Latvia. A breakdown of the projects allocated by project is presented in Table 16.7.

Scheme	Recipients of financing	Financing (EUR)	Start of selection
1. Major ports	Port authorities of major ports	€ 74.1	Year 2016, 1st quarter
2. Riga Airport	SJSC "Riga International Airport" *(VAS "Starptautiskā lidosta Rīga"")*	€ 11.5	Year 2016, 1st quarter
3. Riga transportation			
3.1. Complex reconstruction of bridge Salu Tilts and street connection of Raņka dambis and Vienibas gatve, Mukusalas iela	Riga city municipality	€ 75.1	Year 2015, December
3.2. Construction of multimodal transportation hub in Tornakalns district	Riga city municipality, municipal enterprises ensuring provision of public transportation services	€ 7.1	Year 2016, 2nd quarter
4. Connection of cities with TEN-T			
4.1. Integration of Riga port and Riga city in TEN-T network	Riga city municipality, municipalities of development centers of national importance	€ 46.4	Year 2016, 2nd quarter
4.2. Integration of development centers of national importance in TEN-T network	Ministry of Transportation, municipalities of development centers of national importance (except Riga) according to results of initial assessment	€ 37.7	Year 2016, 2nd quarter
5. TEN-T roads	Ministry of Transportation	€ 218.4	Year 2015, June
6. TEN-T railway			
6.1. Electrification of Latvian railway network	JSC Latvian Railway *(VAS "Latvijas dzelzcels")*	€ 346.6	Year 2016, 1st quarter
6.2. Modernisation and construction of railway infrastructure	JSC Latvian Railway *(VAS "Latvijas dzelzcels")*	€ 107.3	Year 2015, December
7. Regional roads	Ministry of Transportation	€ 235.5	Year 2016, 2nd quarter
Total		**€ 1,159.8**	

Table 16.7: EU Funding Allocations: Sustainable Transport (2014-2020)

Operational Programmes (OP) breakdown the overarching strategic objectives agreed in the Partnership Agreement into investment priorities. The Latvia Operational Programme Growth and Employment (2014) identifies a series of priority axes – priority axis 6 relates to 'sustainable transport system'. This highlights that CF and ERDF will be planned in such a way to promote provision of high-quality transport infrastructure.

The EU Commission review of the Multiannual Financial Framework scheduled in late 2016 will review spending allocations in the period 2014 to 2020.

Connecting Europe Facility (CEF) funding, which forms part of the Cohesion Fund (CF), has already been earmarked for the provision of the Rail Baltica tracks, associated signalling infrastructure and platforms. Stage 1 of the CEF application submitted for Rail Baltica earlier in 2015 has provisionally identified total costs of €2.4m for the 'Detailed technical design of Riga Central Railway junction and related civil structures' and €82.6m for 'Construction of Riga Central Railway junction and related civil structures'. It was assumed that the proportion of the costs to be funded through the CEF are 85% for the design and 81% for the construction.

Our working assumption is that CEF funding will still be available to fund the Rail Baltica elements of the project. The emerging preferred option is clearly significantly more extensive than incorporating the Rail Baltica related infrastructure, which the CEF funding is limited too. There is therefore a requirement to identify other potential funding sources that will enable the delivery of the preferred option.

16.6 Other EU Funding Opportunities

There may be opportunities to apply for additional EU funding for elements of the project that do not qualify for Rail Baltica funding under the CEF. This section summarises that other EU funding opportunities, including a summary of the headline criteria that would need to be met.

Cohesion Fund

CF is aimed at Member States whose Gross National Income (GNI) per inhabitant is less than 90 % of the EU average – Latvia is a qualifying country for the period 2014 – 2020. There is a potential opportunity to source additional EU co-financing of the scheme through the CF, outside of the CEF. The CF allocates funding under the following two activities:

1. **trans-European transport networks, notably priority projects of European interest as identified by the EU, including through the CEF;**

2. **environment: the Cohesion Fund can also support projects related to energy or transport, as long as they clearly benefit the environment in terms of energy efficiency, use of renewable energy, developing rail transport, supporting intermodality, strengthening public transport, etc**

The elements of the project that are not directly related to Rail Baltica are more likely to qualify for the second of the two activities. Regulation EU 1300/2013 states that this can include the promotion of sustainable multimodal urban mobility and mitigation-relevant adaptation measures, which the project could qualify under. Whilst some elements of the project are not on the TEN-T, they would facilitate multimodal access point to it, by improving bus and coach connections and supporting connections with Latvia's national rail network.

European Regional Development Fund

The ERDF aims to strengthen economic and social cohesion in the European Union by correcting imbalances between its regions. Key priority identified by the ERDF are:

- **Innovation and research;**
- **The digital agenda;**
- **Support for small and medium-sized enterprises (SMEs); and**
- **The low-carbon economy.**

The Riga Public Transport Hub project has potential to qualify for ERDF funding under the low-carbon economy priority.

European Fund for Strategic Infrastructure

A potential option to be explored further for financing of the project is through the European Fund for Strategic Infrastructure (EFSI). This is being set up within the European Investment Bank (EIB). It is intended to mobilise additional investments in infrastructure, education, research, innovation, renewable energy and energy efficiency.

The EFSI is a new funding mechanism as the legislative proposal was adopted by the commission on 13th January. Qualifying projects must meet the following criteria.

- economically viable with the support of the initiative,
- sufficiently mature to be appraised on a global or local basis,
- of European added value and consistent with EU policy priorities; and
- maximize where possible private sector financing.

Projects will be selected based on their 'additionality' (i.e. that they could not be realized without the backing of the EU guarantee), economic viability, reliability and credibility and their contribution to key growth-enhancing areas in line with EU policies.

In the context of this project it is important to note that the EFSI focuses on attracting private investors in economically viable projects. It is questionable whether the project will meet the criteria given that the majority of the investment will be public – schemes such as toll roads are likely to be more aligned to the EFSI.

16.7 Apportionment of Capital Costs – Preferred Option

This section summarises our initial assumptions regarding the apportionment of the project costs by the respective funding bodies/stakeholders. It should be noted that EU funds can be used to finance capital investment expenditure only – ongoing operating and maintenance costs would be borne by the operator(s) of the facility. The maximum co-financing limit is 85% of eligible costs and is lower where an anticipation of net revenue is anticipated, in respect to Regulation EU No. 1303/2013.

Support for financing ineligible and unfinanced costs from the above funds would need to come from national or regional contributions or private sector contributions.

Table 16.8 shows the draft allocation of the capital costs for each of the project categories by funding body (price base 2015, costs exclude VAT and design costs). The amount allocated to Rail Baltica CEF (€111.2m) compares with the €82.6m allocated under the Stage 1 of the CEF application for construction. It is important to note that the costs below do not include design costs which have been estimated at the overall project level at €5.3m. Stage 1 of the CEF application for Rail Baltica allocates €2.4m for design.

Funding Body	RAIL INFRASTRUCTURE Cost, €	MULTIMODAL HUB Cost, €	OTHER BUILDINGS Cost, €	CITY PLANNING Cost, €	TRANSPORTATION Cost, €	MANAGEMENT/ CONTINGENCY Cost, €	TOTAL COST PER STAKEHOLDER Cost, €
RB CEF (EU - 81%)	26,607,774	30,462,376	10,720,350	13,136,823	8,426,985	21,879,388	**111,233,697**
RB CEF (National Govt - 19%)	6,241,330	7,145,496	2,514,650	3,081,477	1,976,700	5,132,202	**26,091,855**
Latvian Railways	10,000,000						**10,000,000**
City of Riga			6,834,760	10,812,200	6,935,790		**24,582,750**
Private Development			12,920,000				**12,920,000**

Table 16.8: Apportionment of Capital Costs by Funding Body

The apportionment of the project costs has been undertaken based on the following assumptions:

- **Rail Infrastructure: €10m has been allocated to Latvian Railways as this reflects the improvements that would have been made to the Central Station if Rail Baltica were not developed, including platform rebuilding, track realignment and modernization. The remaining costs have been split between Rail Baltica CEF and national contribution (81% and 19% respectively, which is consistent with the CEF Stage 1 application).**

- **Multi Modal Hub: 81% of the costs have been apportioned to Rail Baltica CEF and 19% to national government.**

- **Other Buildings: costs relating to the construction of the International Coach Station have been split 81% to Rail Baltica CEF and 19% to national government. The rationale is that the project is dislocating the coach operations during construction and possible into the future. Costs relating to office, retail and leisure buildings have been assigned to private developers as these components are not eligible for EU funding. The costs relating to the upgrade of the markets have been assigned to the City of Riga.**

- **City Planning and Transportation: 40% of the costs have been allocate to the City of Riga, with the remainder being split between Rail Baltica CEF and national government (81% and 19%). The rationale for the cost sharing is that the City of Riga would not invest funds in the area in the absence of the Rail Baltica project.**

16.8 Apportionment of Capital Costs – Alternative Options

Tables 16.9 to 16.11 present the breakdown of the project costs by funding body for the 3 alternative options identified in section 16.4.

Funding Body	RAIL INFRASTRUCTURE Cost, €	MULTIMODAL HUB Cost, €	OTHER BUILDINGS Cost, €	CITY PLANNING Cost, €	TRANSPORTATION Cost, €	MANAGEMENT/ CONTINGENCY Cost, €	TOTAL COST PER STAKEHOLDER Cost, €
RB CEF (EU - 81%)	30,955,749	30,462,376	10,720,350	13,136,823	8,426,985	22,553,324	**116,255,607**
RB CEF (National Govt - 19%)	7,261,225	7,145,496	2,514,650	3,081,477	1,976,700	5,290,286	**27,269,834**
Latvian Railways	10,000,000						**10,000,000**
City of Riga			6,834,760	10,812,200	6,935,790		**24,582,750**
Private Development			12,920,000				**12,920,000**

Table 16.9: Apportionment of Capital Costs by Funding Body – Alternative 1

Funding Body	RAIL INFRASTRUCTURE Cost, €	MULTIMODAL HUB Cost, €	OTHER BUILDINGS Cost, €	CITY PLANNING Cost, €	TRANSPORTATION Cost, €	MANAGEMENT/ CONTINGENCY Cost, €	TOTAL COST PER STAKEHOLDER Cost, €
RB CEF (EU - 81%)	34,849,119	30,462,376	10,720,350	13,136,823	8,426,985	23,156,797	120,752,450
RB CEF (National Govt - 19%)	8,174,485	7,145,496	2,514,650	3,081,477	1,976,700	5,431,841	28,324,649
Latvian Railways	10,000,000						10,000,000
City of Riga			6,834,760	10,812,200	6,935,790		24,582,750
Private Development			12,920,000				12,920,000

Table 16.10: Apportionment of Capital Costs by Funding Body – Alternative 2

Funding Body	RAIL INFRASTRUCTURE Cost, €	MULTIMODAL HUB Cost, €	OTHER BUILDINGS Cost, €	CITY PLANNING Cost, €	TRANSPORTATION Cost, €	MANAGEMENT/ CONTINGENCY Cost, €	TOTAL COST PER STAKEHOLDER Cost, €
RB CEF (EU - 81%)	35,881,043	30,462,376	10,720,350	13,136,823	8,426,985	23,316,745	**121,944,322**
RB CEF (National Govt - 19%)	8,416,541	7,145,496	2,514,650	3,081,477	1,976,700	5,469,360	**28,604,224**
Latvian Railways	10,000,000						**10,000,000**
City of Riga			6,834,760	10,812,200	6,935,790		**24,582,750**
Private Development			12,920,000				**12,920,000**

Table 16.11: Apportionment of Capital Costs by Funding Body – Alternative 3

16.9 Next Steps

An appropriate level of inflation will need to be applied to the 2015 base costs to clarify the funding requirement over the construction period.

Discussions are clearly required with stakeholders regarding the acceptability and feasibility of the cost allocations. Clarification is also required regarding the scope for flexibility in the budget allocation to the project in the Rail Baltica CEF Stage 1 funding application. The financing plan will therefore need to be updated as the project progresses through the design and development process.

With regard to funding gaps, it should be noted that there is potential to apply for additional EU funding through the Cohesion Fund or ERDF (as discussed above).

It should be noted that the effective date for incurring eligible European Regional Development Fund expenditure is the date the project is formally selected into the programme.

16.10 Work Package Summary

The capital construction costs for the project have been estimated at €184.8m. After including design costs, the total estimated cost of the project is €190.1m (exc VAT). The costs have been apportioned between the key components, including Rail Infrastructure, Multi Modal Hub, City Planning, Transportation and Other Buildings (including the International Coach Station). The funding that has been earmarked for the project under the Connecting Europe Facility (CEF) provides a good basis for delivering the project. Initial allocations have therefore be made with respect to funding sources, including Rail Baltica (CEF), national government, the City of Riga and private developers. A profile of the costs from 2016 through to 2022 has also been identified in line with the implementation plan. The next stage is to review the allocation of the costs with the respective stakeholders in terms of affordability and acceptability – this work should be undertaken following completion of this study.

17 Conclusions and Recommendations

17 Conclusions and Recommendations

The salient findings, conclusions and recommendations from the overall study are summarized below by various disciplines:

17.1 Train Operations and Track Arrangements

The rail operations work started by obtaining an understanding of the existing operating rules and expected changes to train service provision, then considering how these would apply to the station in future. The future Rail Baltica train service was determined based on previous studies and the client aspiration for an airport shuttle service, and a platform configuration was proposed based on this service but allowing some scope for additional trains on the 1435mm gauge.

The demand work undertaken by the study was used to determine the likely 1520mm gauge train service in 2050, but following client comments an alternative option was also tested with more frequent trains to align with PV's projections of service in 2050.

The existing station track layout was reviewed to identify changes that would enhance the operation of the station. Because it was clear that major extensions to the station footprint would be difficult, options were also considered for 1520mm tracks to be removed to make space for the Rail Baltica facilities.

These two workstreams were combined in the preparation of a timetable for each train service option, which delivered the specified service level with the minimum of station tracks consistent with providing a reliable service. The reliability of this timetable was then further tested by the operational micro-simulation (RAILSYS) model. The software simulated the actual movement of trains to the proposed timetable and track layout. After testing that the timetable could be operated without significant conflicts between trains, the simulation was then run with random but realistic delays applied to trains. In this situation some delayed trains will cause conflicts that lead to extra delay, and the extent of these additional delays was measured to determine how well the station layout performed in a realistic situation.

This work concluded that tracks 3, 9 and 12 could be removed and the total extra delay per train was acceptable under both timetable options. After further discussion with the client, it was agreed to keep track 9 in the final layout, as this provides a facility for a long freight train to wait in the station area without blocking other trains. The resulting schematic layout forms the basis for the development of geographical track layouts and plans for station facilities.

17.2 Urban Design

The first step in the analysis was to undertake an in depth urban study of the zone. This has been carried out to identify the urban constrains, understand the potential of the different areas and study the current situation of the area in relation to the future planned changes for Riga city.

Multiple alternatives have been considered for the urban integration of the Rail Baltica into the City. The urban proposals have been studied carefully to compromise the urban regeneration, and upgrading of the study area, combining architectural decisions, urban proposals and the correspondent structural feasibility studies for their future development.

The urban proposals integrate the new multimodal hub in the urban network and the improvement goes across the railway barrier into the next neighborhood.

Some of the main proposals: The water feature recovered for city of Riga with new promenades along it, turn it into a lively place, connected to the Market area. Removal of embankment 1 and provide a direct connection from the Old City to the new Public Space. Renovation of the access plaza to the railway station. Solve the underpass and lack of pedestrian crossings in the area.

17.3 Traffic

The main purpose of the design is to assure the connectivity between Old Riga Center and new Multimodal Hub, giving priority to the pedestrians and reducing the length of travel.

The existing junctions have been adapted to the existing traffic flows, adapting the Public Transit network and private car routes to accommodate a safe access to the Multimodal Hub, throughout new areas for Bus, Tram and TrolleyBus, taxi parking and Kiss & Ride areas for the users of Multimodal Hub.

A new design has been provided for the Streets Klavu iela, Dzirnavu iela, Elisabetes iela & Timoteja iela to accommodate a direct and safe route for International buses to the Multimodal Hub.

The turning of all the vehicles has been checked though the software ISTRAM/ISPOL in accordance with Latvian Standards and *Rigas Satiksme* directions/guidelines, including swept path analysis to check the feasibility of vehicle turning conflict zones (junctions, new streets and access/exit from/to the Multimodal Hub)

17.4 Multimodal Hub

The main issue of the multimodal hub is to enclose multiple modes of transportation within the same building. In order to separate the different modes, we propose to locate under the tracks a bus interchange (that can serve efficiently to train and city passengers) while the train station is above the tracks. With this configuration we achieve clean connections and avoid mixing paths between all the areas.

The bus interchange is complemented with a north-south connection that allows the people to cross from the station plaza to the Market Area.

The proposed/altered Main Hall is the most prominent station area. A three-storey space welcomes the passengers and includes the main vertical circulation elements (i.e. escalators).

The train station is a glazed volume located above the tracks. All the waiting areas and the retail spaces have great views to the Centre of Riga. The restaurants area is cantilevered over part of the Station Plaza, allowing to have a covered outdoor space before entering the Station.

17.5 Traffic and Pedestrian Modelling Assessment

Table 17.1: RPTH Pedestrian and Traffic Models Summary, states the pedestrian and traffic modelling undertaken to inform the development of the ‘preferred option’ and ultimately determine its feasibility.

Modelling Purpose	Software Used	Outputs	Section
Origin - Destination Changes	SATURN Strategic Modelling	Link +/- Flow Changes	3.3
Accessibility/Connectivity	AECOM Strategic GIS Tool (bespoke)	Walk Isochrones	3.4
‘Around’ RPTH Pedestrian Link Analysis	AECOM Static Analysis Tool (bespoke)	Levels of Service	11.4
‘Around’ RPTH Roads Network Analysis	AECOM Static Analysis Tool (bespoke)	Degrees of Saturation	11.5
‘Around’ RPTH Roads Network Modelling	LINSIG	Signals Optimisation	11.7
‘Around’ RPTH Roads Network Modelling	AIMSUN Microsimulaiton	Journey Times	11.7
‘Within’ RPTH Station Pedestrian Modelling	LEGION Microsimulation	Levels of Service & Journey Times	10.5
‘Within’ Origo Pedestrian Modelling	LEGION Microsimulation	Levels of Service	10.5

Table 17.1: RPTH Pedestrian and Traffic Models Summary

The Origin – Destination SATURN Modelling undertaken essentially identified the Base 2015 pedestrian and vehicular strategic routing (percentage weightings per model link) to and from Central Station. The Accessibility/Connectivity outputs identified key desire lines to and from Central Station and the wider study area. This was an input to the iterative design process which identified connectivity opportunities and constraints.

The 'Around RPTH' Pedestrian Link Analysis has been undertaken using a bespoke static analysis tool, created specifically for this study. Outputs from the analysis model, which determines the Pedestrian Level of Service (LoS), show that almost all links analysed experience LoS A in 2050 future design year Scenarios. Two links during the PM peak are shown to experience LoS B and one experiences LoS C – all are within the acceptable threshold of A to C.

The 'Around RPTH' Roads Network Analysis which has been undertaken using a bespoke static analysis tool, created specifically for this study. Outputs from the analysis model, which determines the Degree of Saturation (DoS) of all modelled junction arms within the study area in the 2025 opening year and 2050 future design year Scenarios, show that almost all arms experience a DoS less than the practical capacity of 0.85. Only one junction (Satekeles iela/Lāčplēša iela) in the 2050 'do something' (i.e. with development') scenario approaches capacity. Our analysis of the junctions within the study area determines that all junctions could feasibly operate within capacity (i.e. less than 1.00) in 2050 with only minor modifications to signalisation.

LINSIG modelling was undertaken to optimise the fixed plan cycle timings of junctions adjacent to the RPTH in the 2050 'Preferred Option' scenario which includes changes to the roads layout. These optimised timings were used successfully as an input to the AIMSUN traffic microsimulation modelling undertaken.

Traffic Microsimulation modelling of the Base 2015 scenario and Future 'do minimum' and 'do something' 2050 scenarios has been undertaken using AIMSUN software for junctions adjacent to the RPTH. The modelling outputs conclude that the 2050 'do something' (i.e. with development') scenario roads network changes are conceptually feasible. The feasibility has been determined by analysing 'do something' 2050 journey times through the network and comparing them with the existing Base scenario. Although journey times increase overall from the 2015 base scenario, this is to be expected due to the calculated increase in flow (due to background growth, committed and development flows). The journey times are significantly lower than those of the 2050 'do minimum' scenario and crucially, from a feasibility perspective, the observed modelled queue lengths within the 'do something' are not extensive and clear within a signal cycle.

'Within RPTH' Pedestrian Microsimulation modelling of the Base 2015 scenario and Future 'do minimum' and 'preferred design option' 2050 scenarios has been undertaken using LEGION software. The modelling outputs determine that the preferred design option for the RPTH station building would operate within capacity and provide an appropriate level of service for passengers using and passing through the building. The layout was tested using both LoS Walkways and LoS Queuing up to future demand year 2050; incorporating further demand from associated committed developments. Modelling results compared well between the preferred option and 'do-minimum' model, with LoS recorded between A-D for queuing and A-C for LoS walkways. Crucially, all gatelines were shown to operate within acceptable thresholds and operated within capacity, having been tested to peak 2050 demands.

17.6 Procurement Plan

The procurement plan for the RPTH is based on its size, complexity, and works plan.

The design stages, the procurement and the supervision of works is carried out by a sole Consultant (or JV of consultants), in order to ensure the consistency of the project. The Consultant will advise and agree with the Client the strategy of completion of the necessary works. Depending on the situation, different tender methodologies will be used, and the Client will be guided at all times independently of the chosen method.

17.7 End Note

We believe with this Final report, AECOM has fulfilled all contractual deliverables that were agreed at the outset of the project. And all the contents within this document will act as a firm basis for progressing further stages of this project towards implementation of the recommended scheme for the RPTH, with a view to extend a safe, sustainable and enjoyable experience to the users of this new and much improved transportation node.

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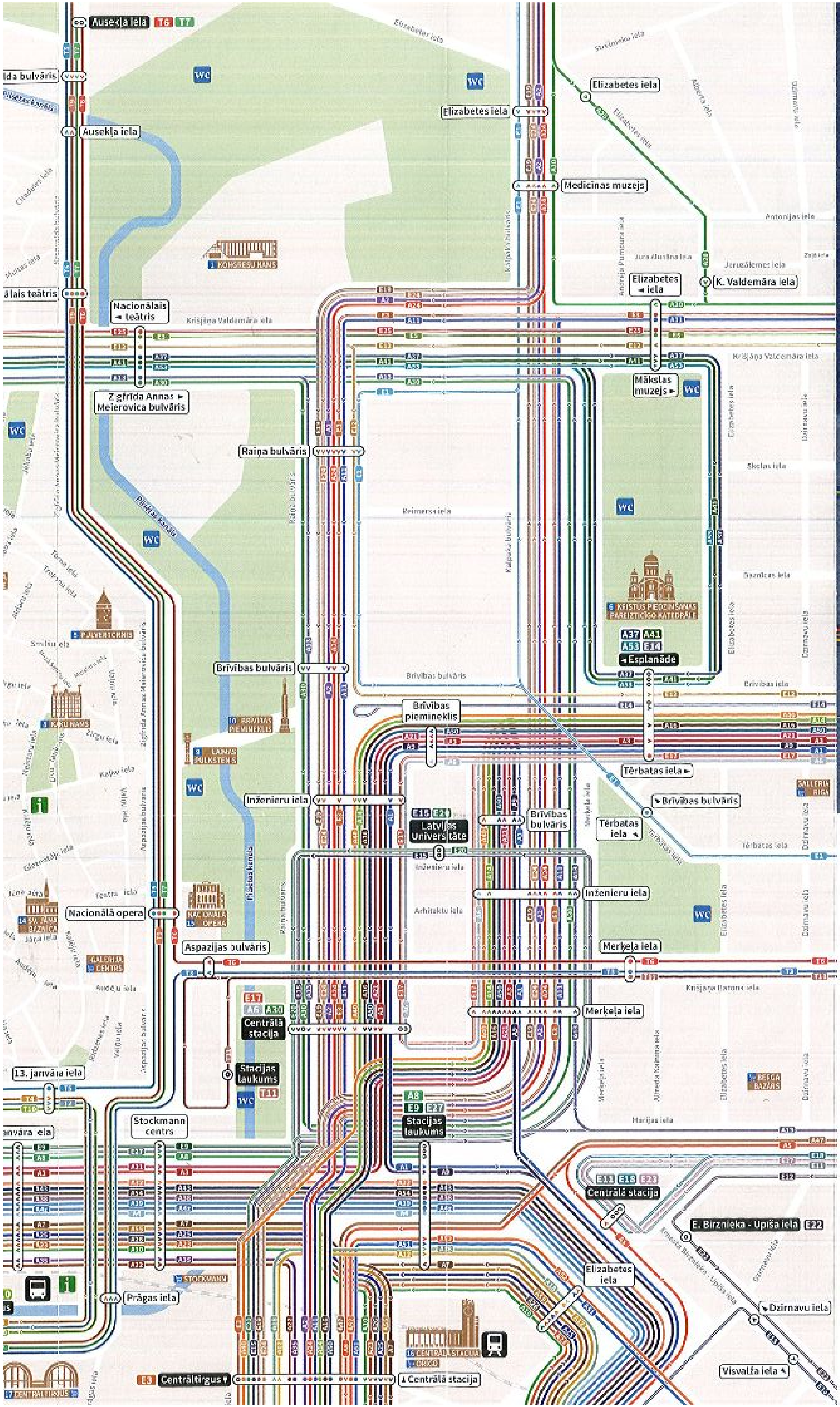
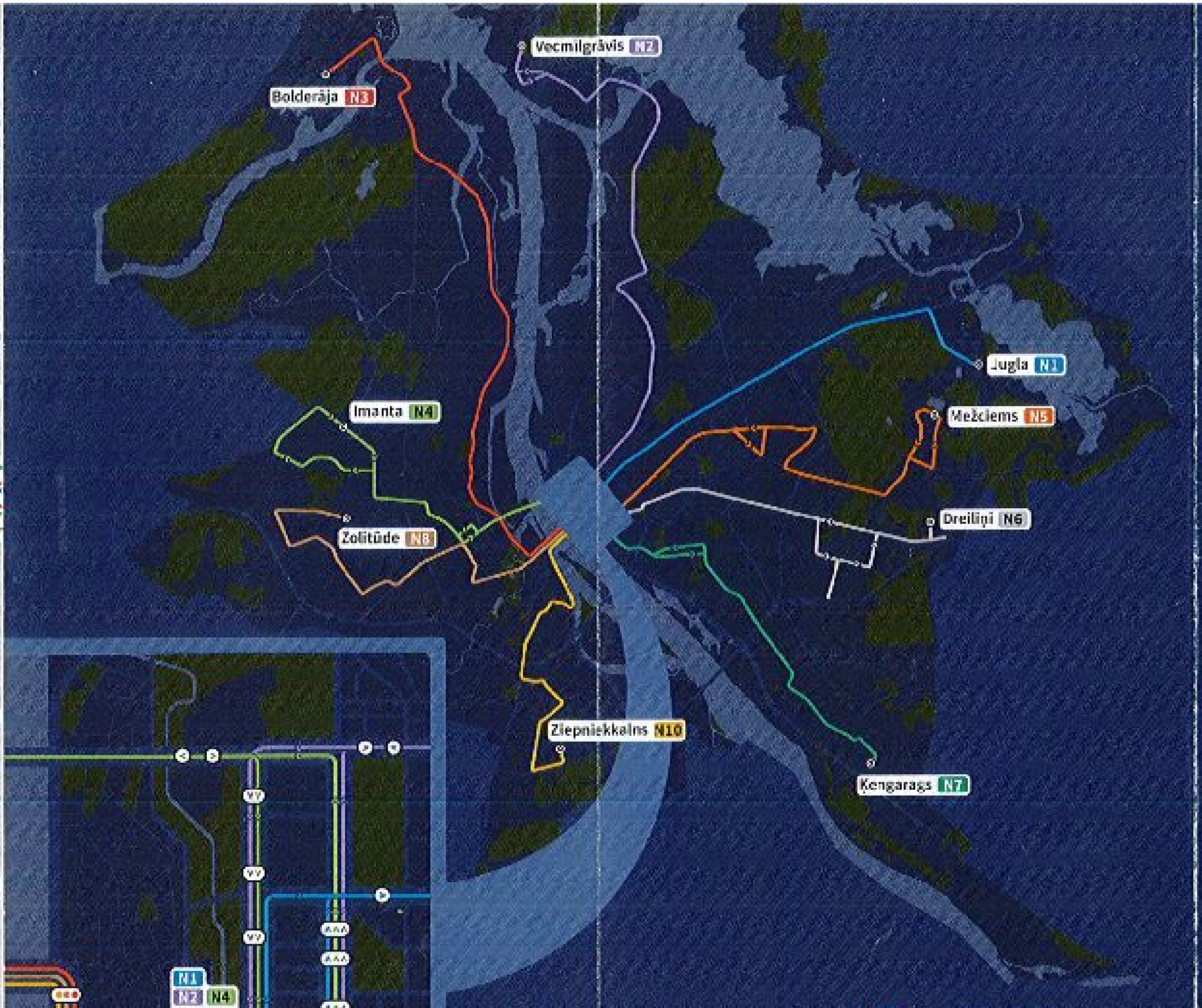
Appendix WP 1.1 – Public Transport Maps





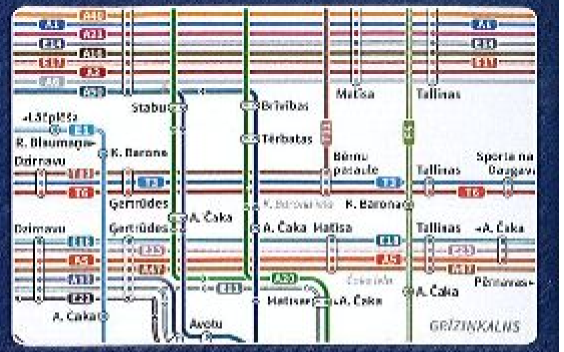
Rīgas nakts autobusi
Ночные автобусы Риги
Riga night buses

Nakti no piektdienas uz sestdienu un no sestdienas uz svētdienu
В ночь с пятницы на субботу и с субботы на воскресенье
Night from Friday to Saturday and from Saturday to Sunday

- N1 Centrs – Teika – Jugla
- N2 Centrs – Sarkandaugava – Vecmīlgrāvis
- N3 Centrs – Bolderāja
- N4 Centrs – Imanta
- N5 Centrs – Purvciems – Mežciems
- N6 Centrs – Pļavnieki – Dreiliņi
- N7 Centrs – Ķengarags
- N8 Centrs – Āgenskalns – Zolitūde
- N10 Centrs – Vienības gatve – Ziepniekkalns

Autobuss | Trolejbuss | Tramvajs

Riga Transit



Rīgas sabiedriskais transports

Общественный транспорт Риги

Riga public transport

Pēdējās izmaiņas 2014. gada februāris
©2011 – 2014 Vitālija Bariševa
Reg. D 15 429
http://rigatransit.lv

Izdevējs
Smalko Sistēmu Studija SIA
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1. Kongresu nams
Дом конгрессов
Congress Centre
2. Rīgas Pils
Рижский замок
Riga Castle
3. Svētā Jēkaba katedrāle
Церковь Св. Иакова
St. Jacobs Cathedral
4. Trīs brāļi
Три брата
The Three Brothers
5. Pulvertornis
Пороховая башня
The Powder Tower
6. Kristus Piedzimšanas Pareizticīgo katedrāle
Кафедральный собор Рождества Христова
Nativity of Christ Cathedral
7. Doma baznīca
Домский собор
Dome Cathedral
8. Kaķu nams
Кошкин дом
The Cat House
9. Laimas pulkstenis
Часы Laima
Laima Clock
10. Brīvības piemineklis
Памятник свободы
The Freedom Monument
11. Rātsnams
Городская ратуша
City Council
12. Melngalvju nams
Дом Черноголовых
House of Blackheads
13. Sv. Pētera luterāņu baznīca
Церковь Св. Петра
St. Peter's Church

Pansionāts A1 – Juglas – Brīvības

Galapunkts
Конечная остановка
Terminus stop

Pietura
Остановка
Stop

Pietura vienā virzienā
Остановка в одном направлении
Stop in one direction

Autobuss
Автобус
Bus

Trolejbuss
Троллейбус
Trolleybus

Tramvajs
Трамвай
Tram

Dzelzceļa stacija
Железнодорожный вокзал
Train station

Starptautiskā autoosta
Международный автовокзал
International coach terminal

Pasažieru prāmju termināls
Пассажирский порт
Ferry terminal

Tirdzniecības centrs
Торговый центр
Shopping Centre

Tualete

Darba laiks: no 5.00 līdz 23.30, atkarībā no maršruta, nakts autobusi Pk/Se un Se/Sv.

Biļešu veidi: 1 – 50 braucieni, 24 st. biļete, 3 vai 5 dienu biļete, mēnešbiļetes. Iepriekšpārdošanā (e-talons) – biļešu automātos, preses tirdzniecības vietās, Rīgas Satiksmes biļešu kasēs un Latvijas Pasta nodaļās.

Kur iegādāties: Pie transportlīdzekļa vadītāja (dārgāk). Iepriekšpārdošanā (e-talons) – biļešu automātos, preses tirdzniecības vietās, Rīgas Satiksmes biļešu kasēs un Latvijas Pasta nodaļās.

Biļetes ir derīgas izmantošanai tramvajā, trolejbusā un pilsētas autobusā. Ja jūs lietojat e-talonu, jums jāreģistrē brauciens, pietuvinot to elektroniskajam biļešu lasītājam, tiklīdz iekāpjat transportlīdzeklī.

Bagāžas pārvadāšana: Par liela izmēra bagāžas pārvadājumu jāiegādājas papildus biļete pie transporta līdzekļa vadītāja, izņemot 22. autobusu (Rīga – Lidosta). Bagāžas izmēru (platums, garums, augstums) summa nedrīkst pārsniegt 300 cm.

Rīgas sabiedriskā transporta darbību nodrošina uzņēmums Rīgas Satiksme.

www.rigassatiksme.lv, 80001919.

Часы работы: с 5.00 до 23.30, в зависимости от маршрута; ночные автобусы Пт/Сб и Сб/Вс.

Типы билетов: 1 – 50 поездок, на 24 ч., 3 или 5 дней, проездной на месяц.

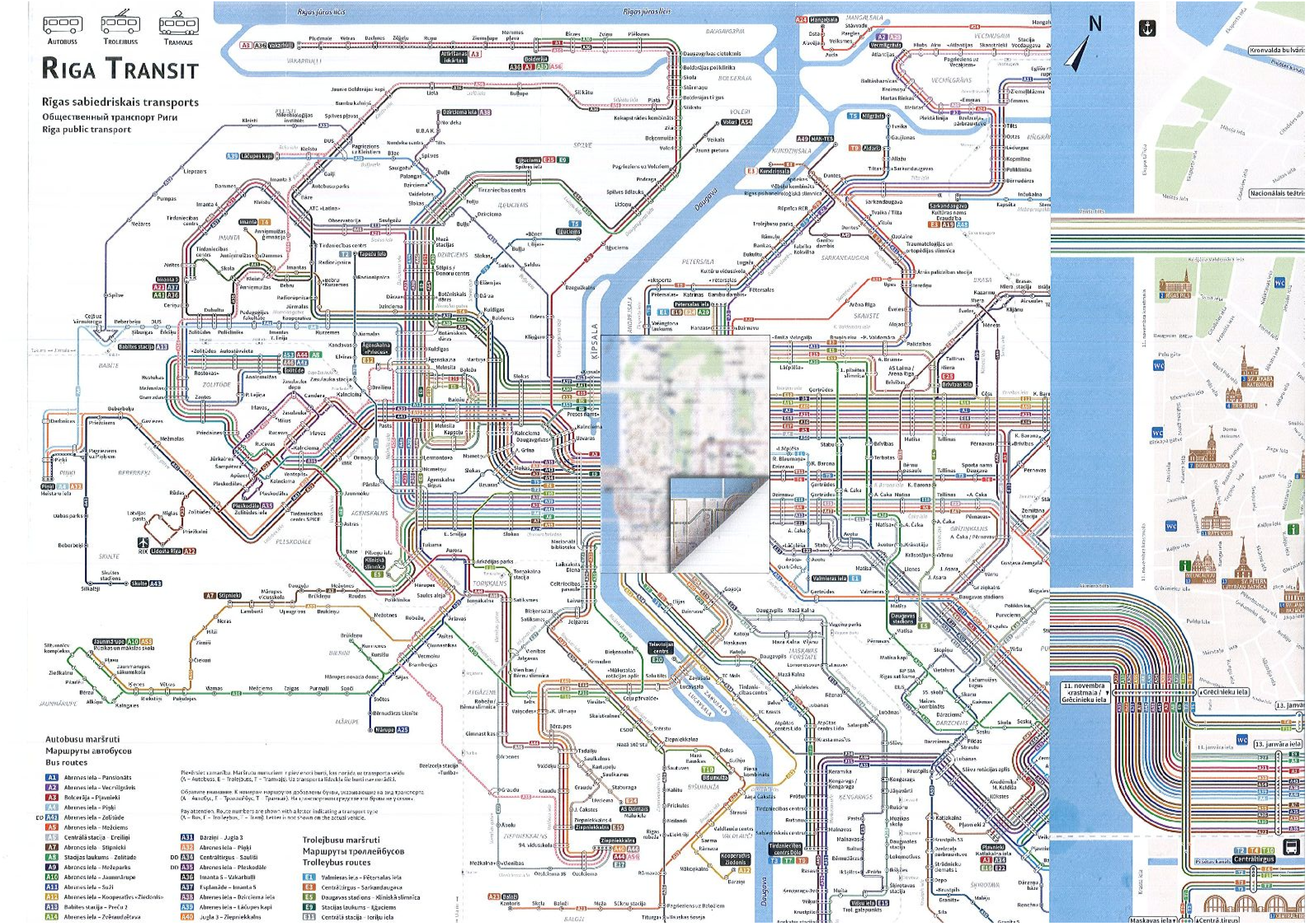
Где приобрести: У водителя (дороже). Предварительная продажа билетов (e-talons) – в автоматах по продаже билетов, газетных киосках, почтовых отделениях, билетных кассах Rīgas Satiksme.

Билеты действительны для использования в трамвае, троллейбусе и городском автобусе. Если вы используете электронный билет, зарегистрируйте свою поездку, приложив его к считывающему устройству, как только вы оказались в салоне транспортного средства.

Провоз багажа: Для провоза крупногабаритного багажа необходимо приобрести дополнительный билет у водителя, за исключением автобуса № 22 (Рига – Аэропорт). Сумма габаритов (длина, ширина, высота) багажа не должна превышать 300 см.

Работу общественного транспорта обеспечивает предприятие Rīgas Satiksme.

www.rigassatiksme.lv, 80001919.


Autobuss
Trolejbuss
Tramvajs
RIGA TRANSIT
Rīgas sabiedriskais transports
Общественный транспорт Риги
Riga public transport
Autobusu maršruti
Маршруты автобусов
Bus routes
A1 Abrenes iela – Pansionāts
A2 Abrenes iela – Vecmīlgrāvis
A3 Bolderāja – Pļavnieki
A4 Abrenes iela – Piņķi
DD A42 Abrenes iela – Zolitūde
A5 Abrenes iela – Mežciems
A6 Centrālā stacija – Dreiliņi
A7 Abrenes iela – Stīpnieki
A8 Stacijas laukums – Zolitūde
A9 Abrenes iela – Mežaparks
A10 Abrenes iela – Jaunmārupe
A11 Abrenes iela – Suži
A12 Abrenes iela – Kooperatīvs «Ziedonis»
A13 Babītes stacija – Preču 2
A14 Abrenes iela – Zvēraudzētava
A31 Bārziņi – Jugla 3
A32 Abrenes iela – Piņķi
DD A34 Centrāltirgus – Saulīši
DD A35 Abrenes iela – Pleskodāle
A36 Imanta 5 – Vakarbuļļi
A37 Esplanāde – Imanta 5
A38 Abrenes iela – Dzirciema iela
A39 Abrenes iela – Lāčupes kapi
A40 Jugla 3 – Ziepniekkalns
Trolejbusu maršruti
Маршруты троллейбусов
Trolleybus routes
E1 Valmieras iela – Pētersalas iela
E3 Centrāltirgus – Sarkandaugava
E5 Daugavas stadions – Klīniskā slimnīca
E9 Stacijas laukums – Iļģuciems
E11 Centrālā stacija – Ieriķu iela
Pievērsiet uzmanību. Maršrutu numuriem ir pievienoti burti, kas norāda uz transporta veidu (A – Autobuss, E – Trolejbuss, T – Tramvajs). Uz transporta līdzekļa šie burti nav norādīti.
Pay attention. Route numbers are shown with a letter indicating a transport type (A – Bus, E – Trolleybus, T – Tram). Letter is not shown on the actual vehicle.
Rīgas jūras līcis
Daugava
KĪPSALA
N
11. novembra krastmala / Grēcinieku iela
13. janvāra iela
Centrāltirgus

1 **Brīvības piemineklis** The Freedom Monument / Памятник Свободы / Freiheitsdenkmal	23 **Sinagoga** Riga Synagogue / Рижская синагога / Rigaer Synagoge	45 **Rīgas geto un Latvijas Holokausta muzejs** / Riga Ghetto and Latvian Holocaust Museum / Музей рижского гетто и Холокоста в Латвии / Rigaer Ghetto und Lettisches Holokaust museum
2 **Rīgas Pils** Riga Castle / Рижский замок / Rigaer Schloss	24 **Latvijas Fotogrāfijas muzejs** Latvian Museum of Photography / Латвийский музей фотографии / Lettisches Museum für Fotografie	46 **Latvijas zinātņu akadēmija** Latvian Academy of Sciences / Латвийская академия наук / Akademie der Wissenschaften
3 **Latvijas Nacionālā bibliotēka** National Library of Latvia / Латвийская национальная библиотека / Lettische Nationalbibliothek	25 **Rīgas Kinomuzejs** Riga Film Museum / Рижский музей кино / Rigaer Kinomuseum	47 **Jūgendstila kvartāls** The Art Nouveau Quarter / Квартал югендстиля / Jugendstil-Viertel
4 **Lielais Kristaps** Great Kristaps / Большой Кристап / Großer Christopherus	26 **Latvijas Sporta muzejs** Latvian Sports Museum / Латвийский музей спорта / Lettisches Sportmuseum	48 **Rīgas Jūgendstila muzejs** Art Nouveau Museum / Рижский музей югендстиля / Rigaer Jugendstilmuseum
5 **LNMM Izstāžu zāle Arsenāls** Exhibition space "Arsenāls" / Выставочный зал "Arsenāls" / Ausstellungssaal Arsenāls	27 **Konventa sēta** Convent Yard / Двор Конвента / Konventhof	49 **P.Stradiņa Medicīnas vēstures muzejs** P.Stradins Museum of the History of Medicine / Музей истории медицины им. П.Страдыня / P.Stradins Museum für Medizingeschichte
6 **Zviedru vārti** Swedish Gate / Шведские ворота / Schwedentor	28 **Dekoratīvās mākslas un dizaina muzejs** Riga Museum of Decorative Arts and Design / Музей декоративного искусства и дизайна / Museum für Dekorative Kunst und Design	50 **Lielā Ģilde** The Great Guild / Большая гильдия / Die Große Gilde
7 **Svētā Jēkaba katedrāle** St.Jacobs Cathedral / Церковь Св. Иакова / St.Jakobi-Kathedrale	29 **Rīgas Porcelāna muzejs** Riga Porcelain Museum / Рижский музей фарфора / Rigaer Porzellanmuseum	51 **Mazā Ģilde** The Small Guild / Малая гильдия / Die Kleine Gilde
8 **Pulvertornis** The Powder Tower / Пороховая башня / Pulverturm	30 **Svētā Jāņa baznīca** St.John's Church / Церковь Св.Иоанна / St.Johannes-Kirche	52 **Romana Sutas un Aleksandras Beļcovas muzejs** Museum of Romans Suta and Aleksandra Belcova / Музей Романа Суты и Александры Бельцовой / Romans Suta und Aleksandra Belcova Museum
9 **Latvijas Kara muzejs** Latvian War Museum / Латвийский военный музей / Lettisches Militärmuseum	31 **Farmācijas muzejs** Pharmacy Museum / Музей фармакологии / Museum für Pharmazie	53 **Galerija Centrs**
10 **Mākslas muzejs Rīgas Birža** Art Museum Riga Bourse / Художественный музей Рижская биржа / Kunstmuseum Rigaer Börse	32 **Splendid Palace**	54 **Galleria Riga**
11 **Trīs brāļi** The Three Brothers / Три брата / Drei Brüder	33 **Saules muzejs** Sun Museum / Музей Солнца / Sonnenmuseum	55 **Stockmann**
12 **Latvijas Arhitektūras muzejs** Latvian Museum of Architecture / Музей архитектуры Латвии / Lettisches Architekturmuseum	34 **Laimas pulkstenis** Laima Clock / Часы Laima / Laima-Uhr	56 **Origo**
13 **Kaķu nams** The Cat House / Кошкин дом / Katzenhaus	35 **Sakta ziedu tirgus** Sakta Flower Market / Цветочный рынок "Sakta" / Blumenmarkt "Sakta"	57 **Berga Bazārs**
14 **Doma luterāņu baznīca** Dome Cathedral / Домский собор / Rigaer Dom	36 **Latvijas Nacionālais mākslas muzejs (LNMM)** Latvian National Museum of Art / Латвийский национальный художественный музей / Lettische Nationale Kunstmuseum	58 **Centrālā Dzelzceļa stacija** Central Railway Station / Центральный вокзал / Hauptbahnhof
15 **Rīgas vēstures un kuģniecības muzejs** Museum of the History of Riga and Navigation / Музей истории Риги и мореходства / Museum für Rigaer Stadtgeschichte und Schifffahrt	37 **Kristus Piedzimšanas Pareizticīgo katedrāle** Nativity of Christ Cathedral / Кафедральный собор Рождества Христова / Christi-Geburt-Kathedrale	59 **Starptautiskā autoosta** International Coach Terminal / Международный автовокзал / Der Internationale Busbahnhof
16 **1991.gada barikāžu muzejs** 1991 Barricades Museum / Музей баррикад 1991-ого года / Barrikadenmuseum	38 **Vecā Sv.Ģertrūdes baznīca** Old St.Gertrude's Church / Старая Гертрудинская церковь / Alte St.Gertruden-Kirche	60 **Pasažieru osta** Passenger Port / Пассажирский порт / Passagierhafen
17 **Melngalvju nams** House of Blackheads / Дом Черноголовых / Schwarzhäupterhaus	39 **Ebreji Latvijā** Jews in Latvia / Евреи в Латвии / Juden in Lettland	61 **Latvijas Nacionālais vēstures muzejs** National History museum of Latvia / Национальный музей истории Латвии / Lettisches Nationalmuseum für Geschichte
18 **Rīgas mākslas telpa** Riga Art Space / Рижская галерея искусства / Rigas Kunstraum	40 **Latvijas Nacionālā opera** Latvian National Opera / Латвийская национальная опера / Lettische Nationaloper	**Kuģīšu piestātne** Boat dock / Причал / Schiffshaltestelle
19 **Latvijas Okupācijas muzejs** Museum of the Occupation of Latvia 1940-1991 / Музей оккупации Латвии / Lettisches Okkupationsmuseum a) 01.05.-31.09.2013 b) 01.11.2012.-31.12.2014	41 **Latvijas Dabas muzejs** Natural History Museum of Latvia / Латвийский музей природы / Lettisches Naturkundemuseum	**Rīgas tūrisma informācijas centrs** Riga Tourist Information Centre / Центр туристической информации / Tourismusinformationszentrum
20 **Sv.Pētera luterāņu baznīca** St.Peter's Church / Церковь Святого Петра / St.Petri-Kirche	42 **Centrāltirgus** Central Market / Центральный рынок / Zentralmarkt	**Tirdzniecības centrs** Shopping Center / Торговый центр / Einkaufszentrum
21 **Baltu rotu muzejs** Museum of Ancient Baltic Jewelry / Музей балтийских украшений / Museum für Baltischen Schmuck	43 **Spīķeru kvartāls** Spikeri District / Квартал Spīķeri / Speicherviertel	**Muzejs** Museum / Музей / Museum
22 **Mencendorfa nams** Mentzendorff House / Дом Менцендорфа / Mentzendorff Haus	44 **"kim?" Laikmetīgās mākslas centrs** / Contemporary Art Centre / Центр современного искусства / Zentrum für Zeitgenössische Kunst	**Apskates objekts** Sightseeing / Достопримечательности / Sehenswürdigkeiten
		Skatu punkts Viewpoint / Смотровая площадка / Aussichtspunkte

Tramvajs / Tram / Трамвай / Strassenbahn

Trolejbuss / Trolleybus / Троллейбус / Trolleybus

Autobuss / Bus / Автобус / Bus

LIVE RĪGA
info@rigatic.lv
+371 67037900
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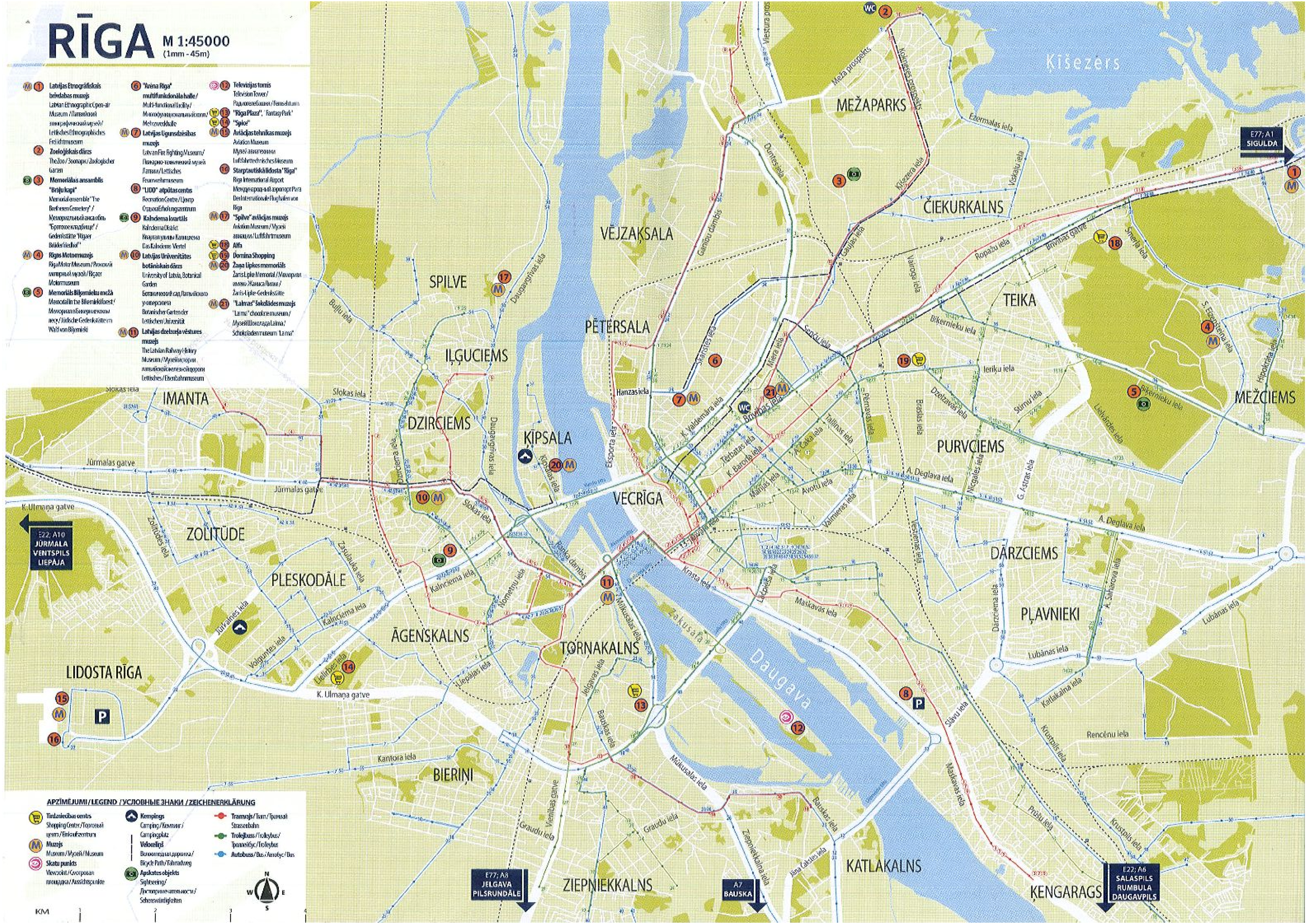
www.LiveRiga.com


RĪGA
M 1:45000
(1mm - 45m)
1 Latvijas Etnogrāfiskais brīvdabas muzejs
Latvian Ethnographic Open-air Museum
2 Zooloģiskais dārzs
The Zoo
3 Memoriālais ansamblis "Brāļu kapi"
Memorial ensemble "The Brethren Cemetery"
4 Rīgas Motormuzejs
Riga Motor Museum
5 Memoriāls Biķernieku mežā
Memorial in the Biķernieki forest
6 "Arēna Rīga" multifunkcionāla halle
Multi-functional facility
7 Latvijas Ugunsdzēsības muzejs
Latvian Fire Fighting Museum
8 "LIDO" atpūtas centrs
Recreation Centre
9 Kalnciema kvartāls
Kalnciema District
10 Latvijas Universitātes botāniskais dārzs
University of Latvia, Botanical Garden
11 Latvijas dzelzceļa vēstures muzejs
The Latvian Railway History Museum
12 Televīzijas tornis
Television Tower
13 "Rīga Plaza", "Fantasy Park"
14 "Spice"
15 Aviācijas tehnikas muzejs
Aviation Museum
16 Starptautiskā lidosta "Rīga"
Riga International Airport
17 "Spilve" aviācijas muzejs
Aviation Museum
18 Alfa
19 Domina Shopping
20 Žaņa Lipkes memoriāls
Žanis Lipke Memorial
21 "Laimas" šokolādes muzejs
"Laima" chocolate museum
APZĪMĒJUMI / LEGEND / УСЛОВНЫЕ ЗНАКИ / ZEICHENERKLÄRUNG
Tirdzniecības centrs
Muzejs
Skatu punkts
Kempings
Veloceliņš
Apskates objekts
Tramvajs / Tram
Trolejbuss / Trolleybus
Autobuss / Bus
KM
Ķīšezers
MEŽAPARKS
ČIEKURKALNS
VĒJZAKSALA
SPILVE
PĒTERSALA
TEIKA
MEŽCIEMS
IĻĢUCIEMS
IMANTA
DZIRCIEMS
ĶĪPSALA
PURVCIEMS
VECRĪGA
ZOLITŪDE
DĀRZCIEMS
PLESKODĀLE
PĻAVNIEKI
ĀGENSKALNS
TORŅAKALNS
LIDOSTA RĪGA
BIERIŅI
ZIEPNIEKKALNS
KATLAKALNS
ĶENGARAGS
Daugava
Zaķusala
E77; A1 SIGULDA
E22; A10 JŪRMALA VENTSPILS LIEPĀJA
E77; A8 JELGAVA PILSRUNDĀLE
A7 BAUSKA
E22; A6 SALASPILS RUMBULA DAUGAVPILS
K. Ulmaņa gatve
Jūrmalas gatve
Brīvības gatve
Brīvības iela
A. Deglava iela
Maskavas iela
Krasta iela
Slokas iela
Kalnciema iela
Daugavgrīvas iela
Eksporta iela
Hanzas iela
K. Valdemāra iela
Ganību dambis
Duntes iela
Ķīšezera iela
Gaujas iela
Vairoga iela
Bauskas iela
Jelgavas iela
Mūkusalas iela
Lubānas iela
Slāvu iela
Ropažu iela
Lielvārdes iela
Biķernieku iela
Kantora iela
Vienības gatve

Appendix WP 1.1 – Central Station Visitor Satisfaction Survey

Riga Central Station visitor satisfaction survey

Report of results

12/2015

Content

- Information about survey 3
- Summary 4
- Main results 7-17
- Target group profile 18

Information about survey

Aptauja
“Riga Central Station visitor satisfaction survey”

Customer:
AECOM

Provider:
SIA „Factum Interactive”
Tērbatas iela 53-6
Rīga LV-1011
www.factum.lv

December 2015

- Goal: perform a survey of Riga Central Station visitor satisfaction.
- Method: quantitative survey of applicable target groups.
- Target group: those who have visited Riga Central Station at least once within the past four weeks.
  - A: use railway transportation services (have taken a train within the past four weeks)
  - B: use the Riga Central Station for reasons unrelated to transportation services (have not taken a train but have used some services within the past four weeks)
- Timing of survey: 09.12.-15.12.2015.
- Sample size: 1160 respondents.
- Sampling method: CAWI (computer-assisted web interviews) with randomised* pre-recruiting on social networks
  - Random sampling denotes equal probability of inclusion in the survey based on primary demographic indicators (gender, age).

- Project manager – Renārs Felcis, FACTUM
- Project group – Renārs Felcis, Līva Buko, FACTUM

Summary (1)

- The results were analysed for the entire survey and for target groups:
- Target group A: use railway transportation services (have taken a train within the past four weeks).
- Target group B: use the Riga Central Station for reasons unrelated to transportation services (have not taken a train but have used some services within the past four weeks).
  - Went through the railway station (58% of target group B respondents)
  - Have visited the Origo shopping centre (51%)
  - Have visited other trade/service locations (25%)
  - Have visited public catering locations/cafes (14%)
  - Have spent time on/met someone coming on a train (7%).
- Most people visiting the Central Station are satisfied with a number of Central Station aspects.
  - 87% of respondents (regardless of target group) with an opinion are satisfied with information about transportation timetables, 82% - with direction signs (at train platforms and Central Station exits), 81% - with access to train ticket windows.
  - The only difference between the target groups is satisfaction with waiting zones (36% of respondents among train passengers are satisfied in comparison with 42% satisfied in total) and satisfaction with Central Station are use (73% of respondents are satisfied among users of other services in comparison with 75% satisfied in total).
- There have been various train travel destinations:
  - The main reason for travelling - work-related (48% of travellers) activities
- 65% passengers believe that they can get to a Central Station exit quickly and 53% comfortably.
- 74% train passengers would prefer to purchase tickets at Central Station ticket windows in comparision with buying tickets in train (28%), buying a monthly tickets (10%), buying tickets on internet / mobile app (9%).

Summary (2)

- Their main reasons in target group B are a quicker and straighter route, combination of going through station tunnels with other habits (shopping, use of services).
- Destinations from the Central Station are diverse.
  - The main ones are nearby public transportation stops (35%), Central Market (30%) and the Centre (29%).
- 78% of those who have visited Riga Central Station at least once within the past four weeks use public transport near the Central Station.
- 84% Riga Central station visitors know how to quickly get from an entrance to an exit, 71% also agree that finding one's way within the Central Station is easy.
- Opinions differ with regard to feeling safe at the Central Station. 45% agree that the Central Station makes them feel safe but 47% disagree.
- More than ¾ of residents are satisfied with access to other Riga city transportation routes.
- Satisfaction with getting to inter-city routes is in range between 61 to 65%.
- 46% of all respondents, or 66% with specific answers (i.e. excluding hard to say) are satisfied with access with a private vehicle.
- Evaluations of proposed improvements are ambiguous. Some aspects cannot be evaluated by ⅓ or more of the people surveyed (connection for bicycles, vehicles, access to minibuses).
  - 76% of Riga Cetral Station visitors agree that environmental improvements and 75% - that legibility of information on the premises of the station would be improvements that encourage use of railway traffic from the Central Station.
  - Vehicle parking (60%) and public transportation connections (68% to 70%) are also aspects that appear significant.

Main results

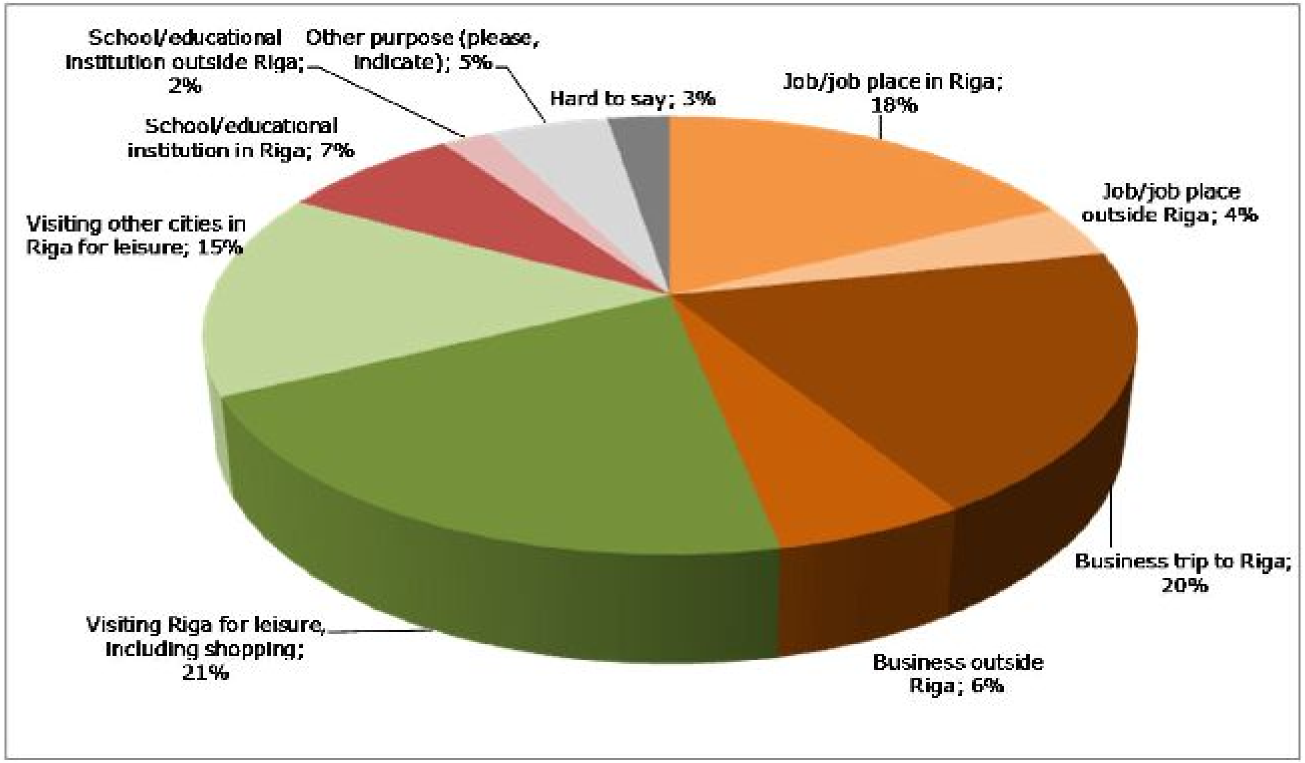
Train use purpose

Evaluation of aspects related to transportation services

Q: Within the past four weeks, what has been the main purpose of using trains for you?

There have been various train travel destinations:

1) Work-related (48% of travellers)
    1) Self-employment (22%)
    2) Travel related to job duties (26%)
2) Leisure (36%)
3) Educational purposes (9%)

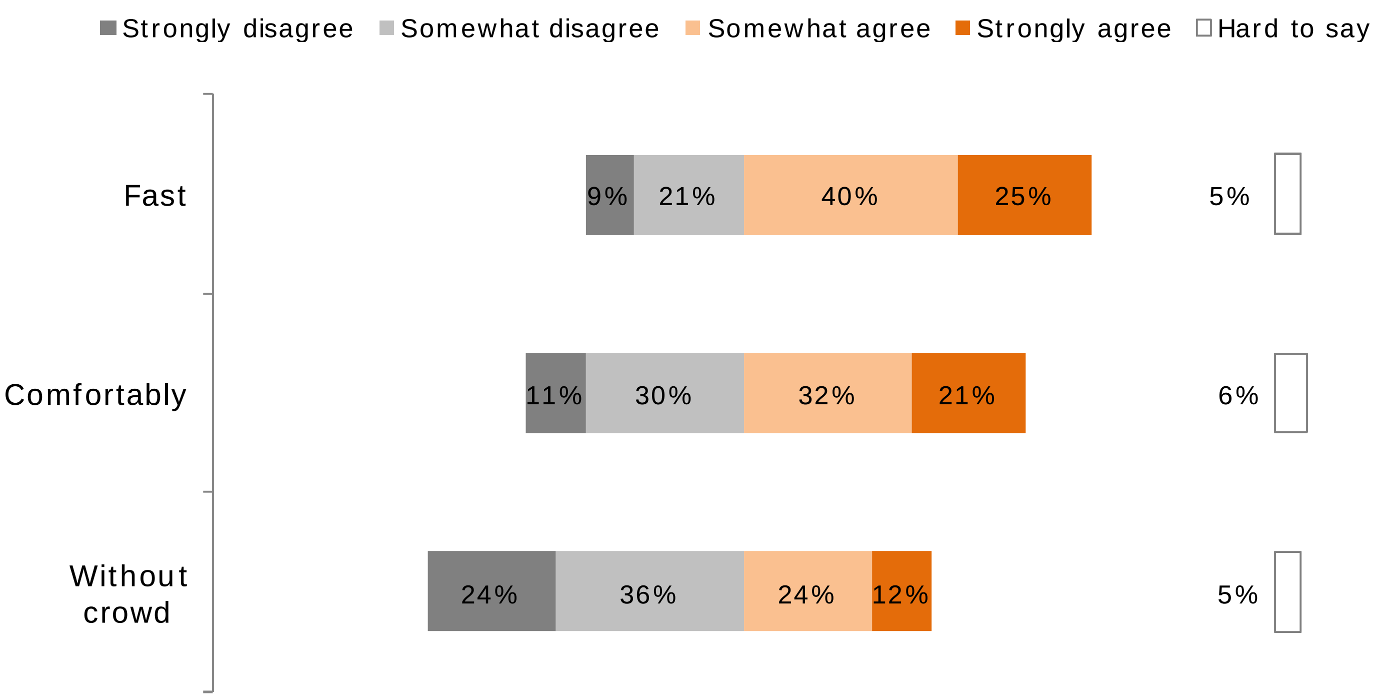


Base: target group A, n=538

Connection of train platforms and Central Station exits

Evaluation of aspects related to transportation services

Q: To what extent do you agree to the following statements?
I can get from a train platform to a Central Station exit...



60% train passengers believe that the Central Station is too crowded.

65% passengers also believe that they can get to a Central Station exit quickly and 53% comfortably.

People who believe they can get to an exit quickly and comfortably also tend to agree that they can get to the exit without feeling crowded, and vice versa.

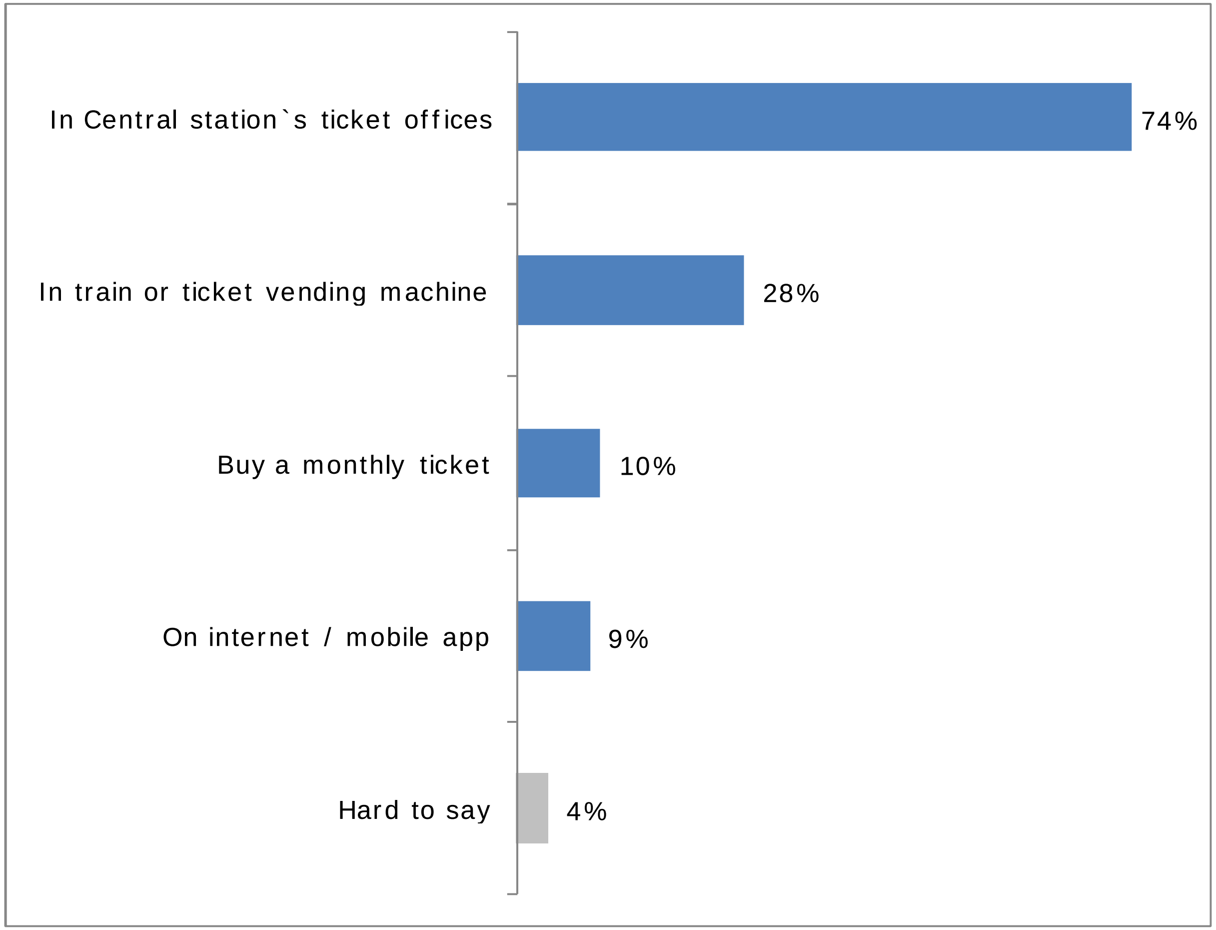
This is evident from a correlation between agreement (or disagreement) with the following aspects – quick, comfortable, not too crowded.

Base target group A, n=538

Where train tickets are purchased

Evaluation of aspects related to transportation services

Q: Where would you most prefer to purchase train tickets?



74% train passengers would prefer to purchase tickets at Central Station ticket windows in comparison with buying tickets in train (28%), buying a monthly tickets (10%), buying tickets on internet / mobile app (9%).*

** Sum of answers >100% as there were multiple answers possible.*

Reason for using station tunnels

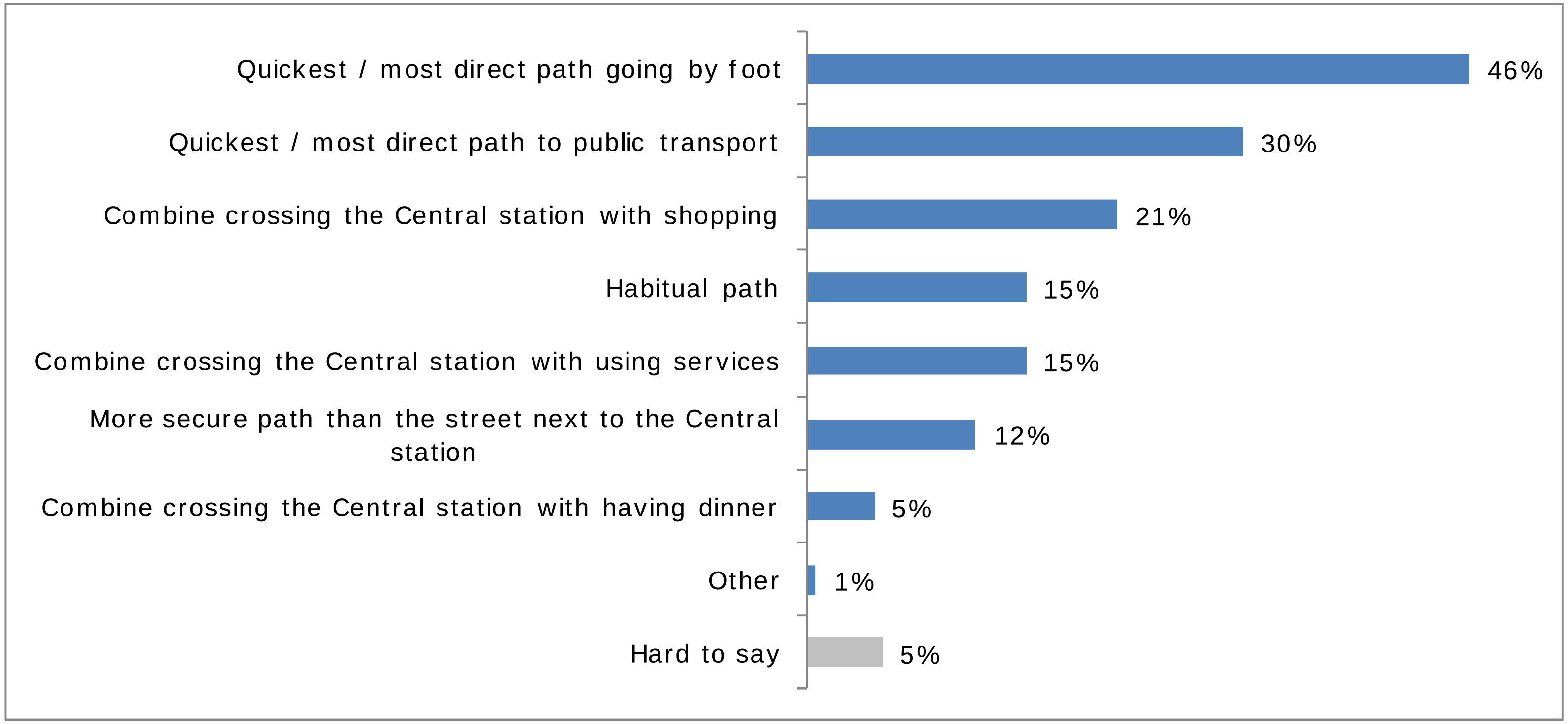
Purpose of visiting, using Central Station (pedestrians)

Q: On your everyday route while at the Central Station within the past four weeks, did you go through station tunnels?

Q: Why do you use Central Station tunnels on your everyday route?

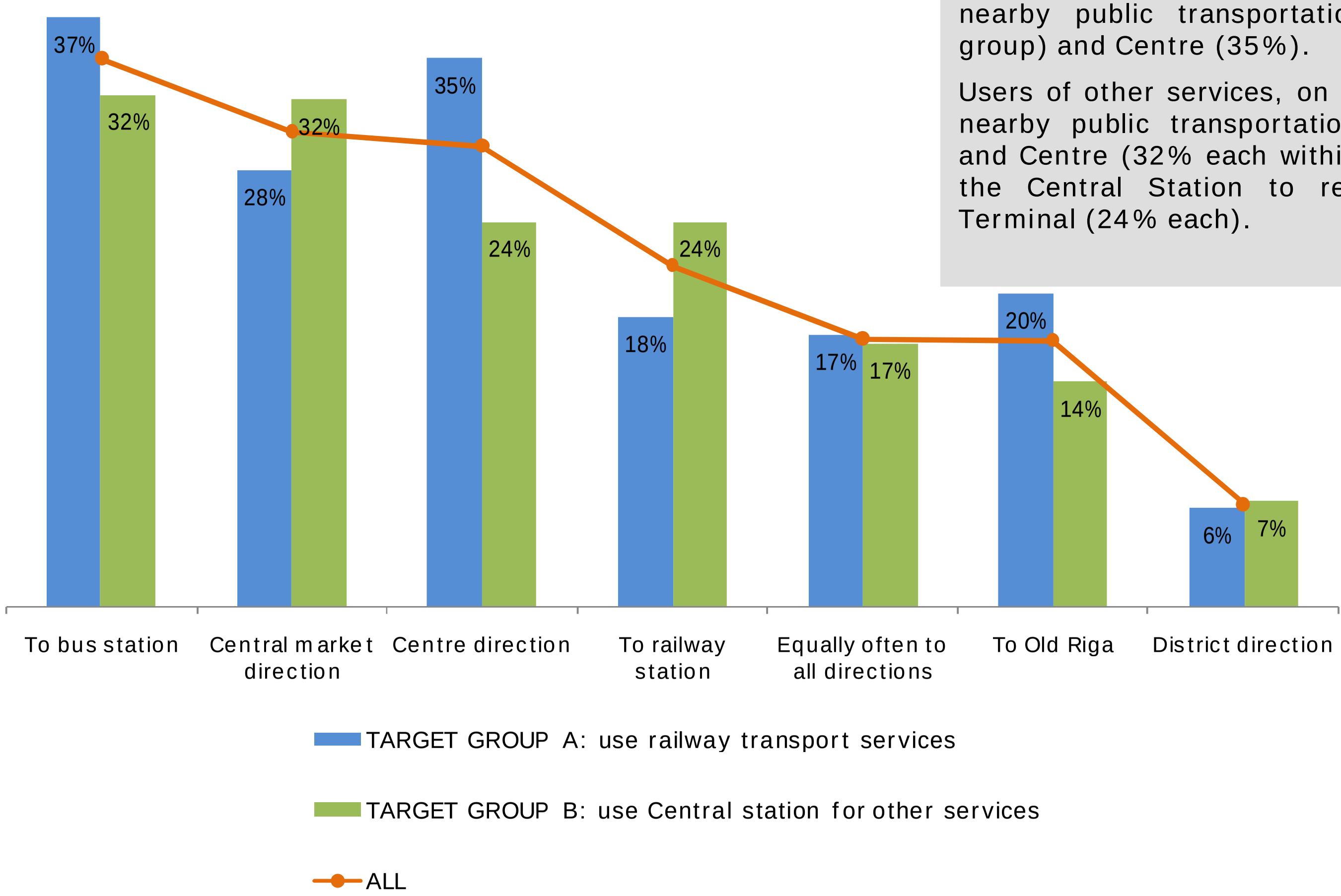
90% Central Station visitors (target group B) who do not use railway transportation services ordinarily go through station tunnels.

Their main reasons are a quicker and straighter route, combination of going through station tunnels with other habits (shopping, use of services).



Destinations from the Central Station

Q: In what direction do your most often head from the Central Station?



Destinations from the Central Station are diverse.

Destinations are: nearby public transportation stops (35%), Central Market (30%) and the Centre (29%).

Among train users (A), frequent destinations are nearby public transportation stops (37% for the group) and Centre (35%).

Users of other services, on the other hand – besides nearby public transportation stops, Central Market and Centre (32% each within the group) – also cross the Central Station to reach the Central Coach Terminal (24% each).

Base: all respondents, n=1160

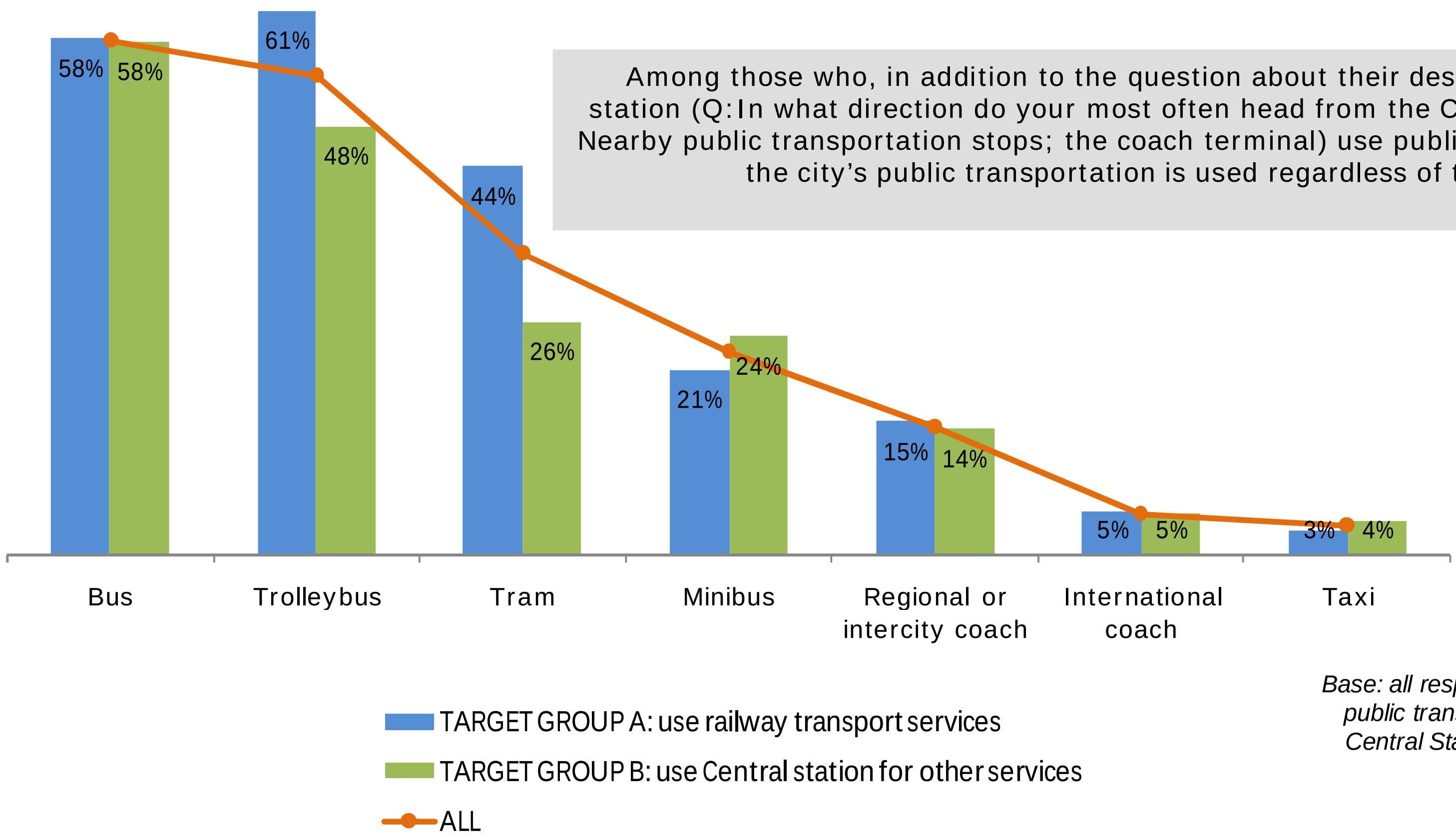
Use of public transportation near the Central Station

Q: Do you use public transportation near the Central Station?

Q: What types of public transportation have you used near the Central Station (Central Station/Central Market/Origo/Stockmann/Merķeļa iela)?

78 % of all respondents (Riga Central Station visitors during last month) use public transport near the Central Station.

Among those who, in addition to the question about their destination from the station (Q:In what direction do your most often head from the Central Station A: Nearby public transportation stops; the coach terminal) use public transportation, the city's public transportation is used regardless of the target group.



Base: all respondents, who use public transportation near the Central Station (in addition to Q2), n=429

Satisfaction with various aspects (1)

Satisfaction with aspects of the environment, information, infrastructure layout.

Q: To what extent are you satisfied with the following at the Central Station?

Most people visiting the Central Station are satisfied with a number of Central Station aspects.

87% of respondents (regardless of target group) (*here and further - exact answers*) with an opinion are satisfied with information about transportation timetables, 82% - with direction signs (at train platforms and Central Station exits), 81% - with access to train ticket windows.

75% are satisfied with Central Station area use, 62% - with cleanliness and 57% with safety.

With regard to environmental access for people with functional difficulties, almost half (47%) have no opinion, but 58% of all respondents in target group (all Central Station visitors) are dissatisfied with the waiting zone / spaces and 64% - among train passengers.

There is a weak but statistically significant difference between train passengers (A) and other Central Station visitors (B) in terms of their satisfaction with the Central Station area and the waiting zone/space.

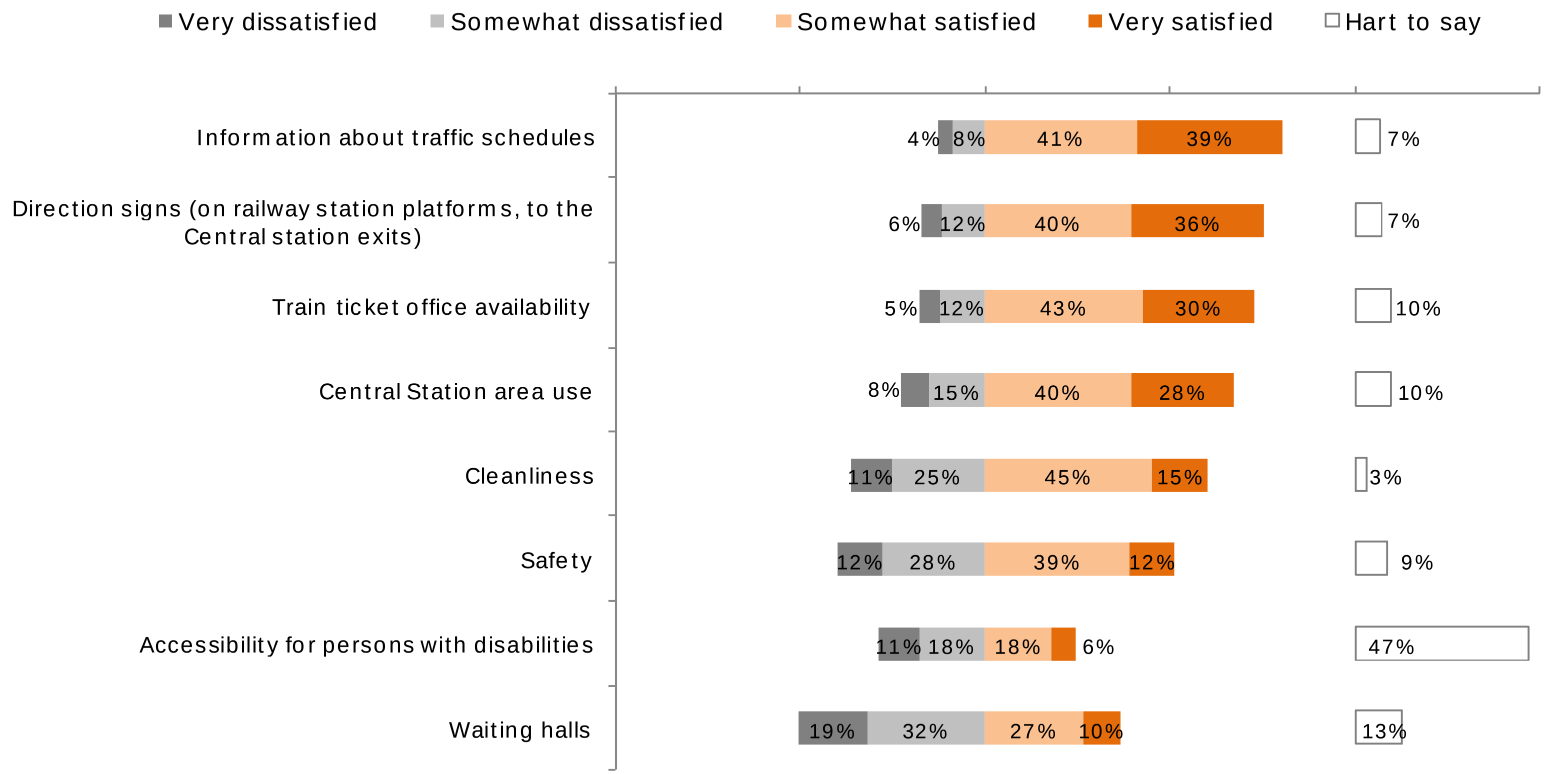
78% of train passengers (A) are satisfied with use of the Central Station area.

48% of users of other services (B) are satisfied with the waiting zone/space.

Satisfaction with various aspects (2)

Satisfaction with aspects of the environment, information, infrastructure layout.

Q: To what extent are you satisfied with the following at the Central Station?



Base: all respondents, n=1160

Evaluation of aspects

Satisfaction with aspects of the environment, information, infrastructure layout.

Q: To what extent do you agree with the following statements?

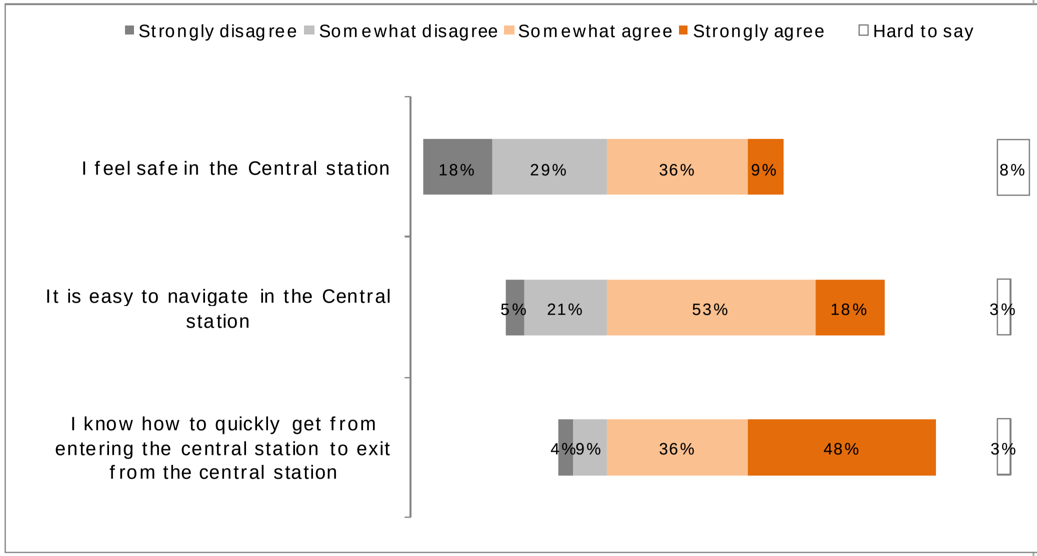
84% Riga Central station visitors know how to quickly get from an entrance to an exit, 71% also agree that finding one's way within the Central Station is easy.

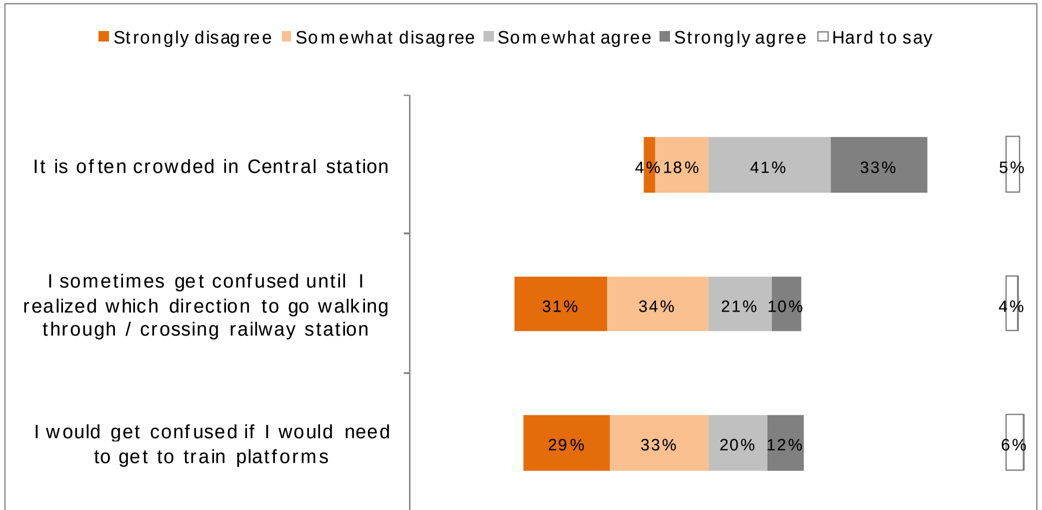
Opinions differ with regard to feeling safe at the Central Station. 45% agree that the Central Station makes them feel safe but 47% disagree.

With the opposite wording of the statement, the response is similar – 62% disagree that they would be confused in certain situations.

There are statistically significant differences between the target groups only for the statement "I would be confused if I had to get to a certain train platform".

37% of those who don't use trains (B) would be confused, 25% among train users would be confused, but 32% of all Riga Central station visitors would be confused if they had to get to a certain train platform.





Base: all respondents, n=1160

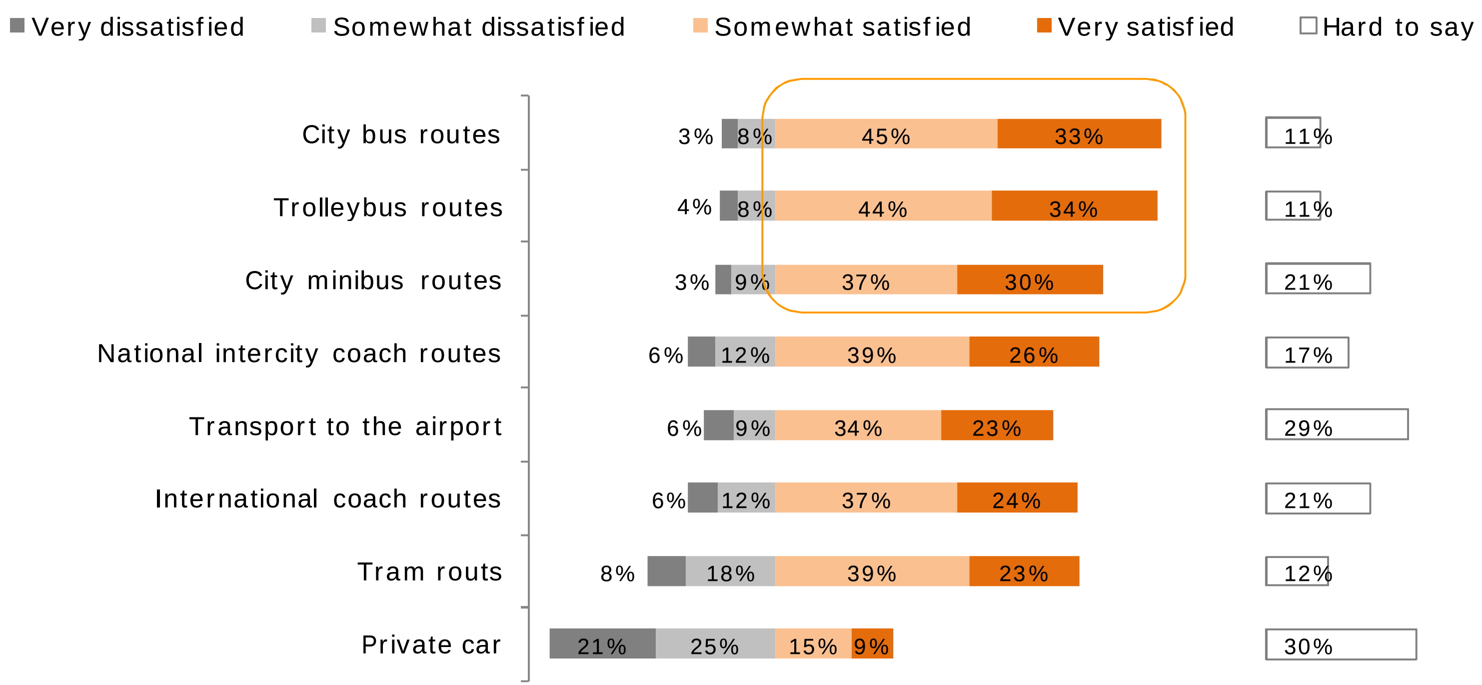
Satisfaction with how the Central Station connects to other means of transportation

Q: To what extent are you satisfied with access from the Central Station to other means of transportation?

More than ¾ of residents are satisfied with access to other Riga city transportation routes.

Satisfaction with getting to inter-city routes is in range between 61 to 65%.

46% of all respondents, or 66% with specific answers (i.e. excluding hard to say) are satisfied with access with a private vehicle.



The graph ranges average satisfaction in descending order. Base: all respondents, n=1160

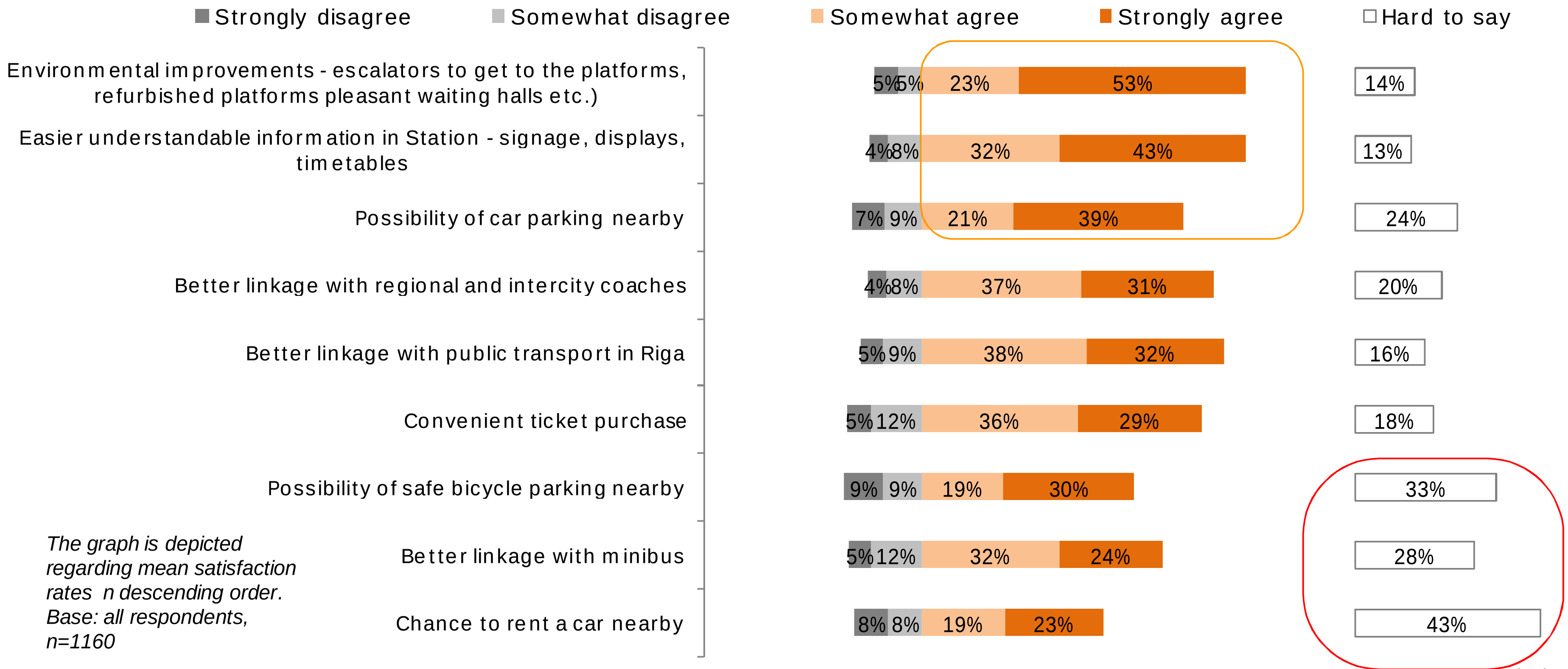
Impact of proposed improvements on use of Central Station railway traffic

Q: To what extent would proposed improvements encourage you to use train traffic from the Central Station?

Evaluations of proposed improvements are ambiguous. Some aspects cannot be evaluated by ⅓ or more of the people surveyed (connection for bicycles, vehicles, access to minibuses).

76% of Riga Cetral Station visitors agree that environmental improvements and 75% - that legibility of information on the premises of the station would be improvements that encourage use of railway traffic from the Central Station.

Vehicle parking (60%) and public transportation connections (68% to 70%) are also aspects that appear significant.



The graph is depicted regarding mean satisfaction rates n descending order. Base: all respondents, n=1160

Target group profile

Within the past four weeks, what has been purposes of visiting Central Station?

	ALL		TARGET GROUP A: use railway transport services		TARGET GROUP B: use Central station for other services	
	***		Total in target group		Total in target group	
	n	Col %	n	Col %	n	Col %
Went by train	538	46,4%	538	100,0%	0	0,0%
Saw to or from train	82	7,1%	36	6,7%	46	7,4%
Visited the mall Origo	538	46,4%	218	40,5%	320	51,4%
Visited other mall or service places	246	21,2%	88	16,4%	158	25,4%
Visited restaurants or cafes	155	13,4%	71	13,2%	84	13,5%
Walked through the railway station	536	46,2%	174	32,3%	362	58,2%
Other	15	1,3%	5	0,9%	10	1,6%
Total	1 160	100,0%	538	100,0%	622	100,0%

Base: all respondents, n=1160

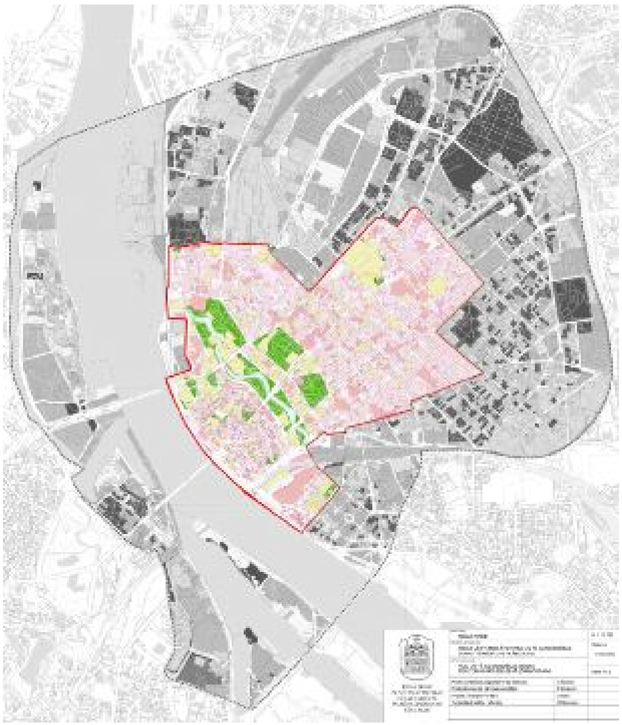
Base: all respondents, n=1160

Multiple-choice question, responses in the column could total >100%

Appendix WP 1.3 – Emerging Issues & Potentials for Development of RPTH

Appendix WP 1.3 - Emerging Issues & Potentials for Development of RPTH

1.1 Background



The Study is the whole central part of the capital city of Riga. Its boundaries and its buffer zone are specified in accordance with the integrity of the urban fabric and the effective protection of the important views of the site. It contains all elements necessary to express **Outstanding Universal Value**, namely the architectural monuments of respective historical styles of the medieval core; the semicircle of boulevards, dominated by harmonically balanced 19th century and early 20th century eclectic architecture and Art Nouveau; and the territory of former suburbs with buildings from the 18th to the 20th century, especially in wood. The outstanding panorama and visual perspectives of the Historic Centre of Riga reflect the effective protection of the important views of the property.

The integrity of the site is challenged by the loss of original substance and authenticity of the site attributes, and the low-quality new developments in the Historic Centre of Riga not respecting the scale, character and pattern of the historic environment. The overall coherence of the site is also vulnerable to the possible adverse impact of new developments in and outside of the buffer zone.

Figure 1: Riga World Heritage Historical Centre – UNESCO – Protected Historical Center and the Buffer Zone

The historic centre of Riga, while retaining its medieval and later urban fabric relatively intact, is of outstanding universal value by virtue of the quality and the quantity of its Art Nouveau/Jugendstil architecture, which is unparalleled anywhere in the world, and its 19th century architecture in wood.

Figure 2: Riga World Heritage Historical Centre

1.2 Study Area General View

The study area is presented below for easy reference

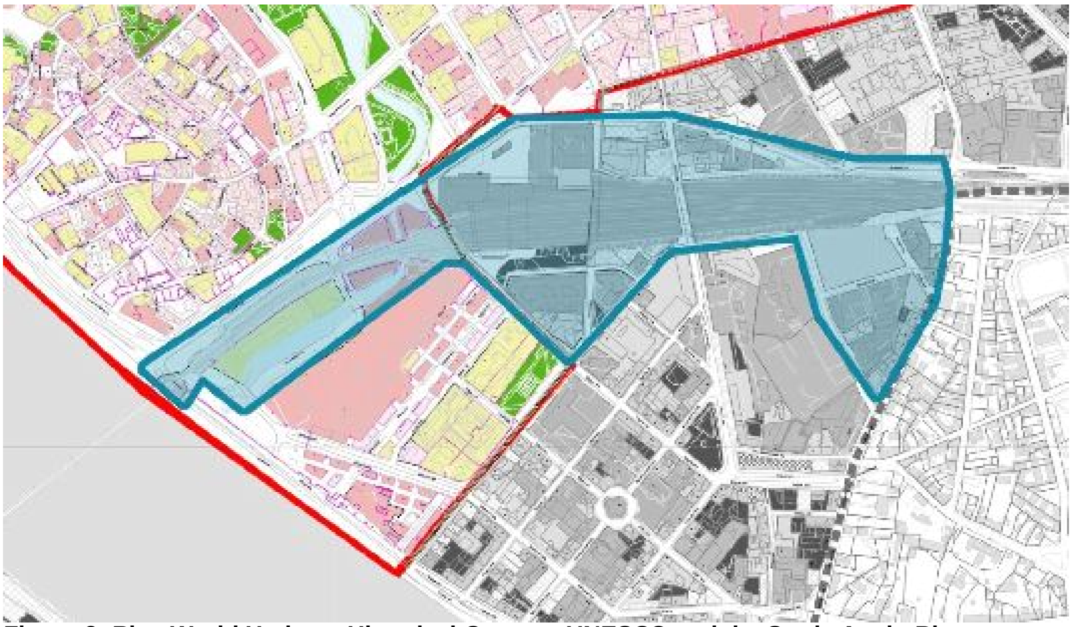


Figure 3: Riga World Heritage Historical Centre – UNESCO and the Study Are in Blue

The key physical features and the boundary defining parameters of the study area are presented in the following figures

Figure 4: Bridge, Bus Platforms and Central market

Figure 5: Bus Platforms and Station, Titaniks, Central Market and Cinemas-Stockmann

Figure 6: Titaniks, Cinema-Stockmann, Central Market, Local market, Train Station and Origo Gogola Street

Figure 7: Local market, Train Station, Origo, Ministry of Transport and Railway platforms.
Gogola Street

Figure 8: Railway tracks and Origo extension
Dzirnavu Street

1.3 Key Activity Zones

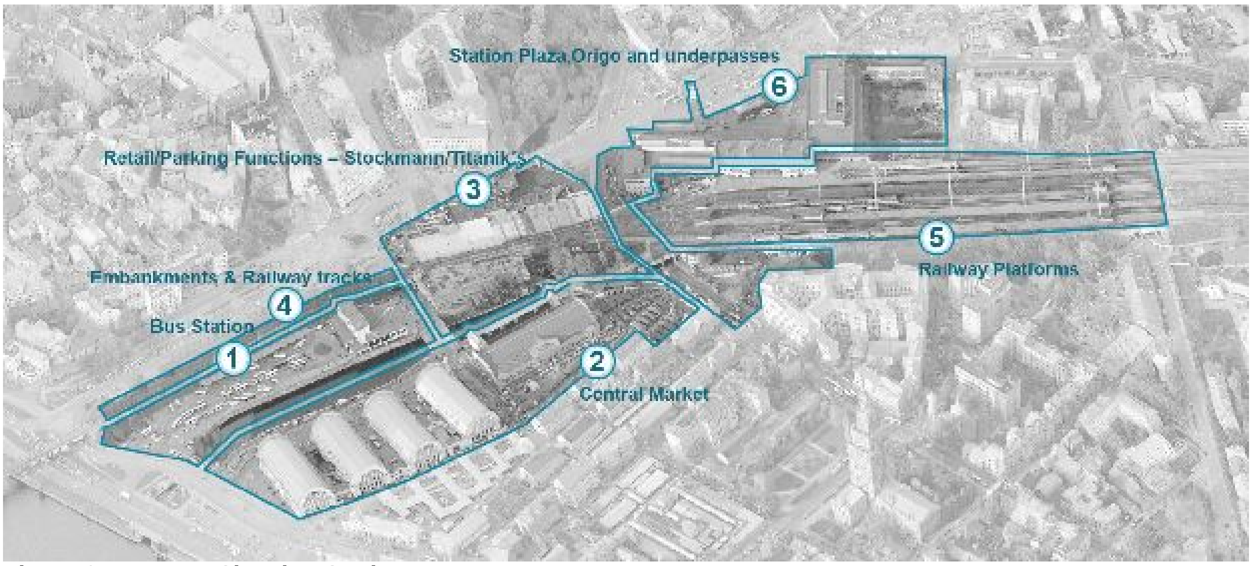


Figure 9: Key Map Showing Study Area Zones

Zone 1: Bus Station

Zone 2: Central Market

Zone 3: Retail/Parking Functions – Stockmann/Titaniks

Zone 4: Embankments and Railway tracks

Zone 5: Railway Platforms

Zone 6: Station Plaza,Origo and Underpasses

Further detailed descriptions of the various identified zones are presented below, with a view to highlighting the key challenges and constraints they present as of now, the opportunities that need to be created for developments and integration of these various physical factors

1.4 Zone 1:Bus Station

The layout of bus station and its various pockets of activities presents below

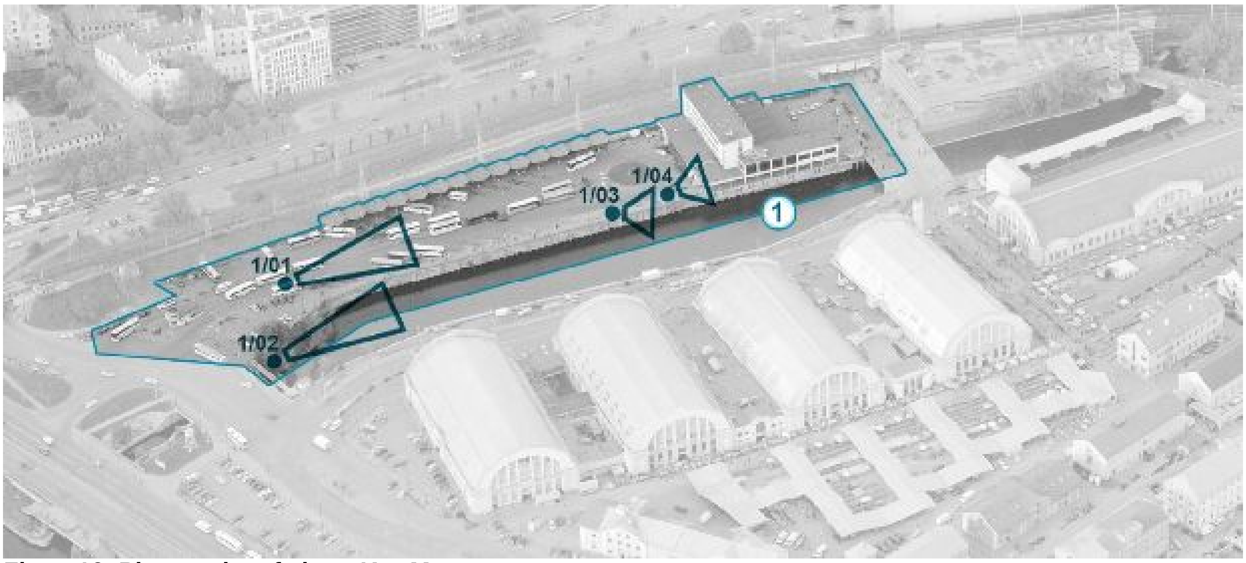
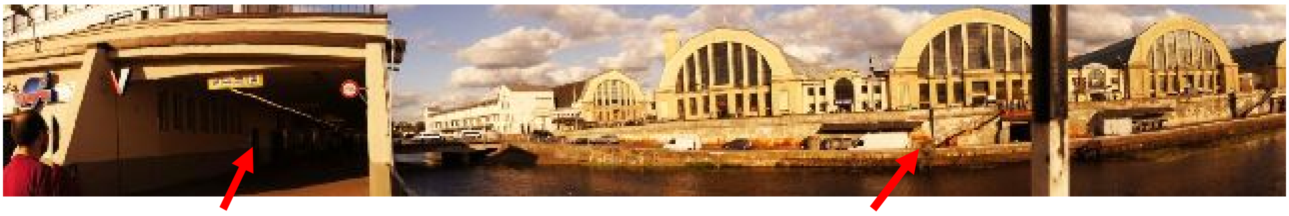


Figure10: Photo point of views Key Map

Figure 11: 1/01 Bus station

Figure 12: 1/02 Bus station and the river



Too narrow and dark pedestrian passages Beautiful views of the historical buildings of the central market

Figure 13: 1/03 Constraints and Opportunities

Detected weak points: There is no clear space for the pedestrians in any of the riversides.

Bus station riverside:

The sidewalk is too narrow.

There is no clear and big enough outdoor waiting area at the bus station. In summer, people waiting outside are blocking the walkway

Figure 14: Riverside Walk

We considered it prudent to compare the above described physical parameters with the riverside development of Bilbao, to demonstrate how these physical features could be harnessed and exploited to create a very lively and eco-friendly urban realm.

Case Study for Urban Integration of the river in the city: Bilbao, Spain

Figure 15: Upgrading of the riverside

Figure 16: Integrated tram in the landscaping

The pedestrian routes and connectivity on Riga riverside are shown in the following figures

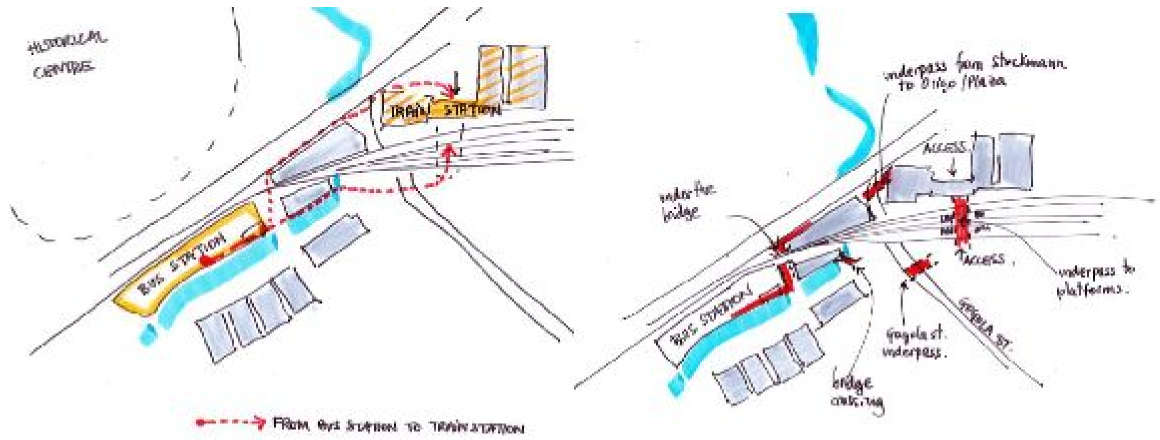


Figure 17: Confusing pedestrian journey options

There are two ways to reach the station but both are a long way finding many difficulties.

The underpasses of both ways are on different levels and across retail areas which makes the transit more difficult.

Main Challenge: The bus station is too far from the railway station and the access ways are too long and complicated. A direct and easy connection from the bus station to the new multimodal station is the main challenge.

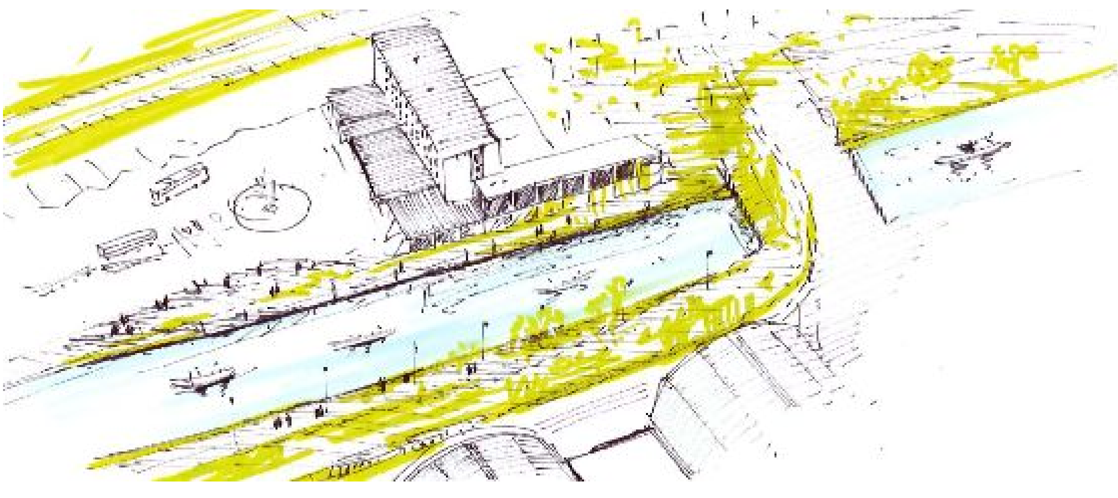


Figure 18: Connection between bus and rail station: graphical representation

1.5 Zone 2: Central Market

The main physical features of the central market zone are discussed below

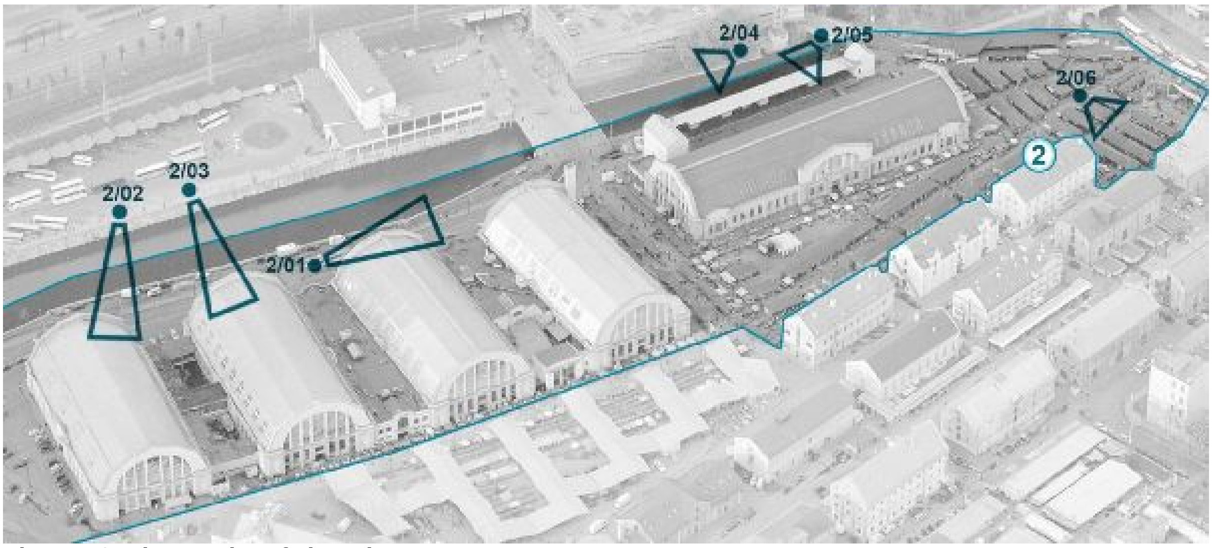


Figure 19: Photo point of views key map

Photo point of views Key Map

Central market riverside:

The central market side is used mainly for cars and the tram. The character of the main space in front of the main façades is wasted in benefit of a loading area. This space could be transformed its industrial character into a very pleasant public real, for people to walk and enjoy the adjoining ambience..

Figure 20: Central Market riverside uses

Potentialities: The surroundings are very beautiful and have a great potential for landscaping. The riverside should be recovered as a pleasant space to be for the pedestrians and a natural path for communicating different places in the city. The central market breathes the history of the city and the impressive curved buildings reflected on the water should become an iconic view and the area be regenerated.

Figure 21: 2/02 Central market. Historical buildings

Pedestrian walkways next to the historical building of the Central Market would give the city a new fresh and friendly image, combining the historical atmosphere with the nature of the water and the new vegetation and gardens. The annex volume attached to the historical market building means a back service facade which could be studied to be demolished and open a new riverside pathway for pedestrians on both sides of the river. The local market occupies a very good positioned land near the existing train station entrance that could be integrated in the alternatives.

Figure 22: Road Parallel to Natural River: Opportunity for Landscape Exploitation

Figure 23: 2/05 Annex building to the market historical building

Figure 24: Bird´s eye of Zone 2

Figure 25: Local Market

The above pictures clearly represent that the central market zone has a huge opportunity for landscape and public realm improvements, which could meet the following objectives for the city:

- Create an integrates RPTH
- Enhance the public realm quality of the area
- Make it a place of destination popular for tourists
- Improve the image of the zone and bring in regeneration

1.6 Zone 3: Retail/Parking Functions – Stockmann/Titaniks

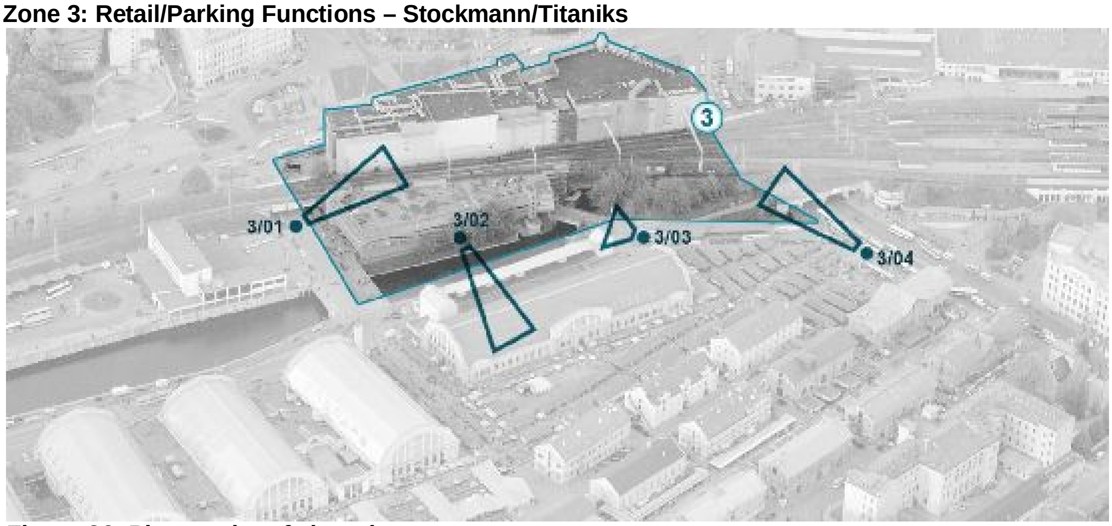


Figure 26: Photo point of views key map

The Titanik building blocks pedestrian flow to the station, the passage is hard for pedestrians for its narrowness, even though the views are beautiful to the river. Titanik car parking could be demolished and moved to another place and be able to free space for the new multimodal hub. There are many possibilities on this area for freeing land and connect the new terminal with the bus station..

Figure 27: 3/01 Titanik´s building

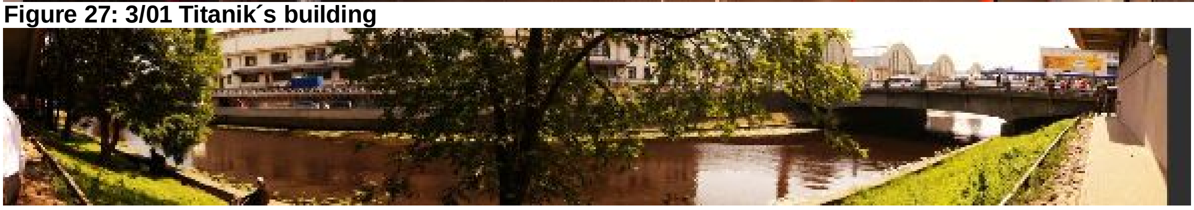


Figure 28: 3/02 Car parking riverside

Figure 29: 3/03 Titanik´s building

Figure 30: 3/04 Gogola Street (Stockmann)

The above pictures show the issues of the Titanic building. This not only creates a barrier between the rail terminal and the regional bus station, but also attracts undesirable car traffic to the parking and create servere space constraints on the riverside walk. Removal of this building will open up many design opportunities in the study area to meet the project objectives.

1.7 Zone 4: Embankments and Railway Tracks

Figure 31:View of the railway embankments

This embankment is an important barrier between the historic centre and the south of the city. A connection between both areas by removing a part of this embankment will increase the opportunities for urban regeneration of this area. Pedestrian access to the canal and the Central Market should be one of the main goals of future interventions.

1.8 Zone 5: Railway Platforms

The description of salient physical characteristics if the existing railway platforms are explained below

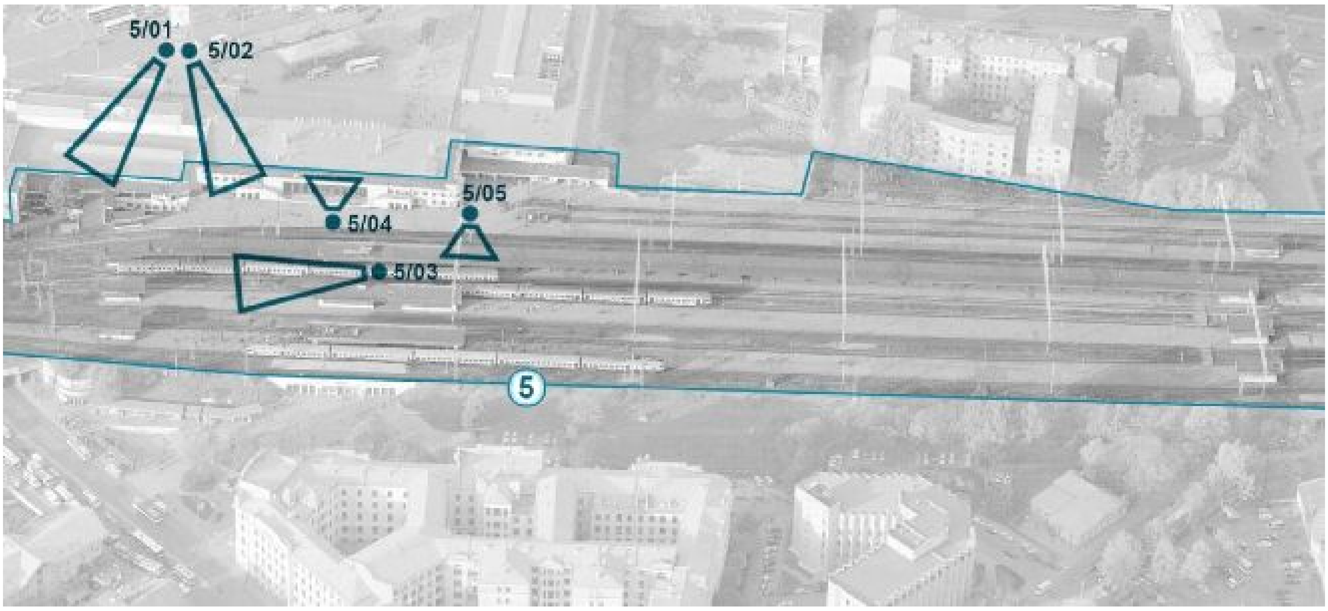


Figure 32: Photo point of views Key Map


Figure 33: 5/01 Arial view of the platforms


Figure 34:5/02 Zoomed on view of the platform and tracts

Figure 35: 5/03 Off peak platform operations

The main observation was that platforms are below the train levels and very dated, so the accessibility will be a priority in all alternatives. Ideally the platforms should be elevated to reach the train level and ensure the easy access to the trains.

Figure 36 5/04: View of the station from platform level.

Figure 37: 5/05: Height difference when boarding trains.

1.9 Zone 6: Station Plaza, Origo and Underpasses

The main access to the existing station and the circulation area between the station plaza, Origo shopping centre and the underpass are outlined below.

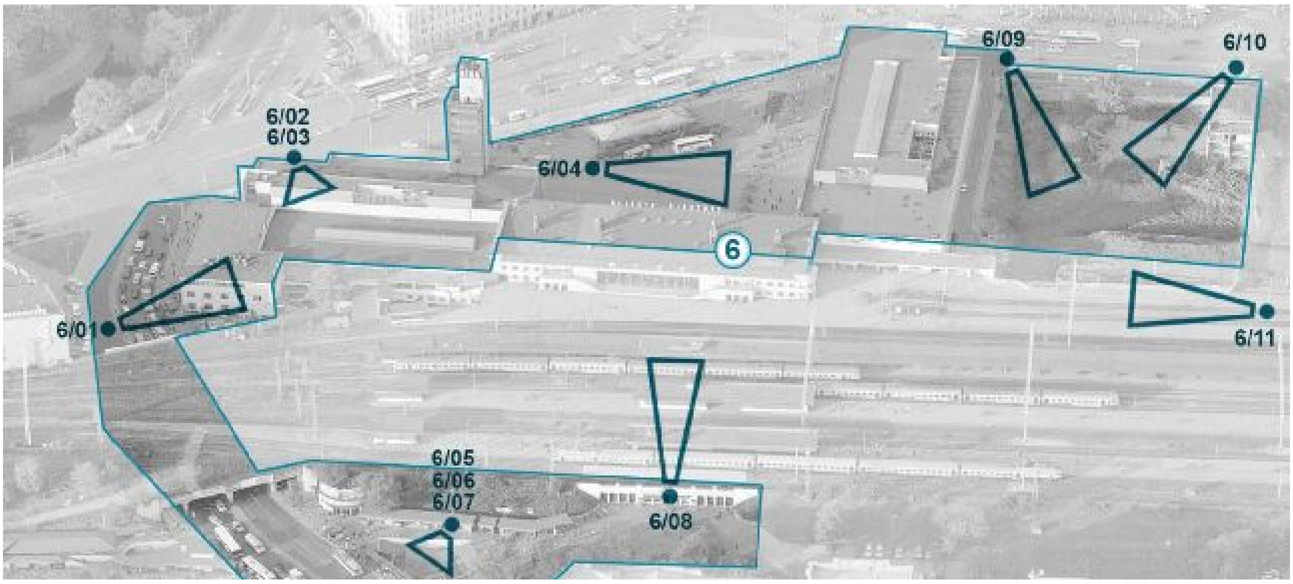


Figure 38: Photo point of views Key Map

Figure 39: 6/01 Underpass accessing from Stockmann to Origo

Figure 40: 6/02 Retail at the Underpass accessing from Stockmann to Origo

Figure 41: 6/03 Access to underpass from station plaza

Figure 42: 6/04 Station and Origo Plaza

Figure 43: 6/05 Access to Underpass at Gogola Street

Figure 44: 6/06 Underpass at Gogola Street

Figure 45   6/07 Underpass at Station/Origo Access

Figure 46: 6/08 Station/Origo Accesses

The Origo planned extension consists of a 5 storeys building that occupies the entire block next to the existing Origo volume.

Figure 47: Proposed Origo extention site

Figure 48: The proposed Origo extention

The above pictures show the zone 6 to be a very active and lively zone already. However, keeping in view the rise in travel demand and further commercial growth of the Origo shopping centre a considerable amount of design interventions will be required at the next stages of the project.

Appendix WP 1.3 – Property Ownership

Seq.No. / *Nr.p.k*	Cadastral No. / *Kadastra nr.*	Address / *Adrese*	Ownership / *Piederība*
1	1000040040	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
2	1000042021	Prāgas iela 1	Legal entity property / posession *Juridiskas personas īpašums/valdījums*
3	1000040069	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
4	1000042011	13. janvāra iela 12	State property / posession *Valsts īpašums/valdījums*
5	1000040166	13. janvāra iela 5	Municipal property /posession *Pašvaldības īpašums/valdījums*
6	1000040080	Nēģu iela 1	Municipal property /posession *Pašvaldības īpašums/valdījums*
7	1000042030	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
8	1000040161	Spīķeru iela 8	Municipal property /posession *Pašvaldības īpašums/valdījums*
9	1000040071	Centrāltirgus iela 1	Municipal property /posession *Pašvaldības īpašums/valdījums*
10	1000040069	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
11	1000042011	13. janvāra iela 12	State property / posession *Valsts īpašums/valdījums*
12	1000040167	Prāgas iela 2	Municipal property /posession *Pašvaldības īpašums/valdījums*
13	1000040015	Prāgas iela 2A	Municipal property /posession *Pašvaldības īpašums/valdījums*
14	1000042005	Prāgas iela 2	Legal entity property / posession *Juridiskas personas īpašums/valdījums*
15	1000040071	Centrāltirgus iela 1	Municipal property /posession *Pašvaldības īpašums/valdījums*
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20	1000042027	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
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22	1000042011	13. janvāra iela 12	State property / posession *Valsts īpašums/valdījums*
23	1000040170	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
24	1000040172	13. janvāra iela 8	Municipal property /posession *Pašvaldības īpašums/valdījums*

25	1000042004	Stacijas laukums 2	State property / posession *Valsts īpašums/valdījums*
26	1000040166	13. janvāra iela 5	Municipal property /posession *Pašvaldības īpašums/valdījums*
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28	1000042015	Stacijas laukums 2	State property / posession *Valsts īpašums/valdījums*
29	1000049001	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
30	1000040003	Marijas iela 2A	Legal entity property / posession *Juridiskas personas īpašums/valdījums*
31	1000042010	Stacijas laukums 1	Legal entity property / posession *Juridiskas personas īpašums/valdījums*
32	1000042003	Stacijas laukums 4	State property / posession *Valsts īpašums/valdījums*
33	1000049004	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
34	1000049002	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
35	1000049006	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
36	1000050036	Raiņa bulvāris 33	Legal entity property / posession *Juridiskas personas īpašums/valdījums*
37	1000050035	Marijas iela 1	Legal entity property / posession *Juridiskas personas īpašums/valdījums*
38	1000050023	Merķeļa iela 1	Legal entity property / posession *Juridiskas personas īpašums/valdījums*
39	1000310045	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
40	1000312050	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
41	1000319006	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
42	1000059007	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
43	1000050022	Merķeļa iela 12	No data / *Nav datu*
44	1000049003	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
45	1000059012	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
46	1000042030	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
47	1000040071	Centrāltirgus iela 1	Municipal property /posession *Pašvaldības īpašums/valdījums*
48	1000042011	13. janvāra iela 12	State property / posession *Valsts īpašums/valdījums*
49	1000042024	No address / *Bez adreses*	Municipal property /posession *Pašvaldības īpašums/valdījums*
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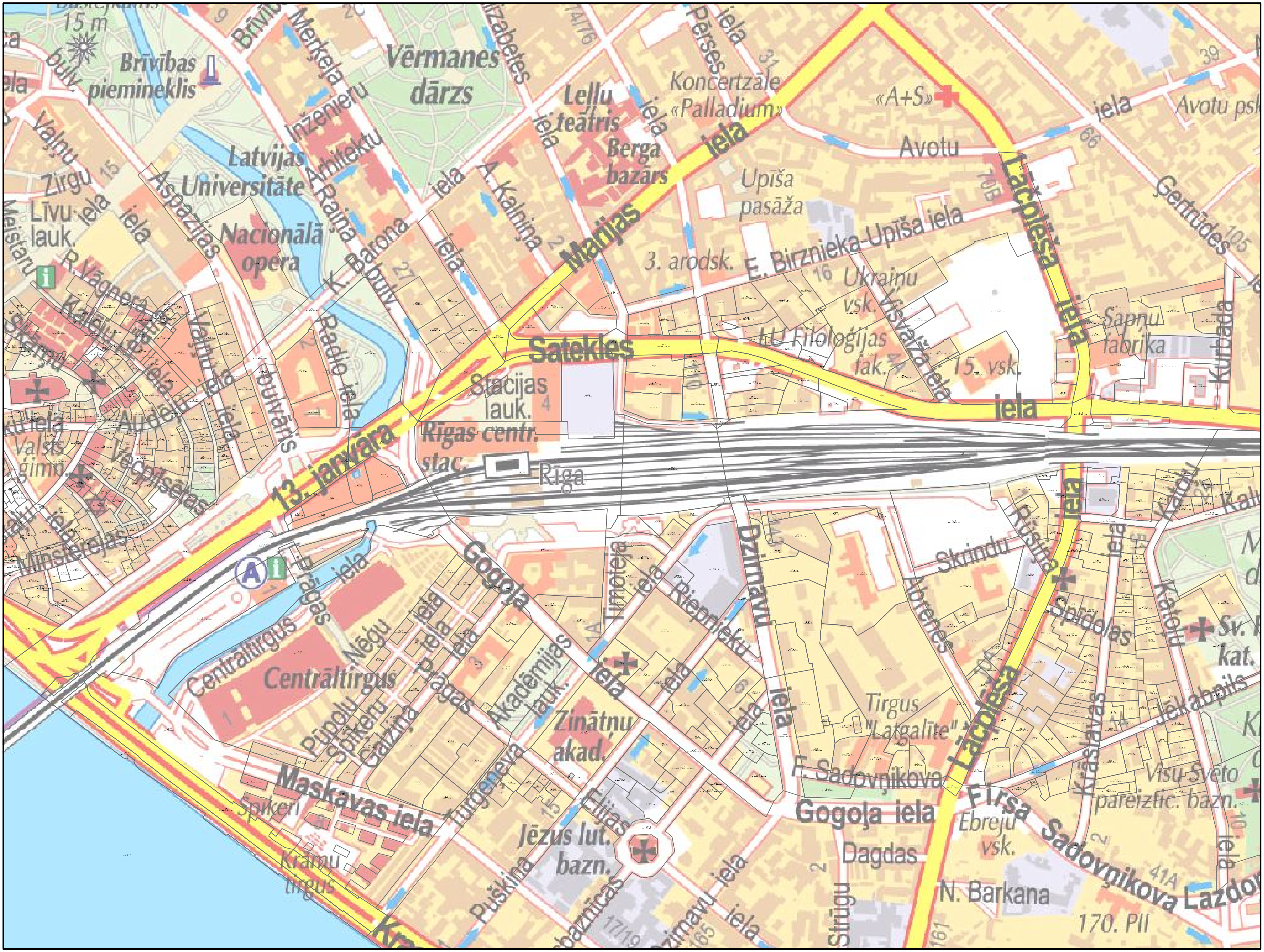

Brīvības piemineklis
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Vērmanes dārzs
Leļļu teātris
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Koncertzāle «Palladium»
«A+S»
Avotu iela
Lāčplēša iela
Ģertrūdes
Upīša pasāža
E. Birznieka-Upīša iela
3. arodsk.
Ukraiņu vsk.
Visvalža iela
LU Filoloģijas fak.
15. vsk.
Sapņu fabrika
Kurbada
Marijas iela
Satekles iela
Stacijas lauk.
Rīgas centr. stac.
Rīga
13. janvāra
Latvijas Universitāte
Nacionālā opera
Aspazijas
Raiņa bulv.
K. Barona
Radio iela
bulvāris
Inženieru
Arhitektu
Merķeļa
Elizabetes
A. Kalniņa
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Avotu
Zirgu
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Meistaru
R. Vāgnera
Kaļķu
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Minsterejas
Prāgas iela
Centrāltirgus
Nēģu
Pūpolu
Spīķeru
Gaizinā
Akadēmijas lauk.
Zinātņu akad.
Gogoļa iela
Timoteja iela
Riepnieku iela
Dzirnavu iela
Skrindu
Abrenes
Tirgus "Latgalīte"
F. Sadovņikova
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Krāmu tirgus
Turgeņeva
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Elijas
Puškina
Baznīcas
Dagdas
Strūgu
N. Barkana
Ebreju vsk.
Firsa Sadovņikova
Lazdo
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Spīdolas
Krāslavas
Katoļu
Jēkabpils
Visu Svēto pareizlic. bazn.
Sv. kat.
Kalna
Kr

Appendix WP 1.5 & 1.6 – Demand Forecasting Note

Technical Note

AECOM

Project:	**Rail Baltica Latvia Intermodal Terminal Joint Venture**	
Subject:	**RPTH Demand Forecasting**	
Prepared by:	**Stuart Fraser**	Date: 02/11/15
Checked by:	**Antony Kivistik**	Date: 09/11/15
Approved by:	**Samya Ghosh**	Date: 10/11/15

1.1 Introduction

As a first stage in the demand forecasting process we have researched historic, economic and transport demand trend data from a variety of data sources. This data has been gathered to help determine an appropriate robust forecast of demand to, from and through the study area. As required, rail, road, air and population statistics have all been considered.

1.2 Trends from 2003-2013

In order to gain an understanding of the current demand trends we have gathered and reviewed data from a number of sources which includes EUROSTAT, AECOM 2011 Rail Baltica Feasibility Study, RIX Aviation Industry Trends and PV Passenger Train Activity Strategy 2015 – 2020.

Figure 1.1 shows the average annual population in Riga between 2009 and 2012, compared with the average annual population in Latvia between 2006 and 2014 in **Figure 1.2**. It can be seen that the population in Latvia, and Riga within it, have decreased.

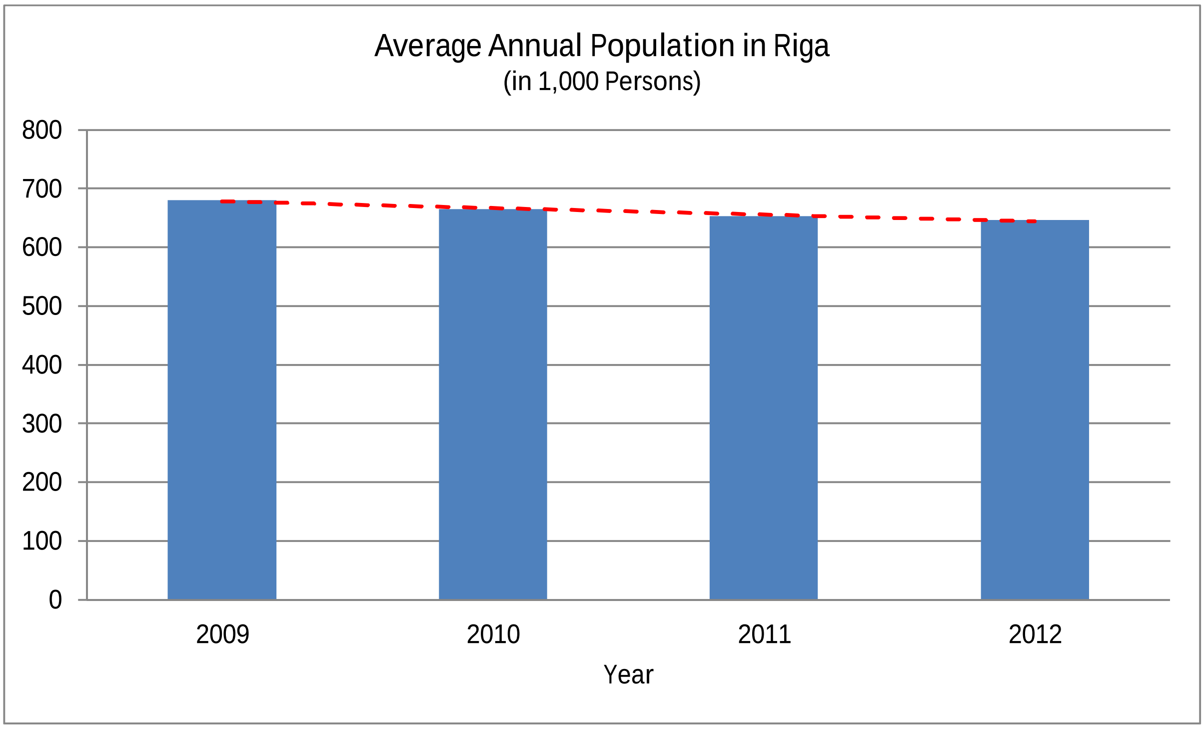


Figure 1.1: Average Annual Population in Riga (in 1,000 persons)
Source: EUROSTAT

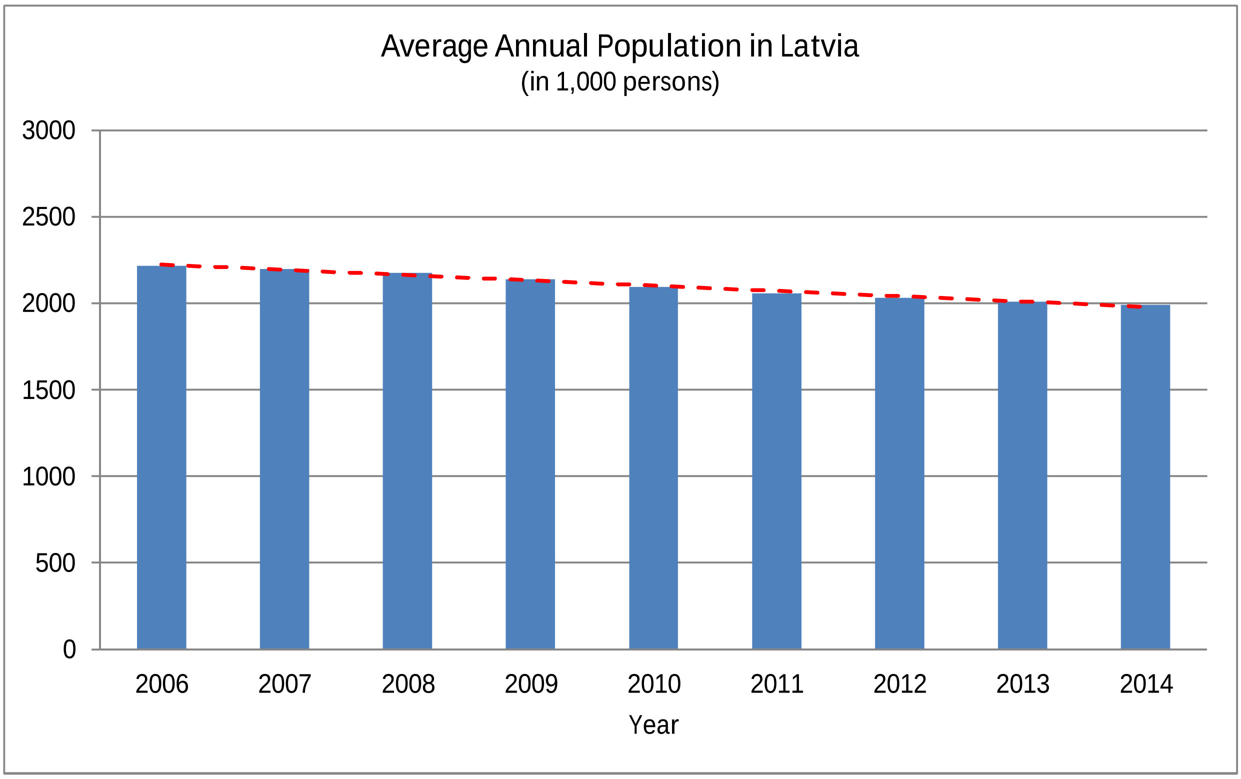


Figure 1.2: Average Annual Population in Latvia (in 1,000 persons)
Source: EUROSTAT

A number of comparisons have been made between Riga, Pieriga and Latvia in order to assess the trends over similar periods. The analysis compared the change in population, employment, GDP and Mean Disposable Income. **Figures 1.3 – 1.6** detail the results of the analysis.

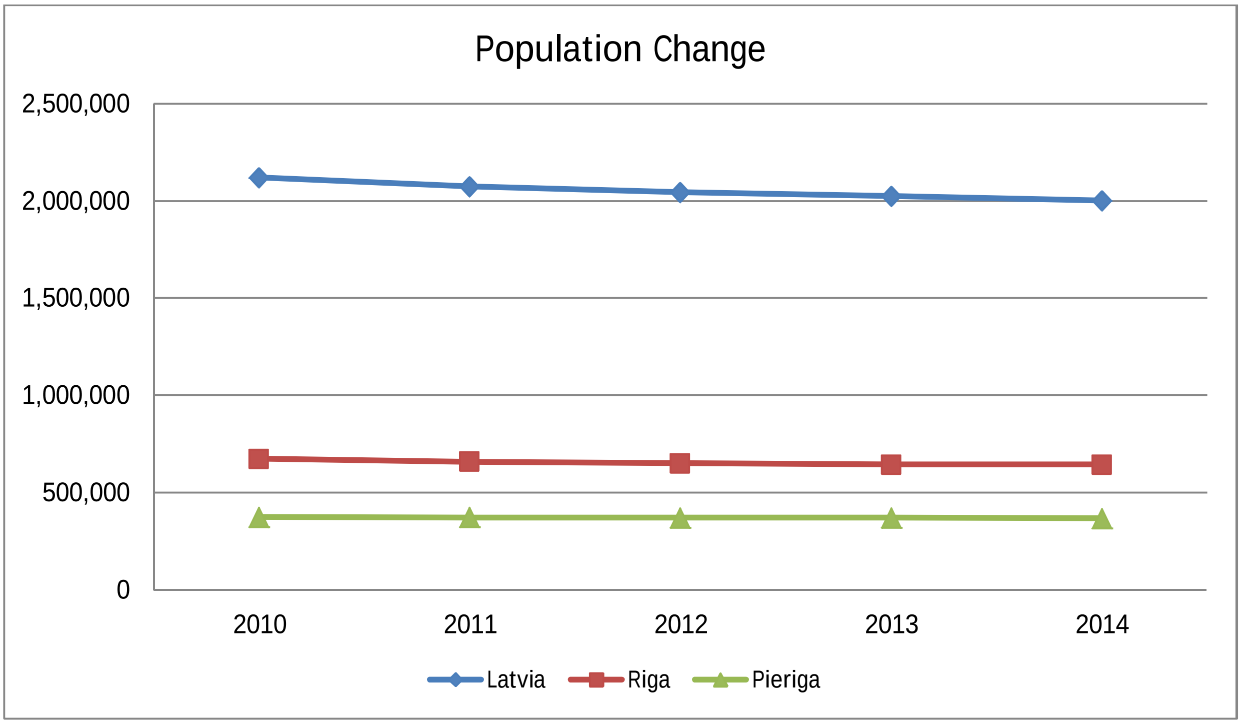


Figure 1.3: Change in Population (in 1,000 persons)
Source: EUROSTAT

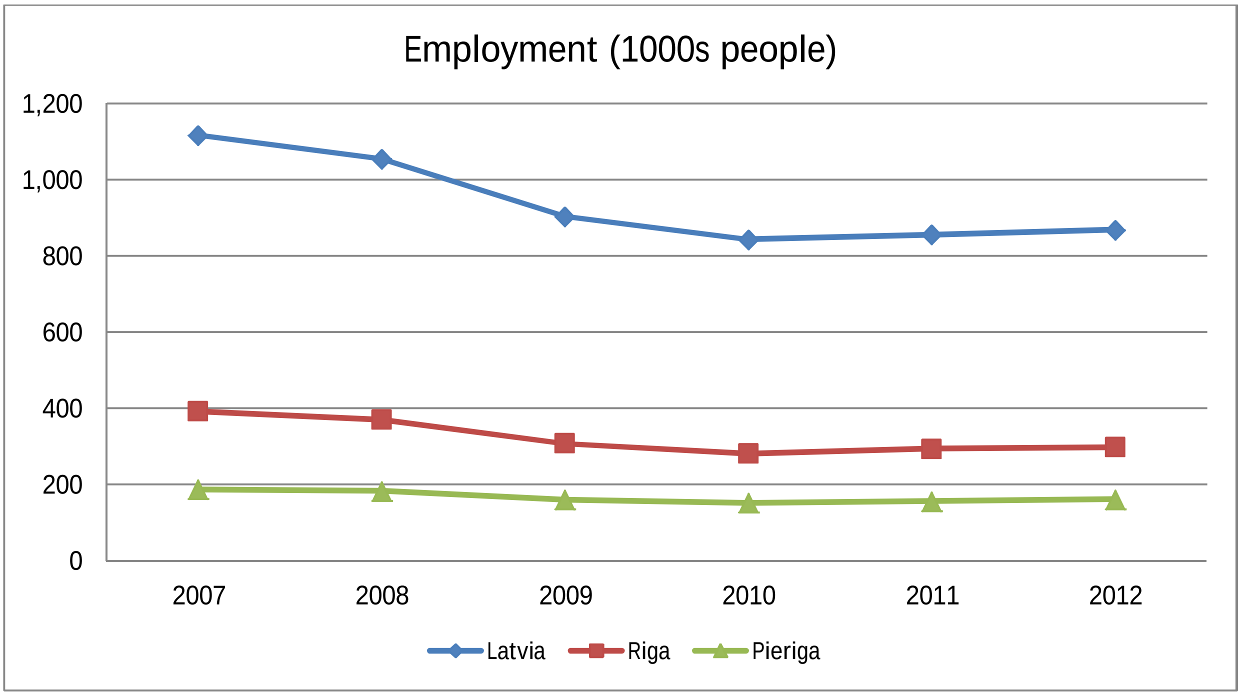


Figure 1.4: Change in Employment (1,000s people)
Source: EUROSTAT

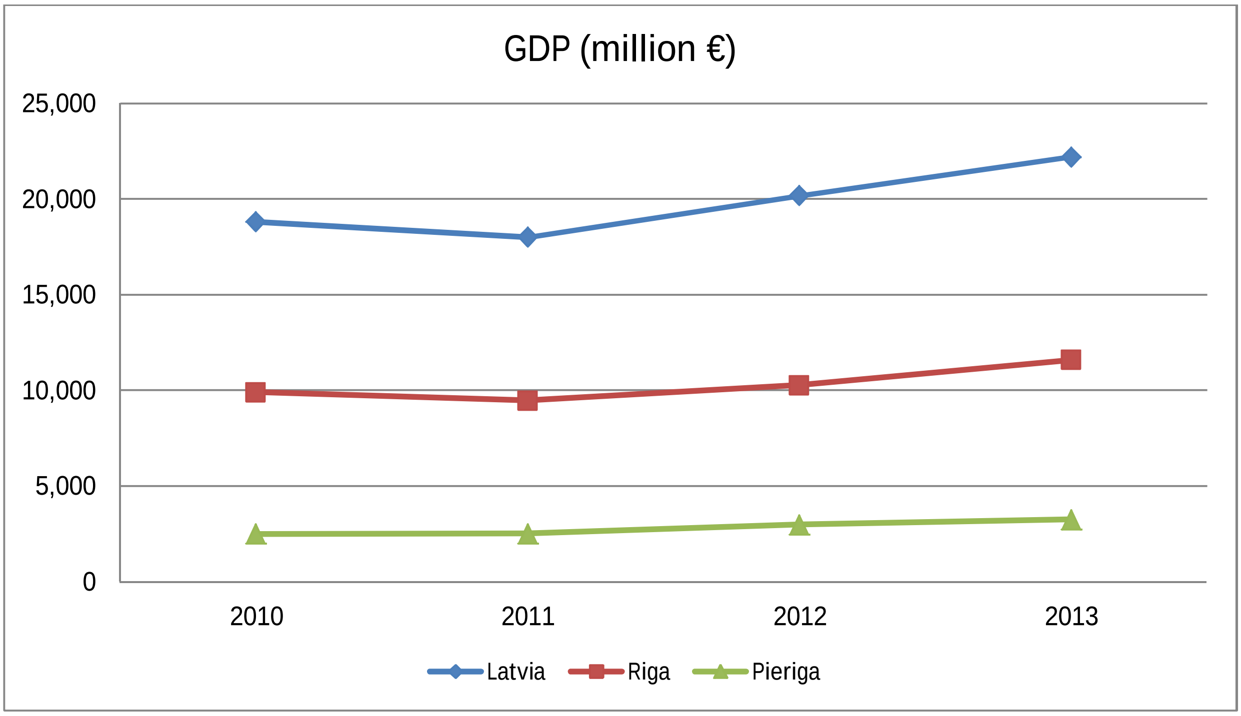


Figure 1.5: Change in GDP (million €)
Source: EUROSTAT

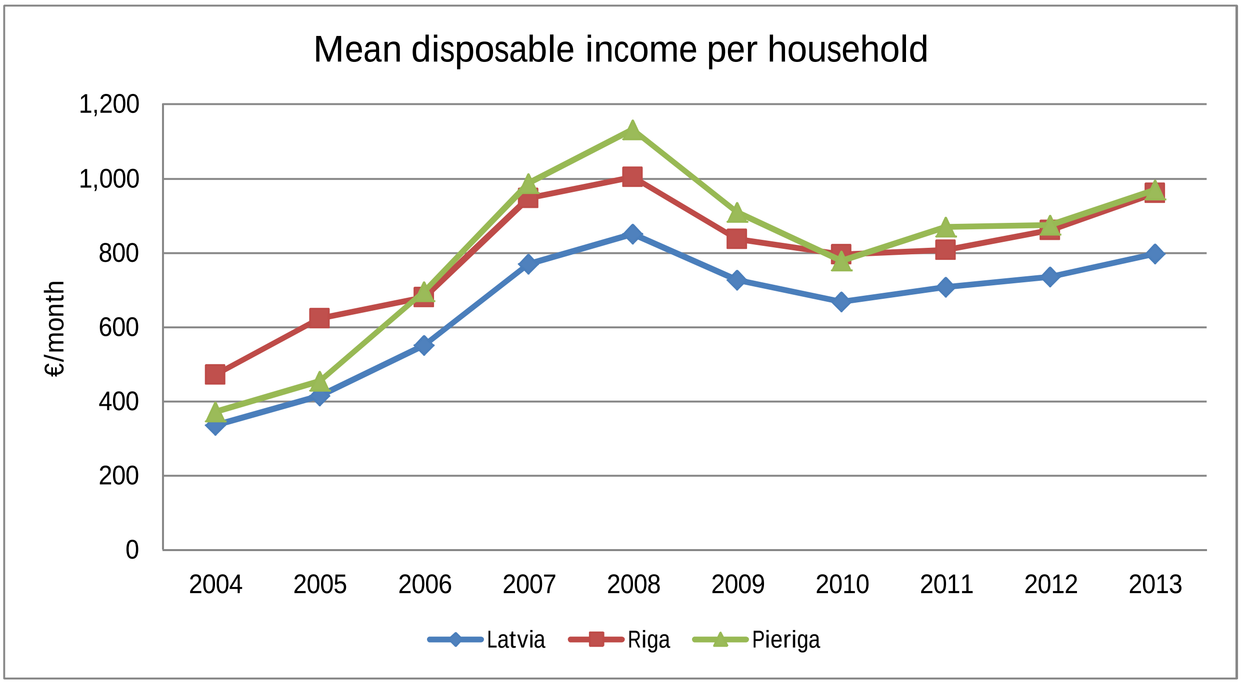


Figure 1.6: Change in Mean Disposable Income per Household
Source: EUROSTAT

The results shown in **Figures 1.3 – 1.6** above, demonstrate that Riga, Pieriga and Latvia share very similar trends.

Following a review of the total annual railway passenger transport demand, a reduction in passenger usage between 2008 and 2009 is evident. The demand continues to show a declining trend thereafter.

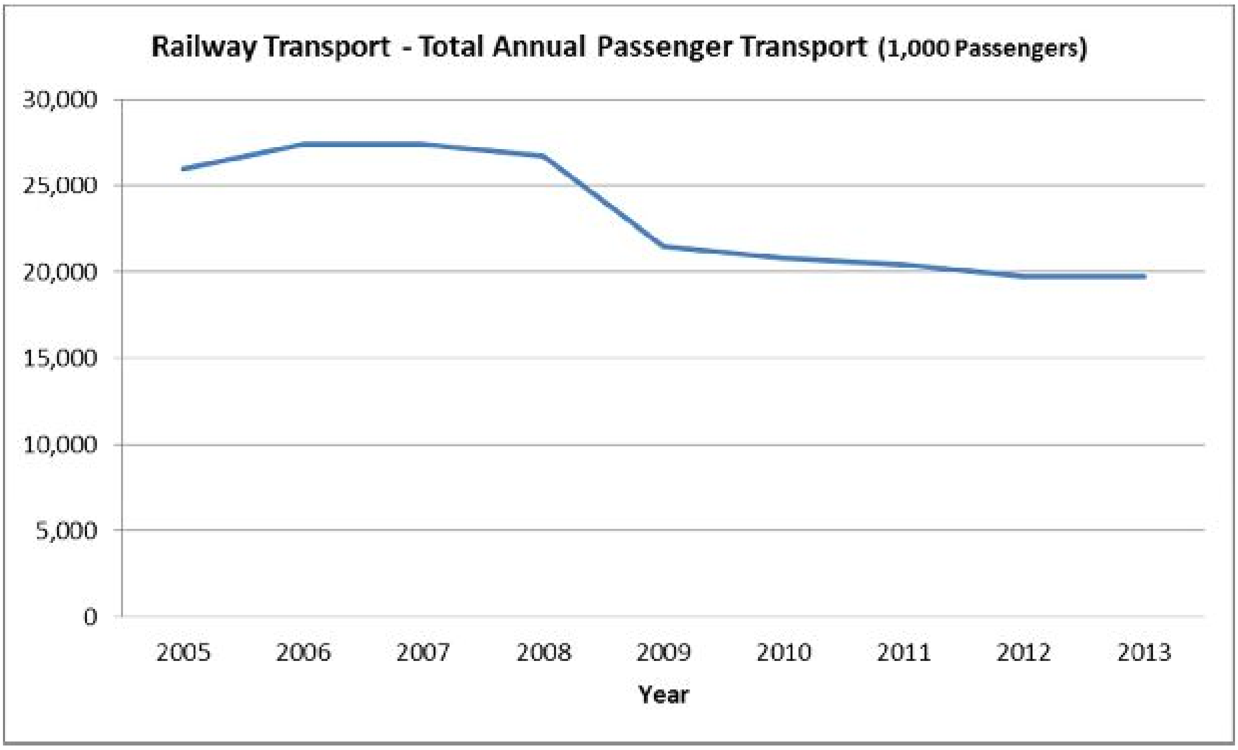


Figure 1.7: Railway Transport – Total Annual Passenger Transport in Latvia (in 1,000 persons)
Source: EUROSTAT

Factors behind this reduction include; outdated rolling stock, ticketing, platforms, public transport system, financial crisis and population decline all of which were contributing factors to the decline. However, during 2012 and 2013 the decline slowed and almost levelled out.

Private vehicle demand has also seen a decrease since 2008, as per **Figure 1.8**, with trends levelling out between 2011 and 2013.

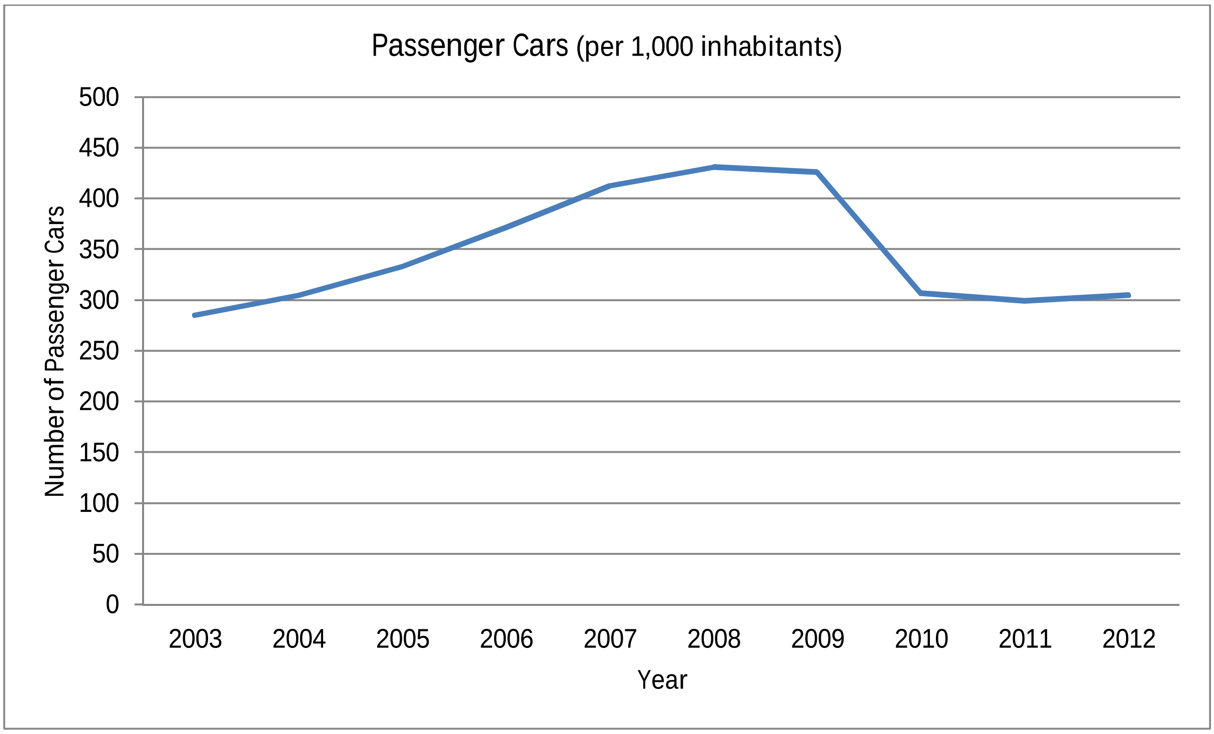


Figure 1.8: Passenger cars in Latvia per 1,000 inhabitants
Source: EUROSTAT

This is also reflected in the volume of passenger transport (relative to GDP), **Figure 1.9**, which experienced a decrease from 2009 to 2011 and subsequently levelling out by 2013.

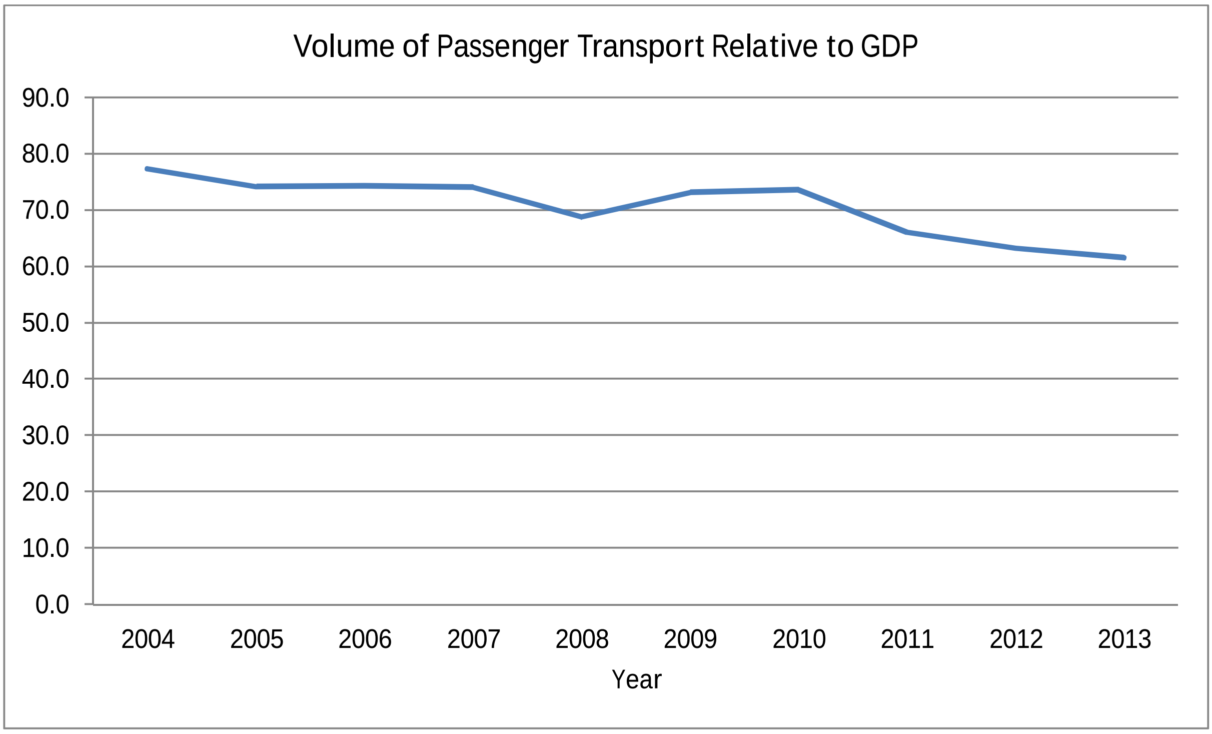


Figure 1.9: Volume of Passenger Transport Relative to GDP – the ratio between passenger transport modes (passenger km's) and GDP indexed as 2,000 pkm = 100 GDP
Source: EUROSTAT

It should be noted that modal split between train, private car and bus has remained consistent between 2004 and 2013 as per **Figure 1.10**. This is despite the demand fluctuations throughout that period.

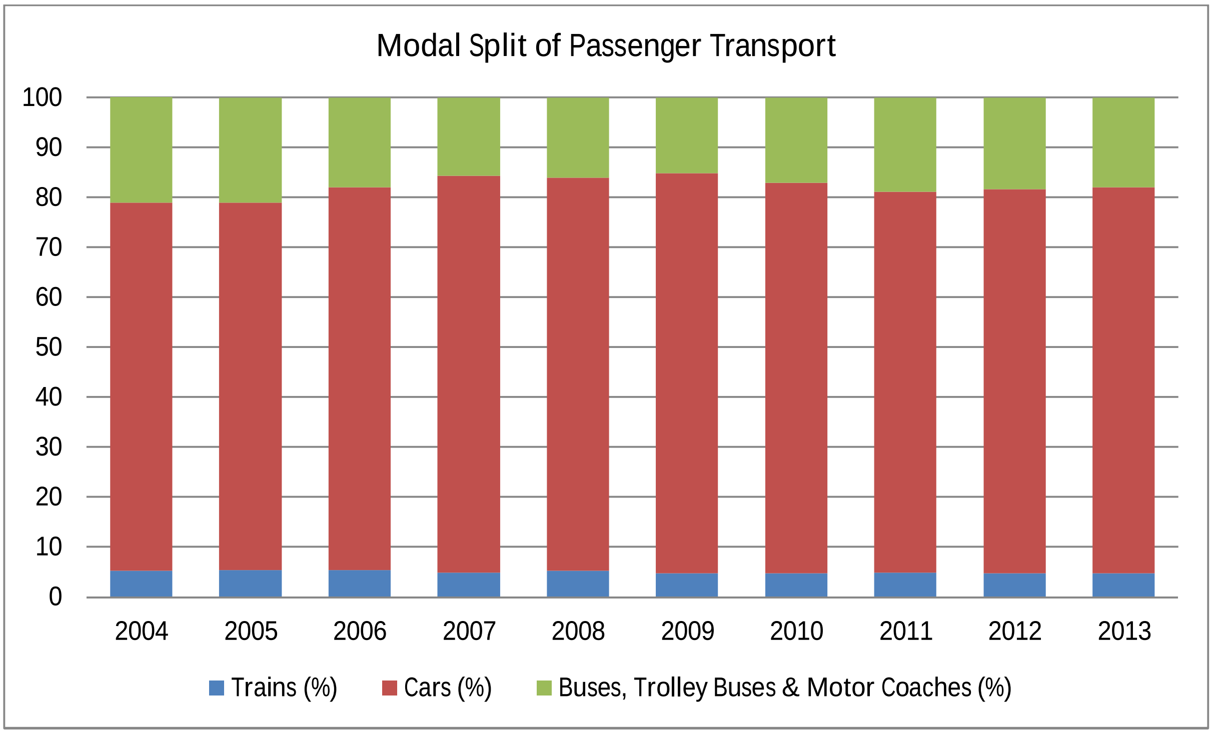


Figure 1.10: Latvia Modal Split of Passenger Transport
Source: EUROSTAT

1.3 Existing sources of forecasting

The existing trend data presented in **Figure 1.1** to **Figure 1.10** between 2003 and 2014 suggests that following a decrease in 2008, demand trends have slowly levelled out in recent years.

In order to forecast beyond 2015 a number of data sources have been reviewed which include:

- AECOM 2011 Rail Baltica Feasibility Study;
- RIX Aviation Industry Trends;
- JSC "Pasažieru vilciens" /"Passenger train"/Activity Strategy 2015 – 2020; June 30, 2015;
- Riga, 2014: Sustainable Development Strategy of Riga until 2030 and Development Programme of Riga for 2014-2020;
- The Study of Trip Attraction Rates of Shopping Centres in the City of Riga, Latvia;
- Eurostat Data;
- Autoosta Bus Data;
- Space Syntax Urban Study, 2009;
- Centralas Statistikas Parvaldes Datubazes;
- European Commission;
- Mobility Plan and Action Program for Riga and Pieriga;
- Ernst & Young Rail Baltica Demand Forecasts; and
- Latvian Railways Forecast Train Services.

In accordance with the 2011 Rail Baltica Feasibility Study, the population of Latvia is forecast to decrease between 2015 and 2050 by an average of -0.18% per year as shown in **Figure 1.11** below.

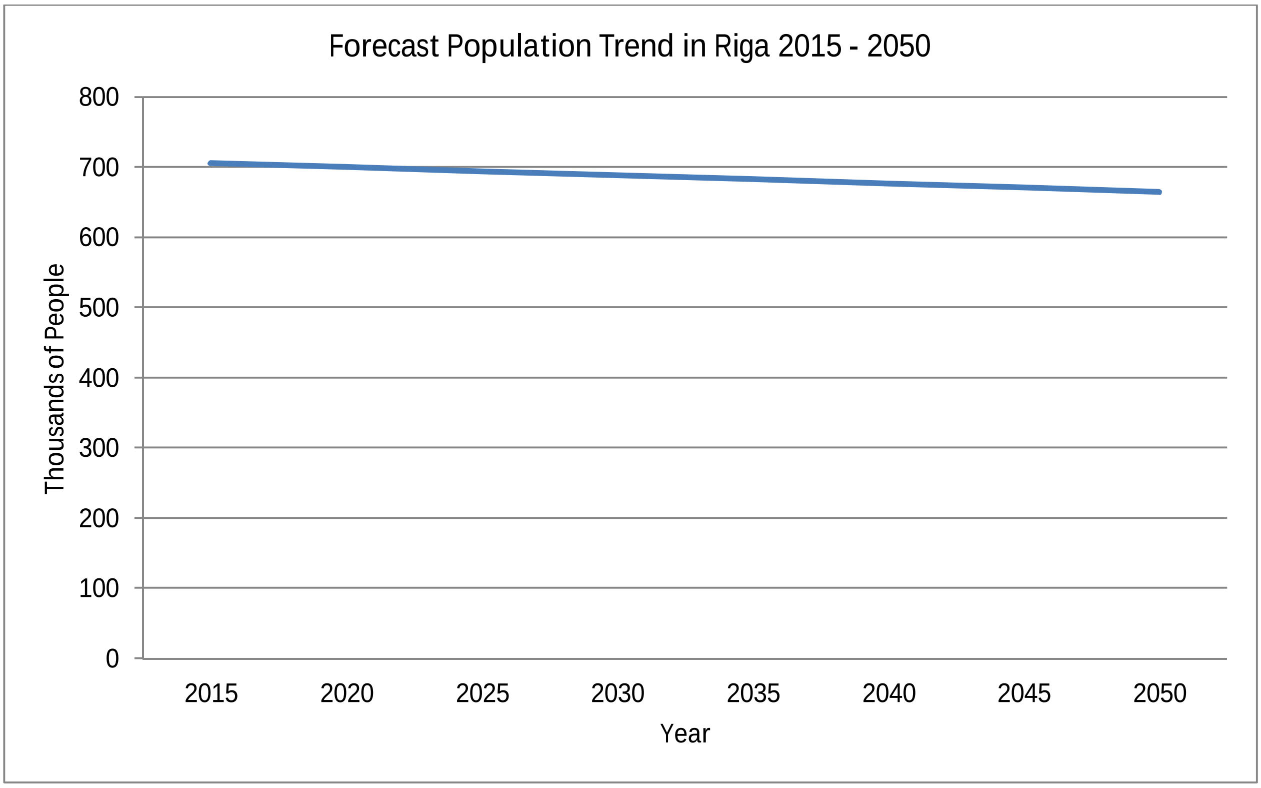


Figure 1.11: Forecast Population Trend 2015 - 2050
Source: AECOM 2011 Rail Baltica Feasibility Study

When considering the wider Riga area, it is evident that the population change shown in **Figure 1.12** has been slowing since 2010, more rapidly across Latvia has a whole than Riga and Pieriga which has remained steady.

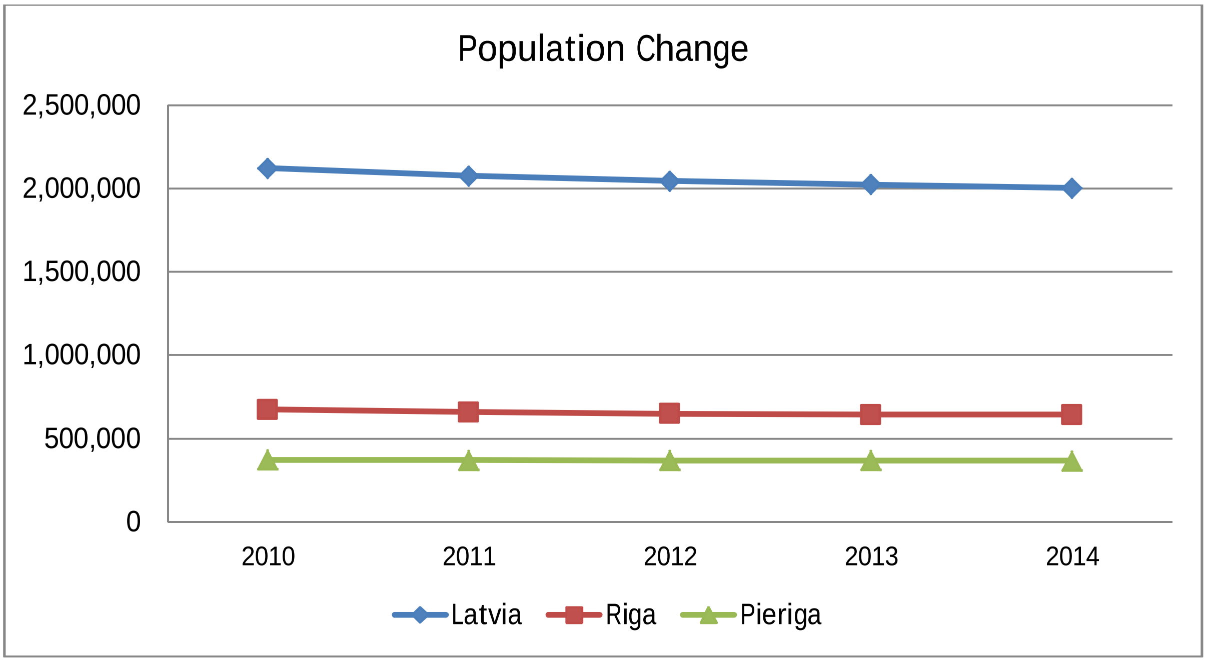


Figure 1.12: Population Change between 2010 and 2014 in Riga, Pieriga and Latvia
Source: EUROSTAT

Although the overall population of Latvia is forecast to decrease between 2015 and 2050, Riga airport passenger demand is forecast to increase by an average of 1.11% per year between 2014 and 2036. **Figure 1.13** below depicts the forecast growth between 2014 and 2036 (blue line), this has then been extend to 2050 based on an average of 1.11% growth per annum (red line).

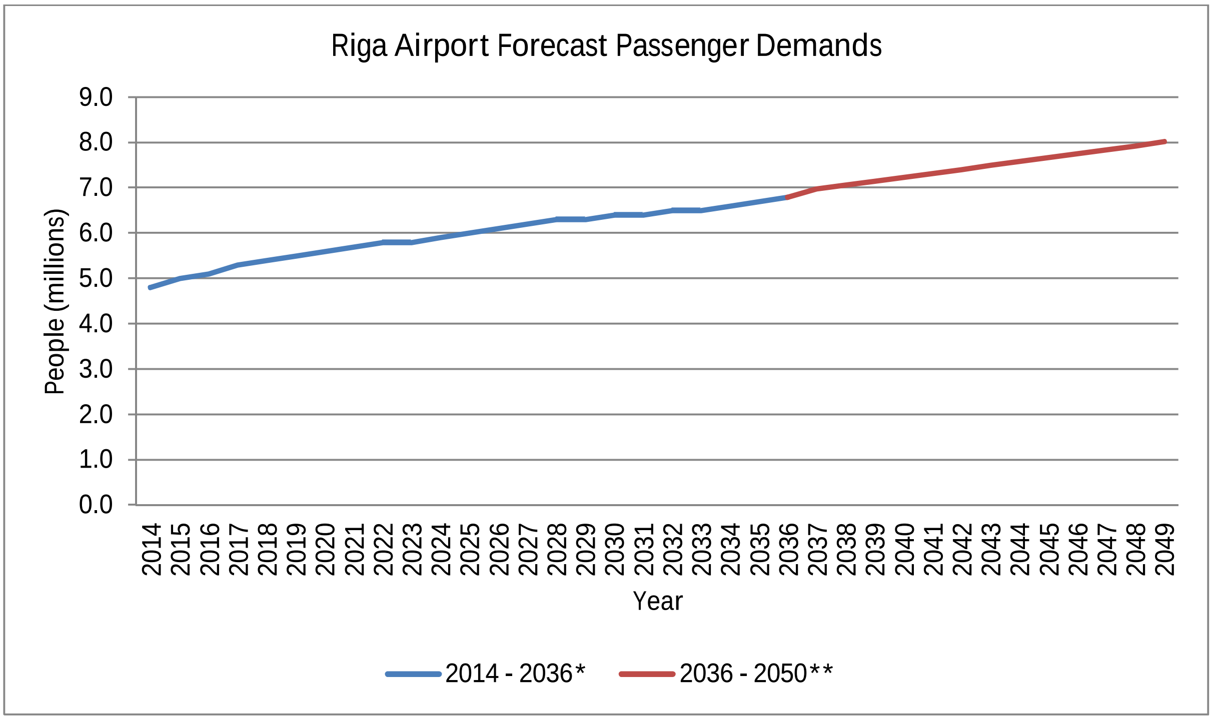


Figure 1.13: Forecast Riga Airport Passenger Demand 2015 - 2050
Source: Riga Aviation Industry Trends *Note: Assumed based on linear growth

Based on the results of the AECOM 2011 Rail Baltica Feasibility Study the average annual demand in passenger growth is forecast to increase between 2009 and 2040. **Table 1.1** shows the predicted growth per period.

Table 1.1: Average Annual Growth in Passenger Demand

Period	2009 – 2020	2020 – 2030	2030 – 2040
Latvia	0.63%	1.25%	1.35%

Source: AECOM 2011 Rail Baltica Feasibility Study

The forecasts above assumed that traffic will grow at 60% of the rate of GDP per head and 100% the population rate. The AECOM 2011 Rail Baltica Feasibility study predicted for Riga/Pieriga Region: average long term population and GDP per head growth of -0.14% and 3.21% per annum respectively. This has been shown graphically in **Figure 1.14** below.

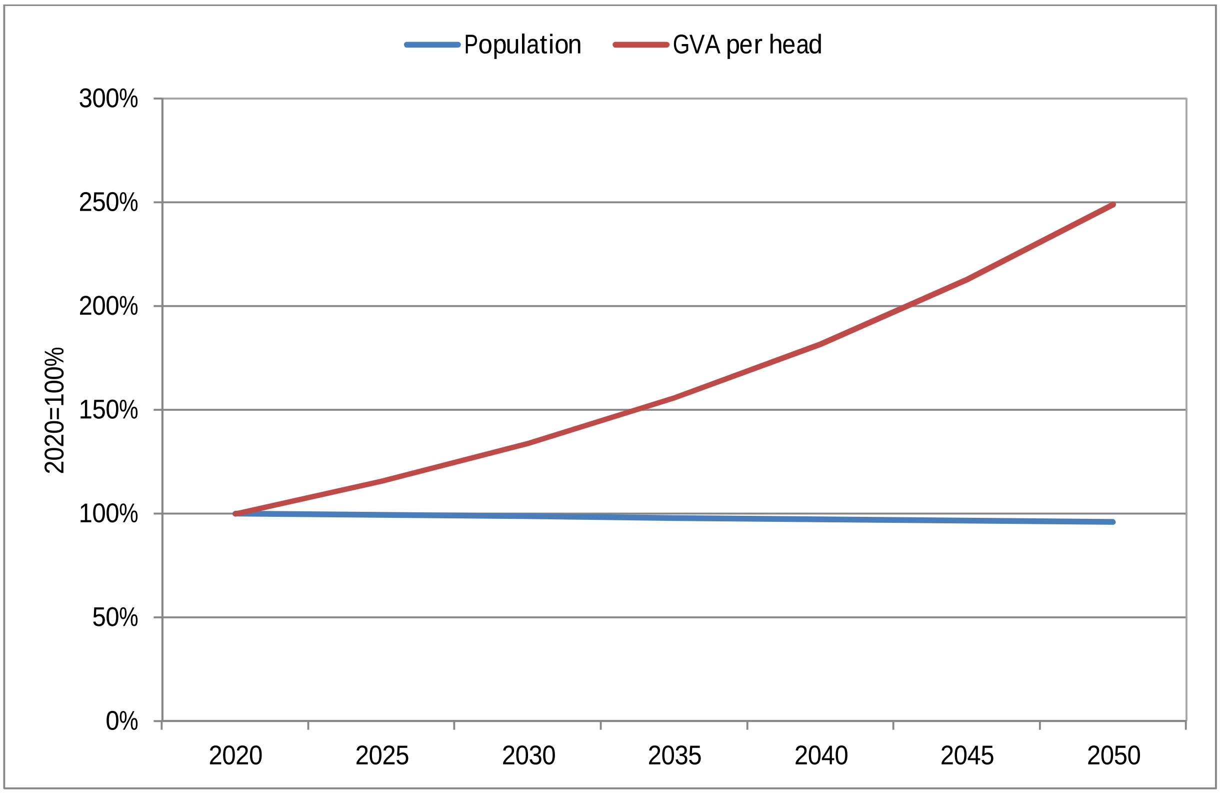


Figure 1.14: Forecast Growth between 2020 - 2050

Source: AECOM 2011 Rail Baltica Feasibility Study

Gross Domestic Product (GDP) in Latvia fell sharply in 2008 but was predicted to slowly increase from 2010 onwards as shown in **Figure 1.15**. The average long term GDP growth, as predicted in the AECOM 2011 Rail Baltica Feasibility study, is forecast to be 2.2% based on the AECOM 2011 Rail Baltica Feasibility Study.

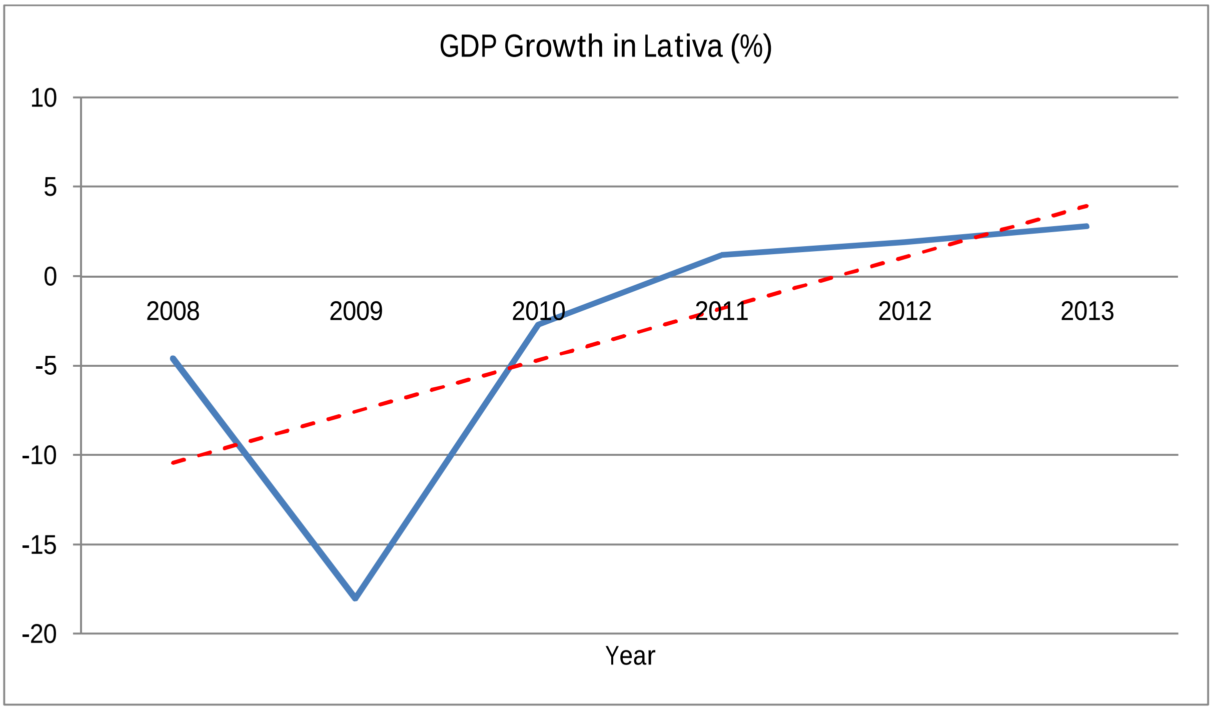


Figure 1.15: Gross Domestic Product (GDP) in Latvia (%)
Source: AECOM 2011 Rail Baltica Feasibility Study

In addition, based on the results of the Aviation Industry Trend report it was found that GDP growth has direct correlation with demand for aviation services which results in passenger growth. Short term GDP forecast for Latvia is 3.9% per annum while in the long run economy is forecasted to slow down and GDP is forecasted to increase at 1.9% per annum.

1.4 Demand Forecast Summary

As illustrated by **Figures 1.1** to **1.15** the economic and transport trend data since 2010 has levelled out. In addition, existing sources of forecasting suggest a steady increase to PT patronage, GDP and air passenger demand is forecast to increase by an average of 1.11% per annum. Therefore, it is reasonable to forecast a steady increase in traffic flow, PT patronage and pedestrian flow within our study area.

Three main sources have been used to determine the average annual percentage uplifts to determine the 2050 demands. The source and justification are as follow:

- **Background Demand PAX** – Source: 2011 AECOM Feasibility Study
  Background growth has been determined using the 2011 AECOM Rail Baltica Feasibility Study. The forecast methodology and calculated percentage increases (average annual growth rates) within the 2011 study correspond with the trend data gathered during *Stage 1: Current Situation Analysis* of the RPTH study – i.e. levelling out of recent downward population and transport trends and anticipation of a modest increase similar to that evident up to 2008;
- **Long Distance Rail Baltica PAX** – Source: 2015 Ernst & Young Rail Baltica Study
  To help ensure consistency between Rail Baltica project teams, we have adopted the latest patronage forecasts determined by Ernst & Young. For information, the Ernst & Young demand forecasts and associated methodology assumptions are attached to this technical note; and
- **Airport Shuttle PAX** – Source: RIX 2015 Airport Strategy
  The annual percentage uplift associated with the proposed shuttle service has been determined using the annual demand increase projected by RIX within their 2015 Airport Strategy document. Our forecast uplift percentages are therefore consistent with the long-term patronage forecast determined by RIX. For information, a table stating the Airport PAX forecast passenger demands is attached to this note.

Table 1.2 below provides a summary of the average annual percentage uplifts used within this study.

Table 1.2: Growth Rate Summary

Movement Type	2009 – 2020	2020 – 2030	2030 – 2050
Background Demand (Total PAX)	0.63%	1.25%	1.35%
Long Distance Rail Baltica PAX	-	2.65%	2.55%
Airport Shuttle	-	1.89%	1.89%

Ernst & Young Demand Forecasts and Methodology

Passenger flows	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Rail Baltica													
Riga - South	300,459	310,299	325,184	342,488	360,567	379,088	396,969	413,357	427,816	441,721	455,029	470,678	487,364
South - Riga	289,667	293,330	300,786	309,634	318,775	328,222	337,119	345,776	354,152	362,205	369,892	377,066	383,770
Riga - North	354,270	359,503	367,728	377,877	389,819	402,181	414,242	426,515	438,707	450,487	462,059	473,049	482,788
North - Riga	339,485	342,511	348,641	355,851	363,221	370,756	377,553	384,056	390,234	396,062	401,508	406,475	411,033

Passenger flows	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2050
Rail Baltica														
Riga - South	504,987	523,540	543,040	563,722	585,338	607,887	631,404	655,891	681,434	707,985	735,546	764,166	793,847	1,102,627
South - Riga	389,922	395,542	400,946	406,414	411,940	417,911	423,987	430,185	436,530	442,990	448,995	455,095	461,294	528,511
Riga - North	489,280	497,881	506,190	514,877	523,800	533,083	542,497	552,116	561,958	569,059	578,316	587,724	597,276	696,723
North - Riga	415,140	418,826	422,307	425,889	429,474	433,315	437,194	441,126	445,132	449,180	452,914	456,683	460,488	501,354

Similar to our freight forecast approach, we used the traffic forecasts as basis and applied future year assignment and mode choice models to the results. Both models are based on the respective base year models and adjusted through identified trends per scenario (influence factors, see table attached). Our elaborated passenger forecasts have the following key features:

- Baseline plus 4 development scenarios considering with or without Rail Baltica;
- Long distance passenger volumes to/ from Riga main station (inbound/ outbound traffic) on a travel link basis (O/D pairs) and per respective catchment area;
- Long distance passenger volumes via Latvia (transit);
- Long distance passenger volumes to/ from the Airport of Riga (inbound/ outbound traffic) on a travel link basis (O/D pairs) and per respective catchment area;;
- Urban passenger volumes of Airport (Express) Shuttle train;
- Rough estimation of regional passengers (North line to Salacgrīva, South Line to Bauska, Iecava, Baldone) with possible extensions to Pärnu, EE and Paneve;zis, LT;
- Effects of modal shift (air-to-rail, road-to-rail, induced traffic);
- Results in number of passengers p.a. and transport mode.

As growth driver for passenger flows, the Gross Value Added (GVA) have been considered based on official forecasts from Oxford Economics. Also for the passenger traffic forecasts and scenarios until 2050, the elastic-multiplier methodology (e-multiplier) has then been applied. The passenger demand assignment has been done through:

1) identifying the overall passenger potential (air, coach, car) per O/D pair (inbound, outbound, transit) from public sources

2) applying approx. 13% of the identified demand per O/D pair as induced demand which correspond to findings from other, comparable studies.

3) Assigning per O/D pair and transport mode the probability of PAX switching to RB (see assumption table attached) based on other, comparable studies and professional judgement

An individual set of influence factors has been developed covering the principle trends of the macro-economic perspective (e.g. population, demographics, global economy, industrial and service development, economic integration, environmental policies, among others) as well as covering the specific Rail Baltica project perspective (e.g. value-added services, transport times and costs, urban mobility, competitiveness of services, policies and attitudes regarding the project, special project milestones for a specific year, among others). The strength of each influence factor has been defined through review of other studies, expert panel meetings and professional judgment of industry experts and can vary depending on the development scenario.

The traffic forecast of a given year is generated by using the identified passenger volume of a specific connection (inbound, outbound, transit) of the previous year and applying both, GVA multipliers and e-multipliers, as follows:

$PAX_x = PAX_{x-1} + [PAX_{x-1} * grGVA_{x-1} *(M_x + I_x)]$

<u>PAXx:</u> Passenger volume of an individual connection in year X
<u>grGVAx-1:</u> Growth rate of GVA in year x-1
<u>M:</u> GVA multiplier (M = Passenger Growth / GVA Growth) adjusted past average
<u>I:</u> Total e-multipliers for year x (sum of e-multipliers for each influence factor)

RIX 2015 Airport Strategy Forecast Patronage

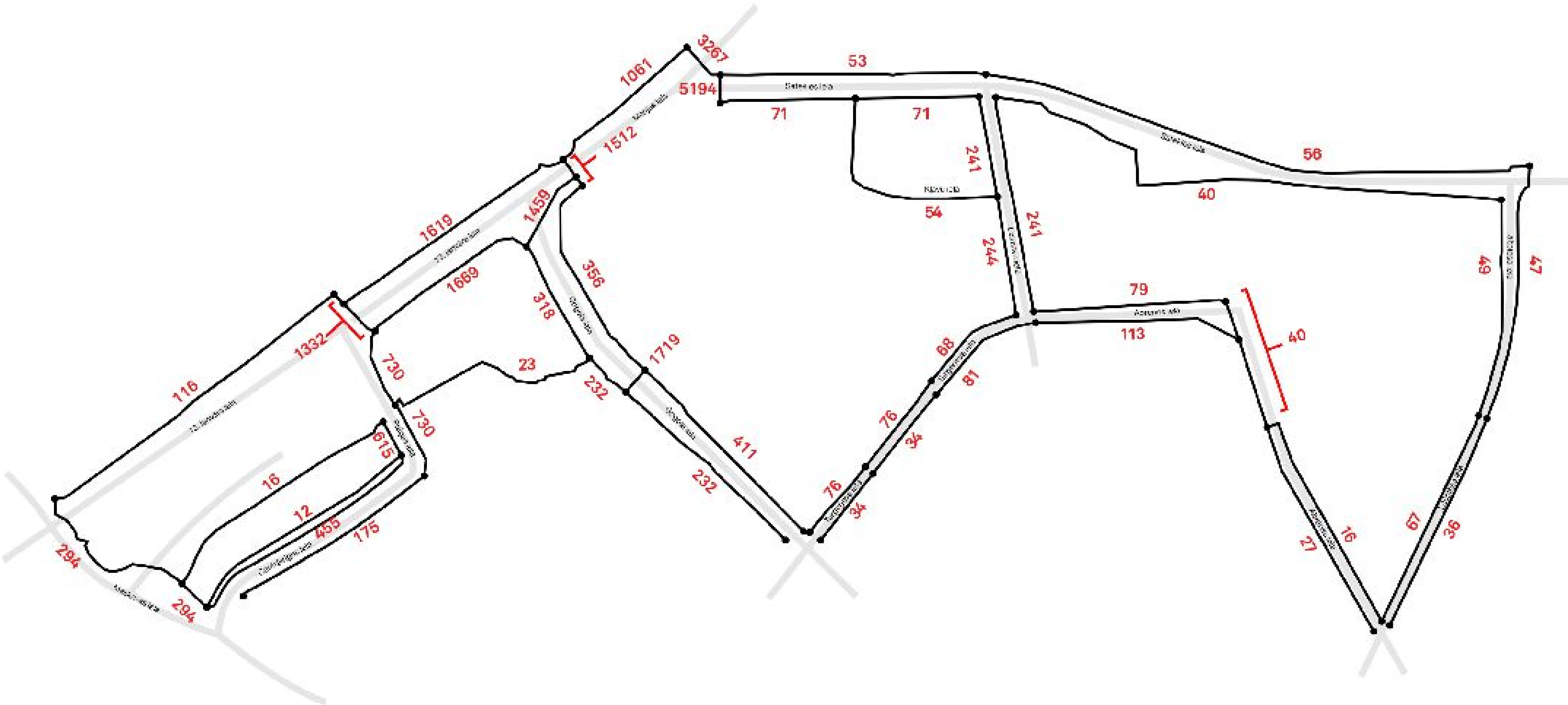
PAX	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34	FY35	FY36
Pax			4.8	5.0	5.1	5.3	5.4	5.5	5.5	5.7	5.8	5.8	5.9	6.0	6.1	6.2	6.3	6.3	6.4	6.4	6.5	6.5	6.6	6.7	6.8

*PAX in millions

Appendix WP 1.5 & 1.6 2 – Flow Diagrams

RPTH Study Area Pedestrian Link Flows

AM (08:00 - 09:00) Base 2015



RPTH Study Area Pedestrian Link Flows

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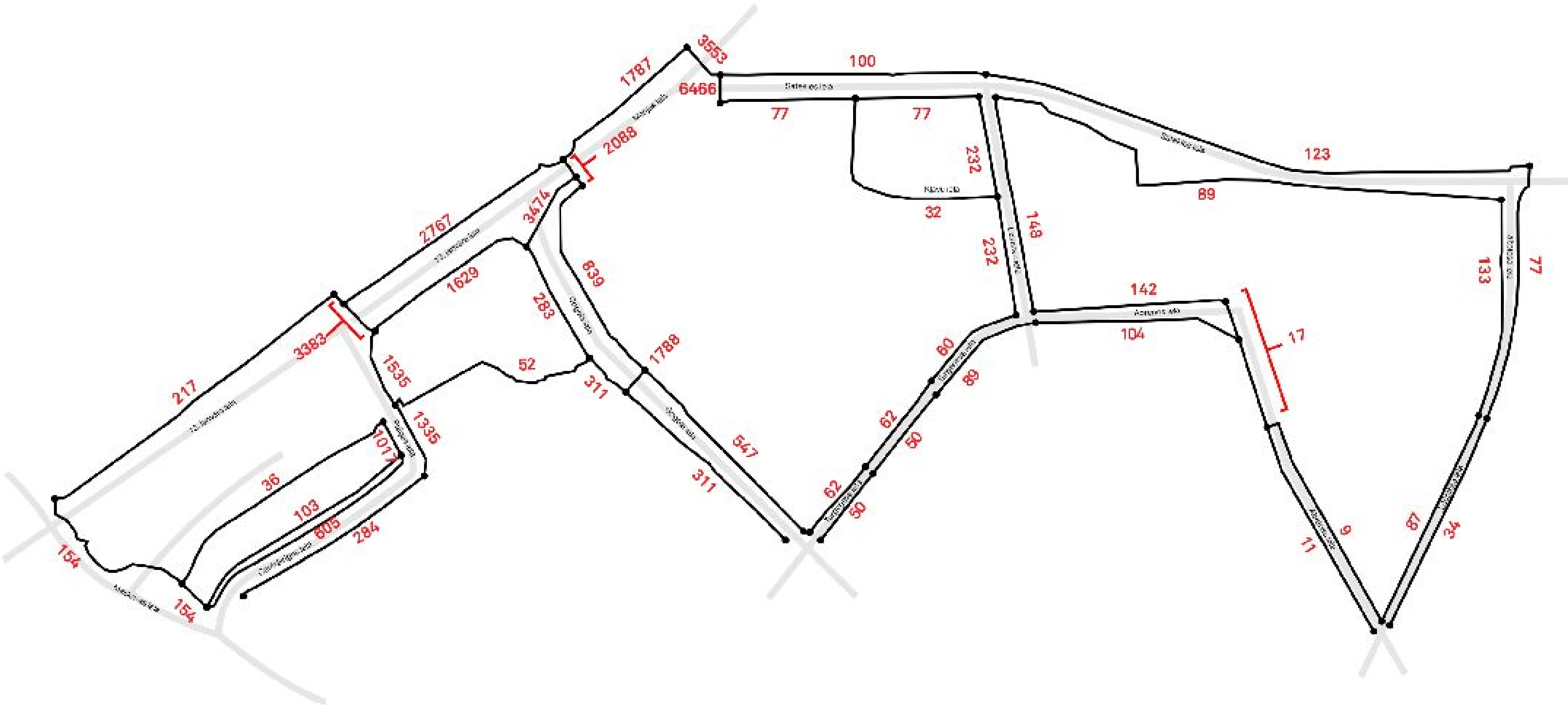
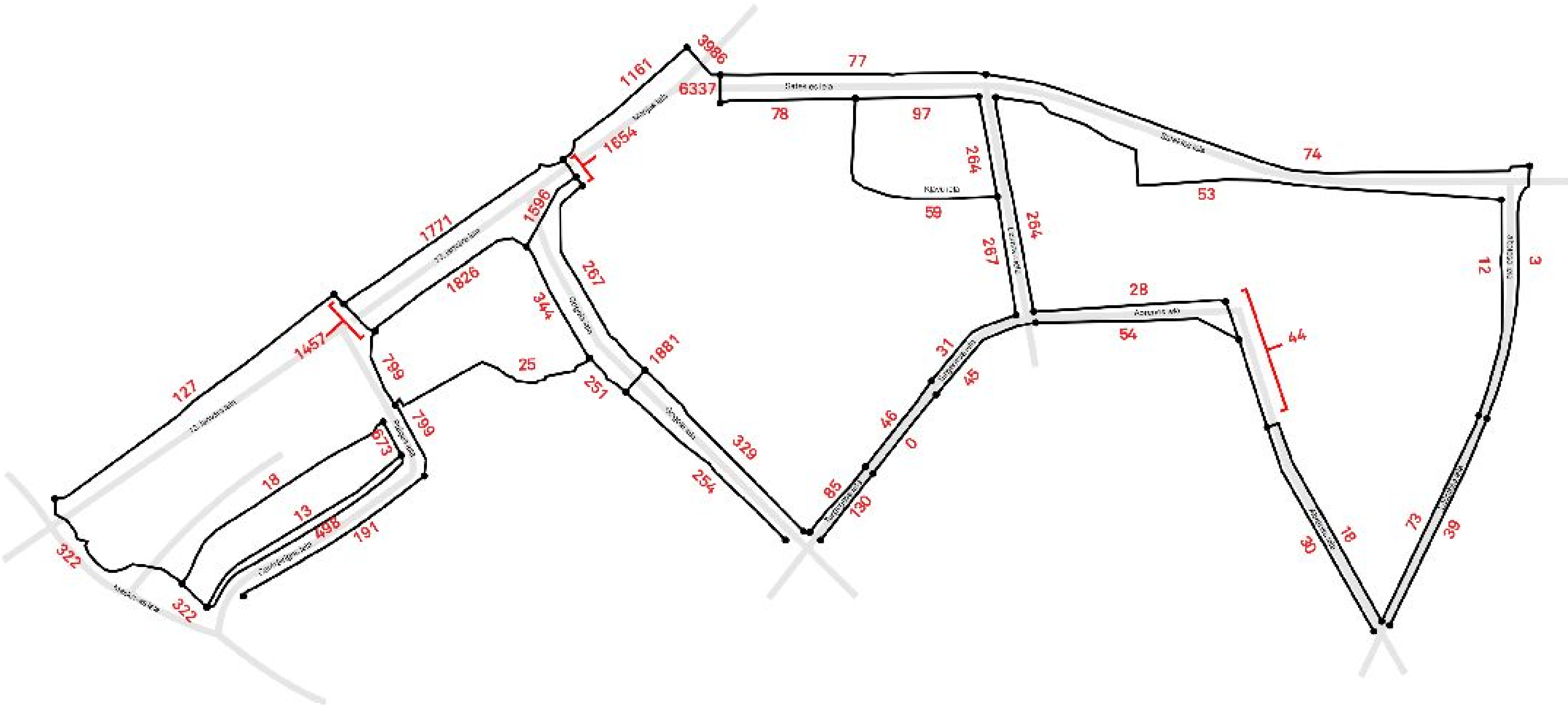


RPTH Study Area Pedestrian Link Flows

AM (08:00 - 09:00) 'Do Minimum' 2025



RPTH Study Area Pedestrian Link Flows

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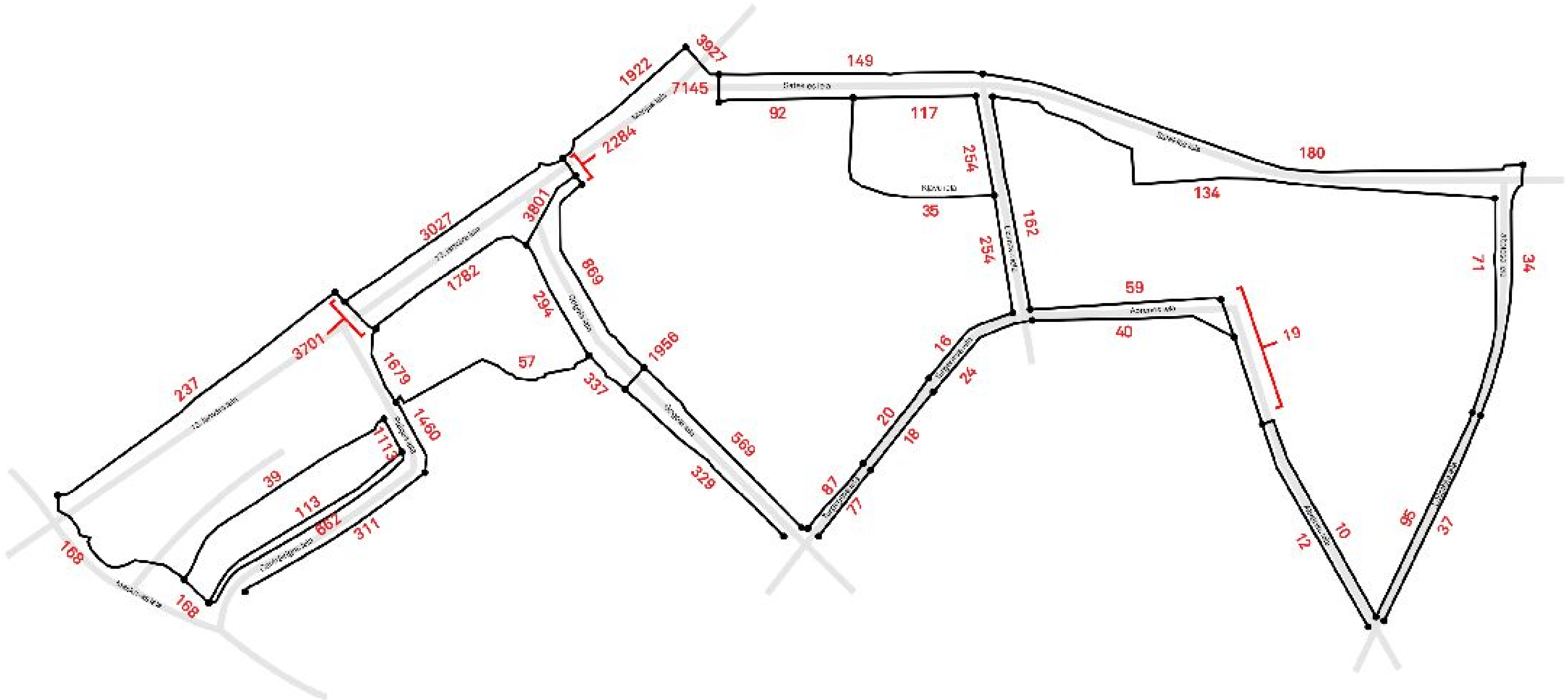

RPTH Study Area Pedestrian Link Flows

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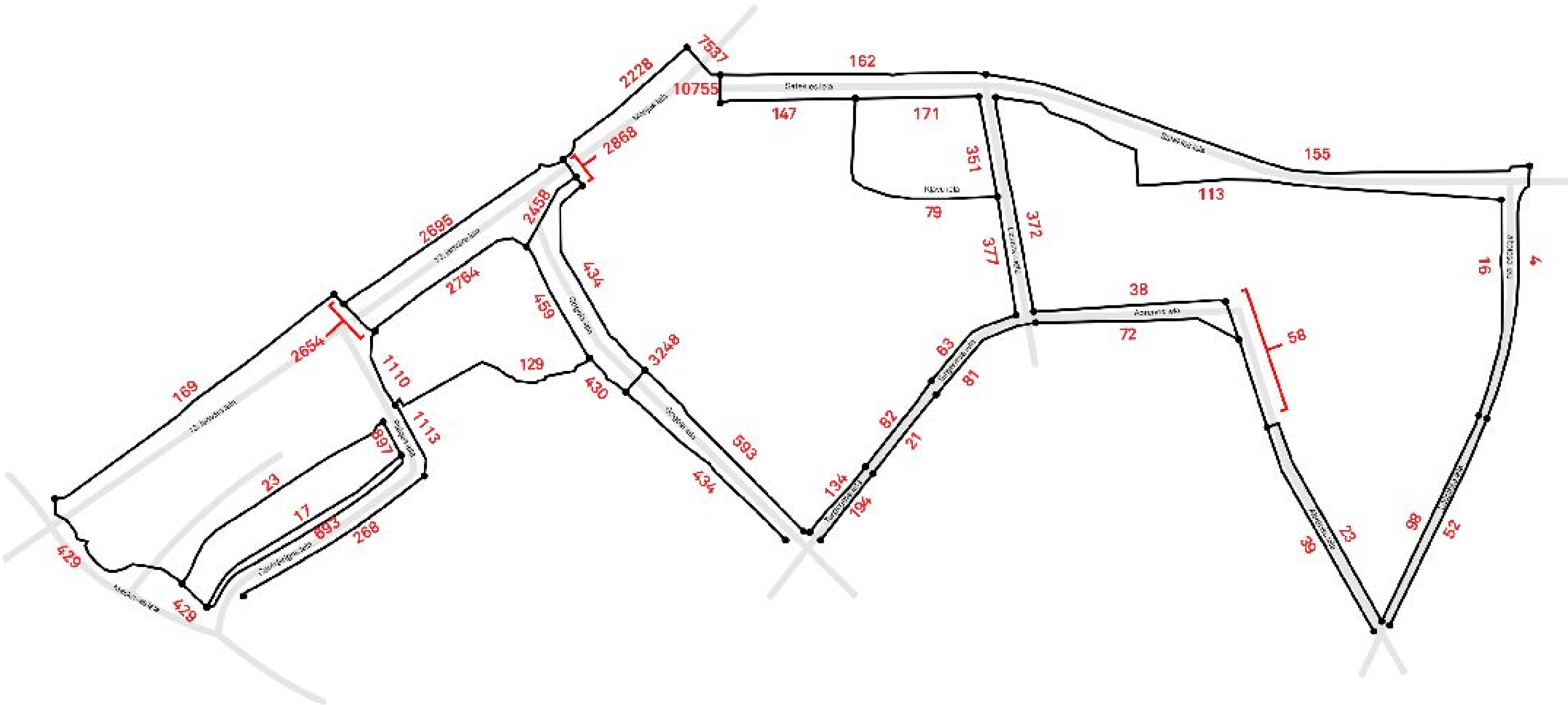

RPTH Study Area Pedestrian Link Flows

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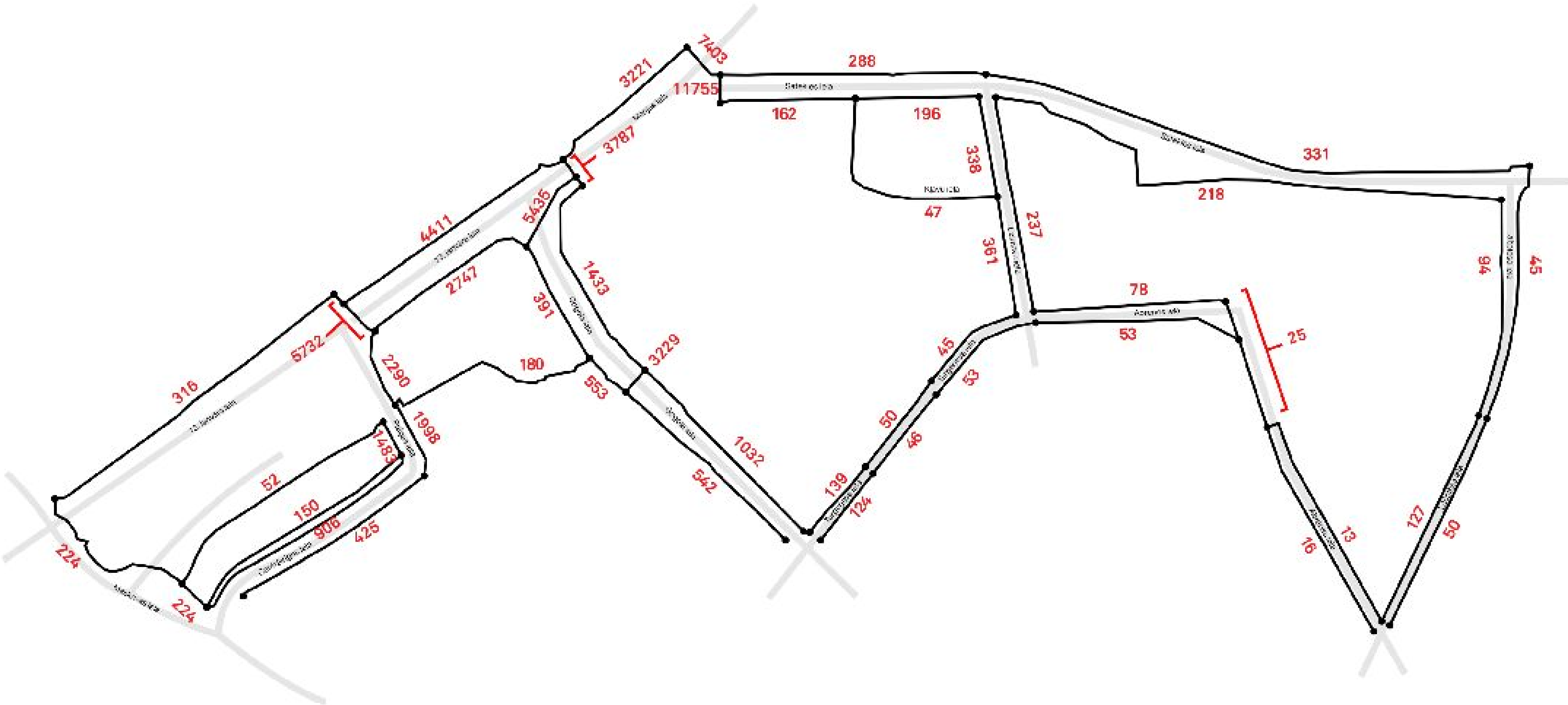

RPTH Study Area Pedestrian Link Flows

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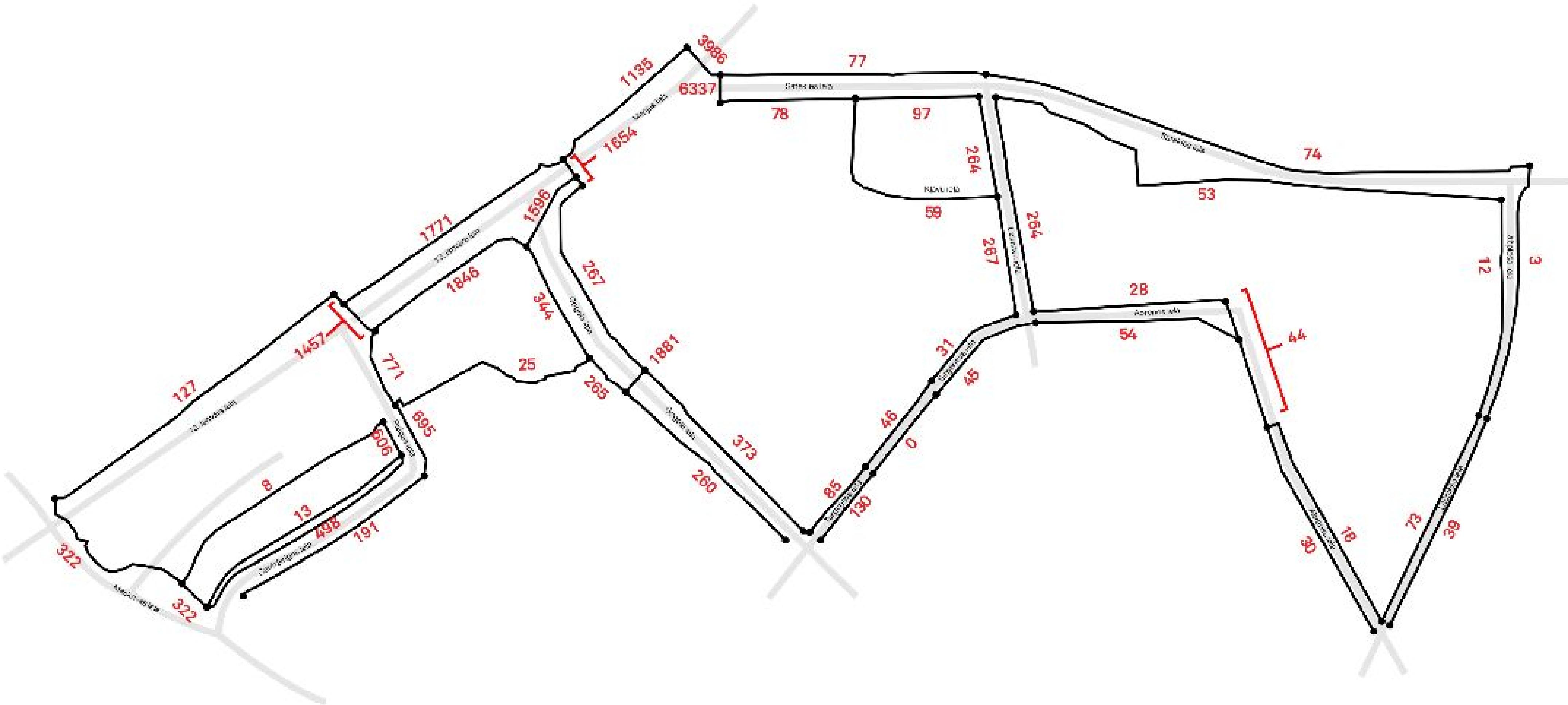

RPTH Study Area Pedestrian Link Flows

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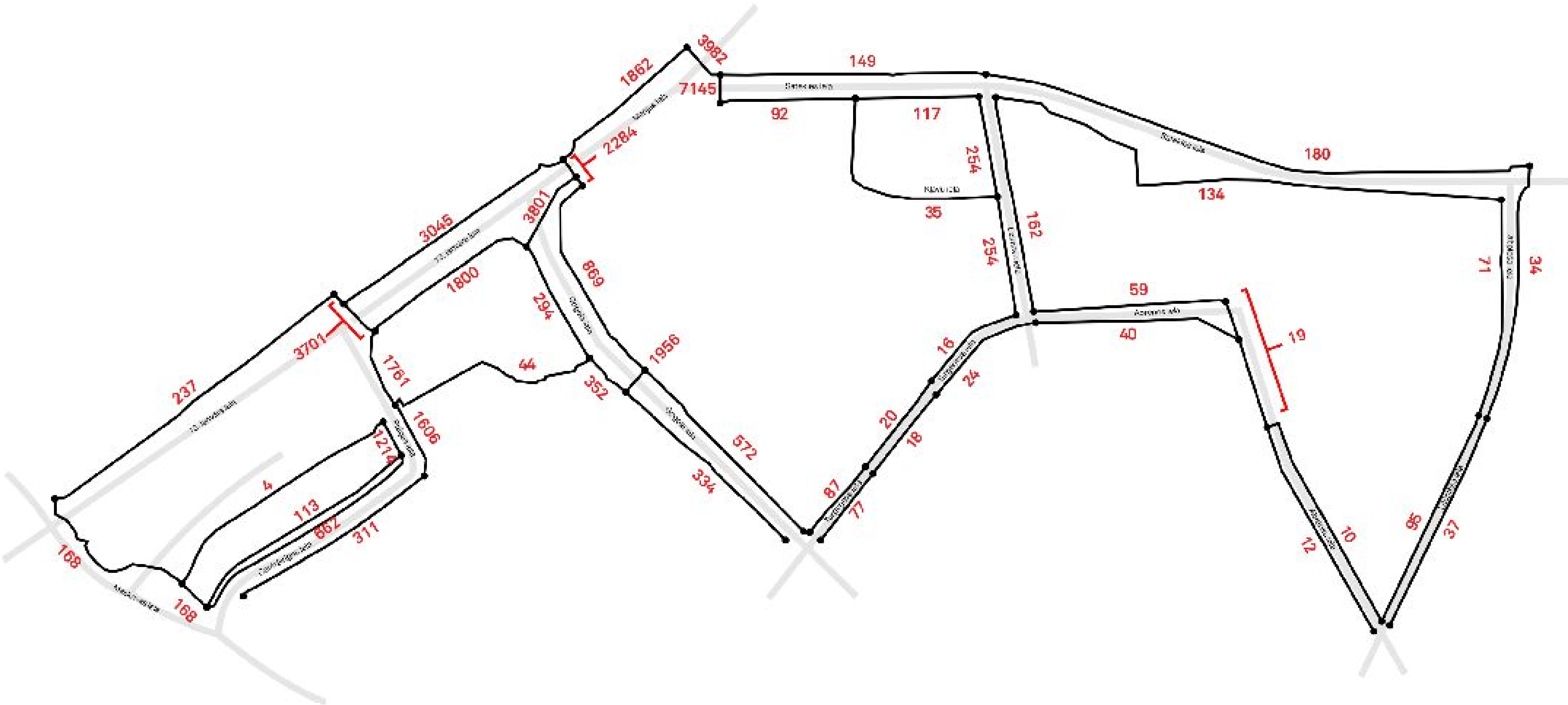

RPTH Study Area Pedestrian Link Flows

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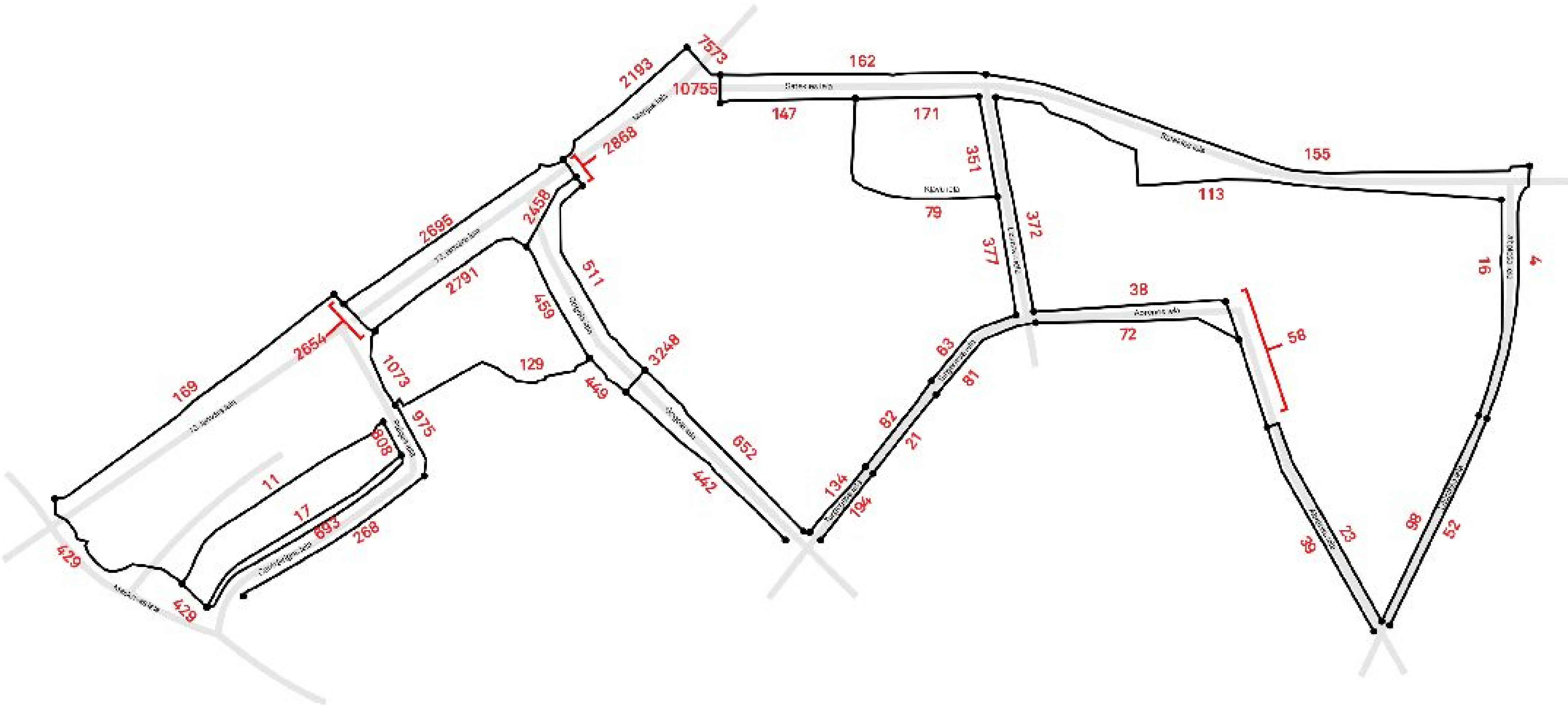

RPTH Study Area Pedestrian Link Flows

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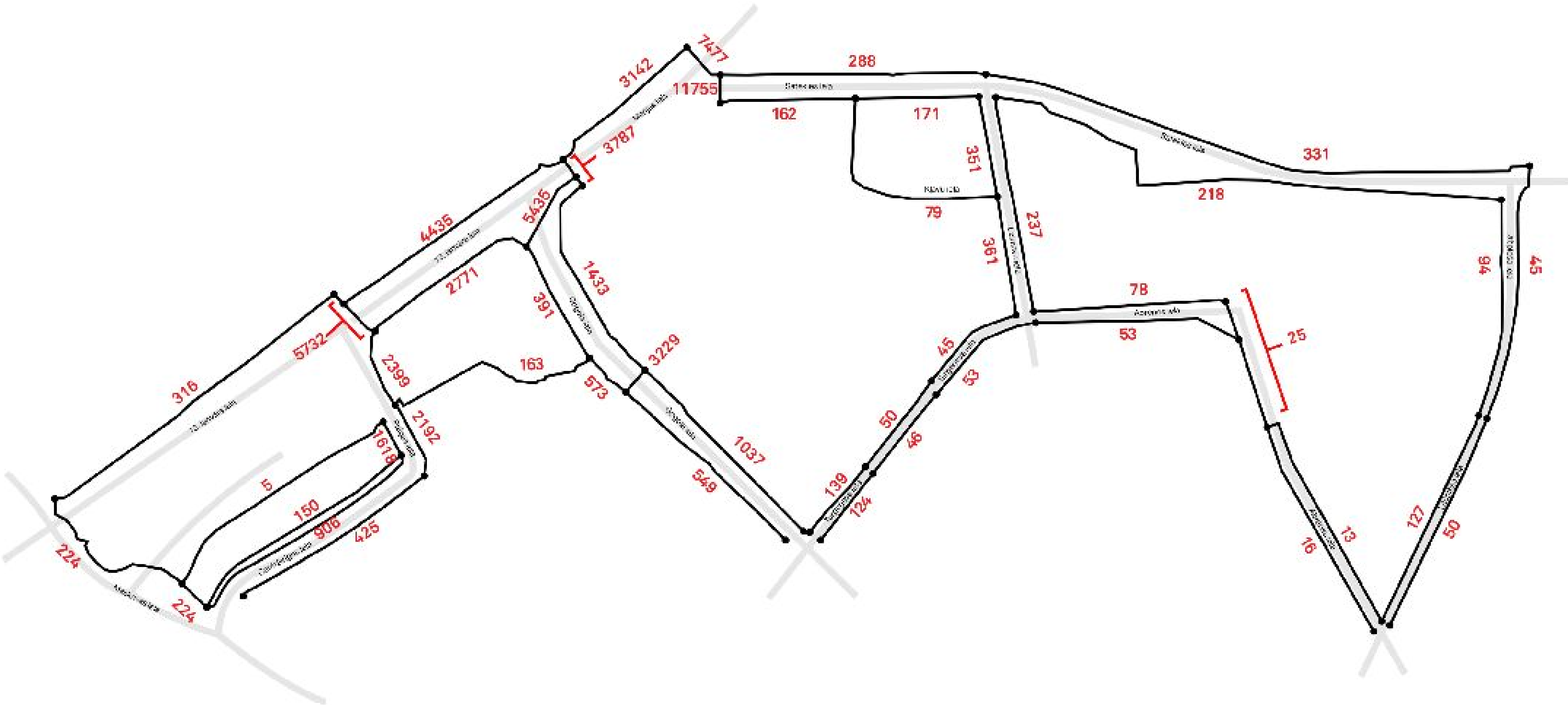

RPTH Study Area Traffic Link Flows

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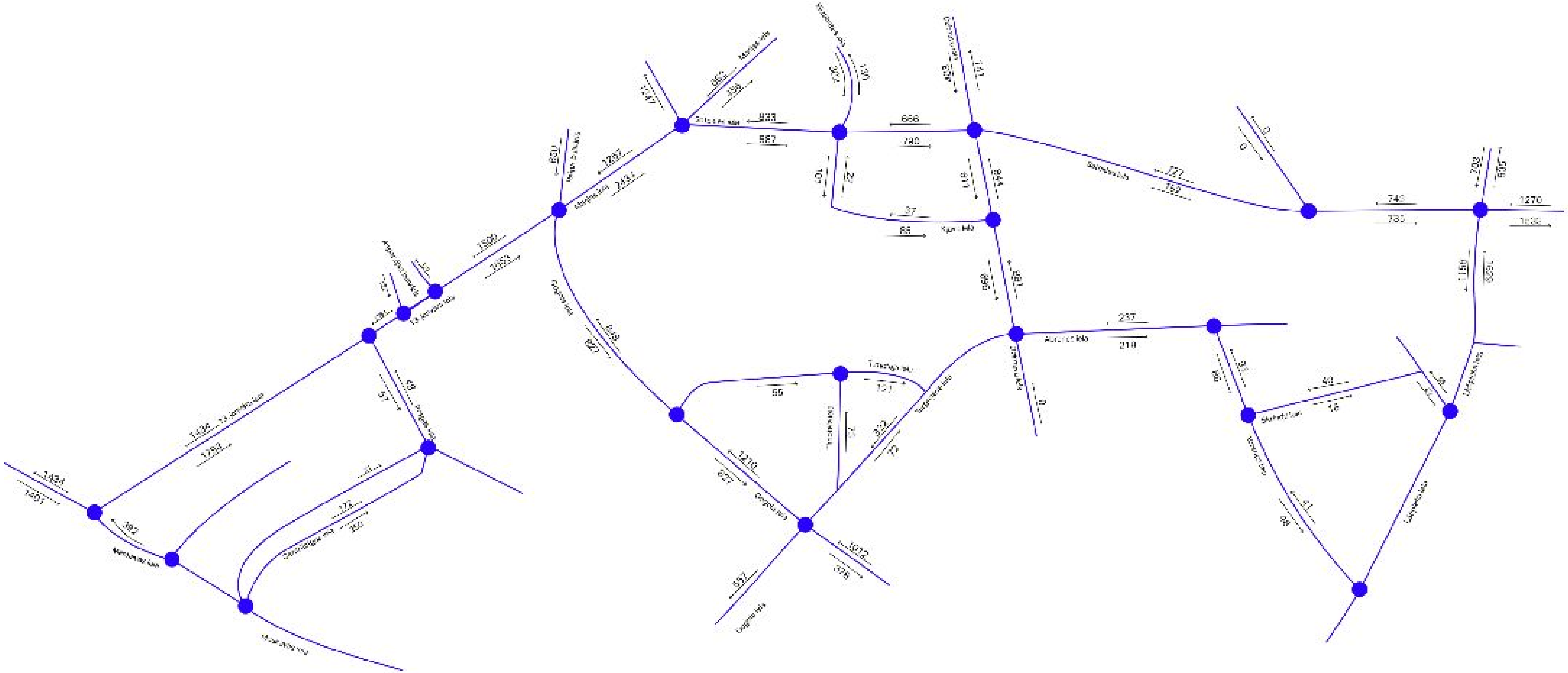

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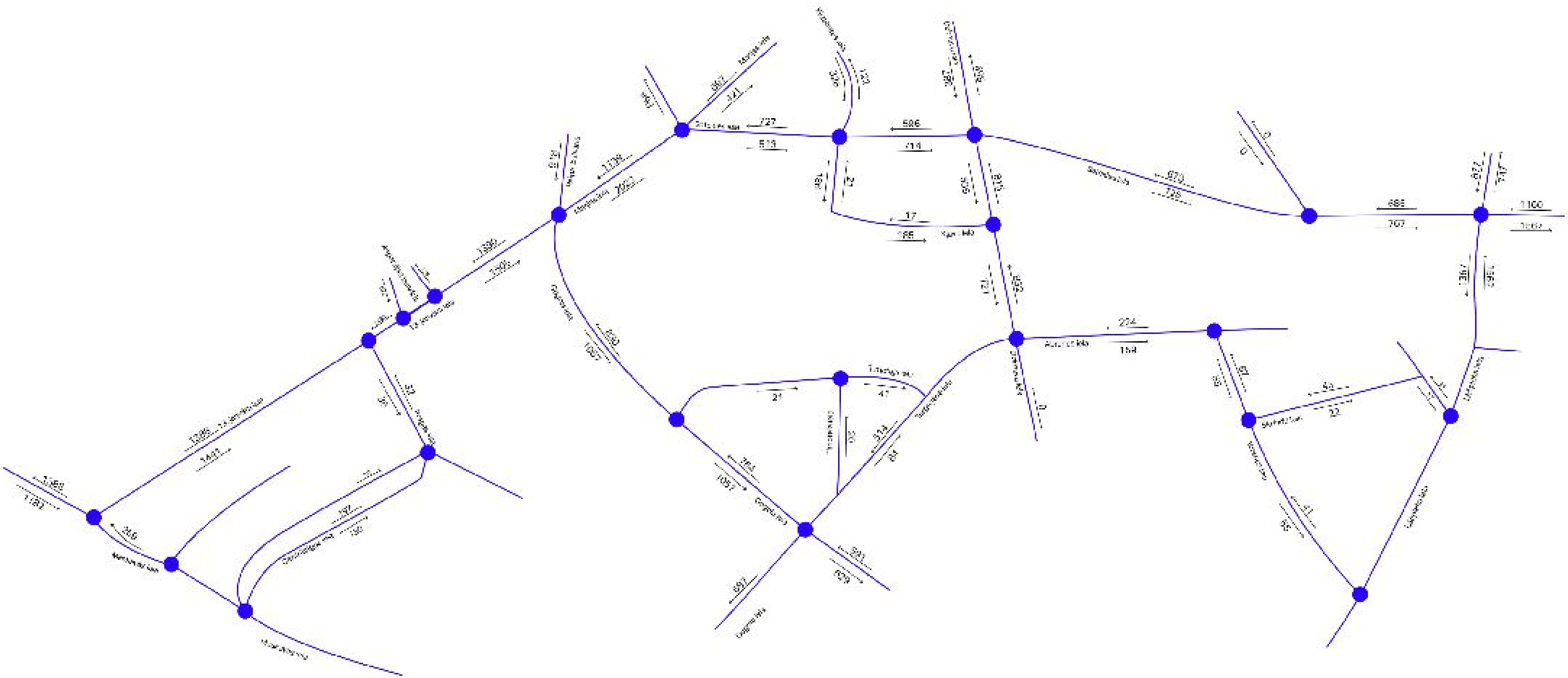

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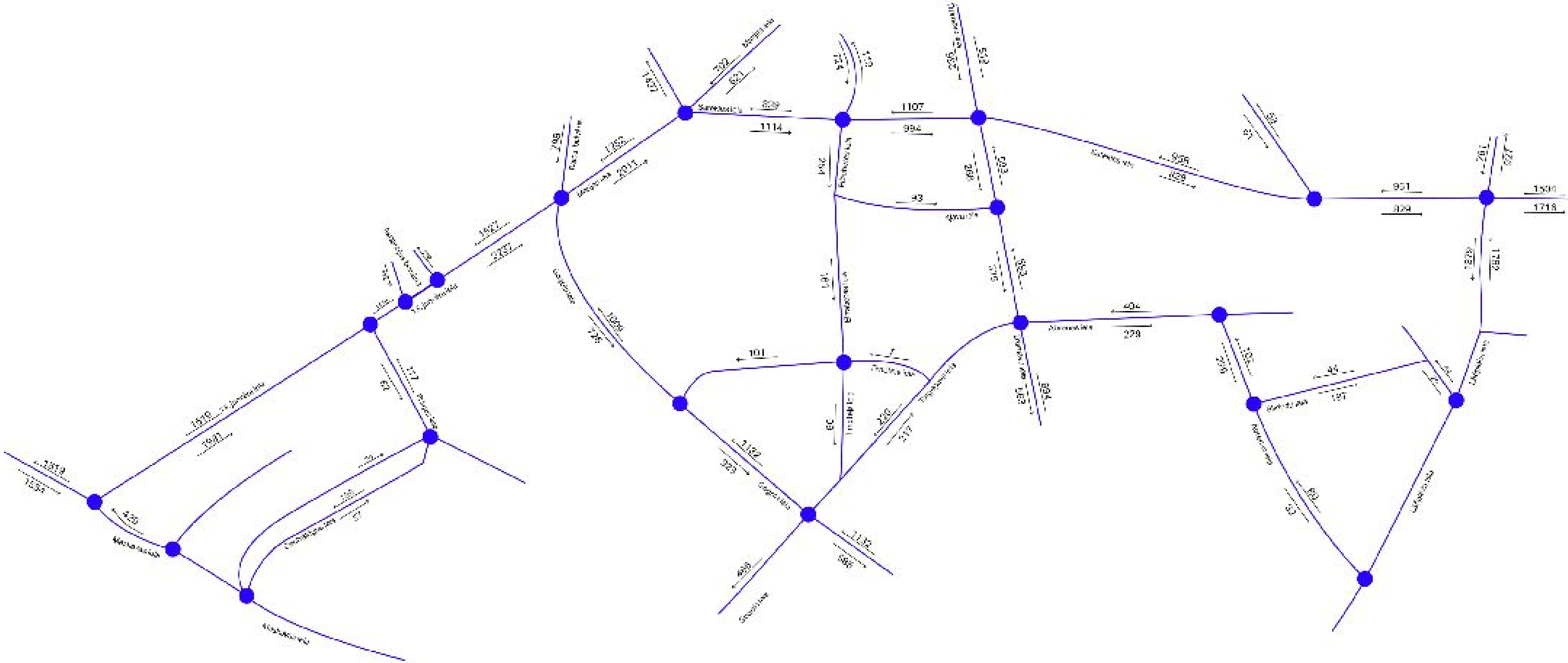

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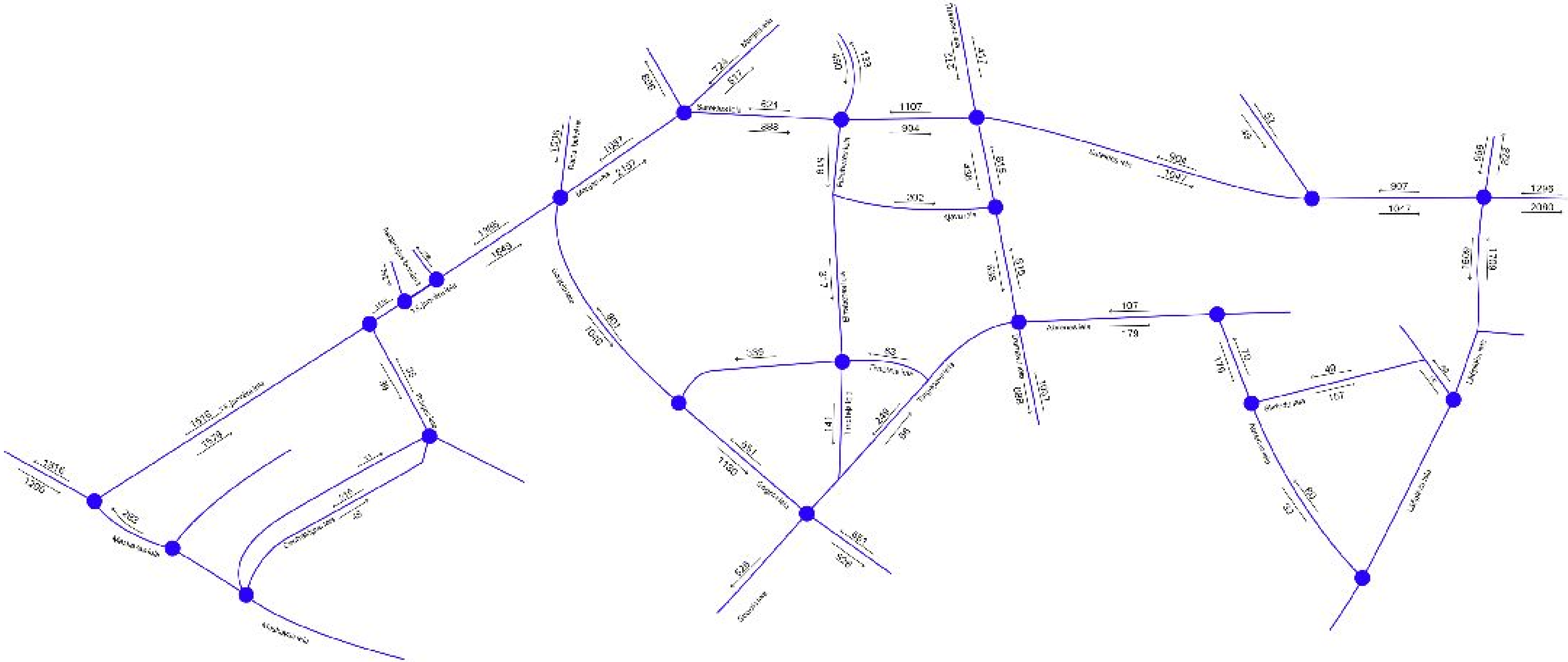

RPTH Study Area Traffic Link Flows

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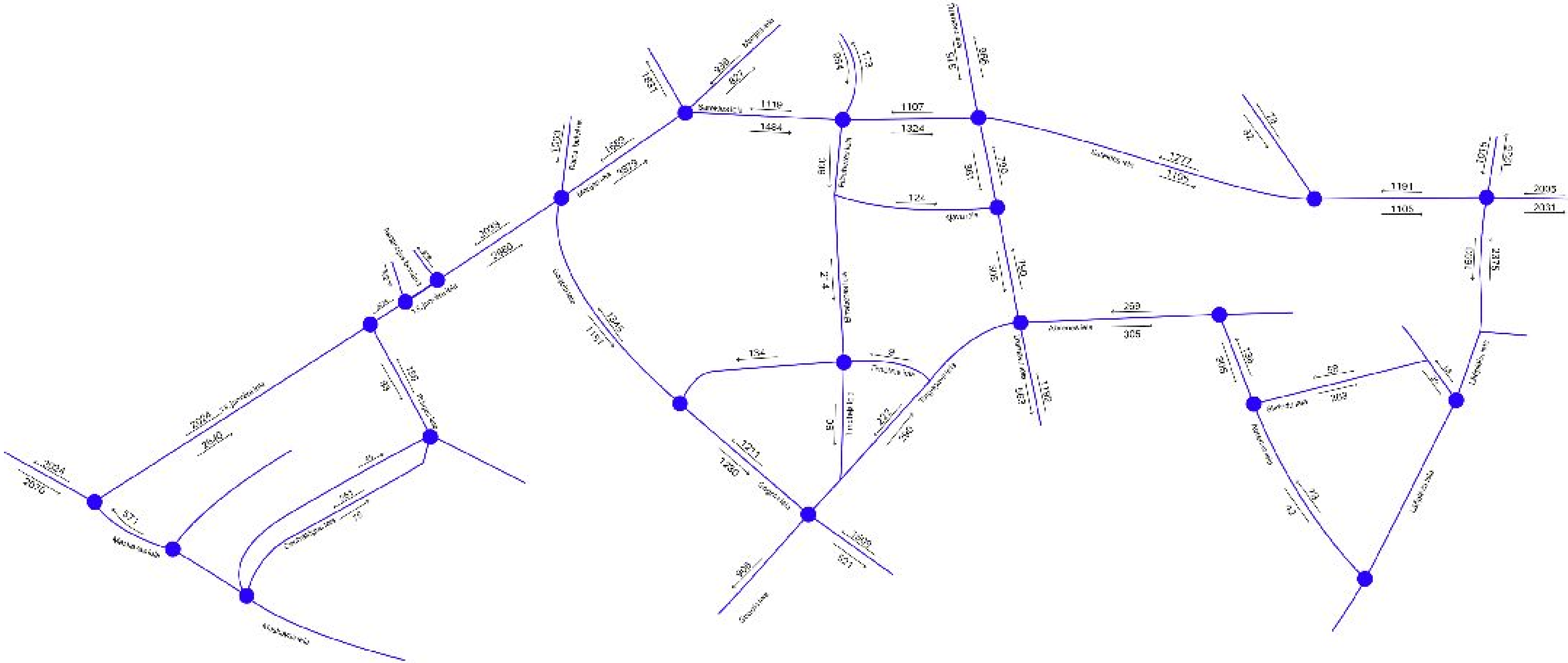

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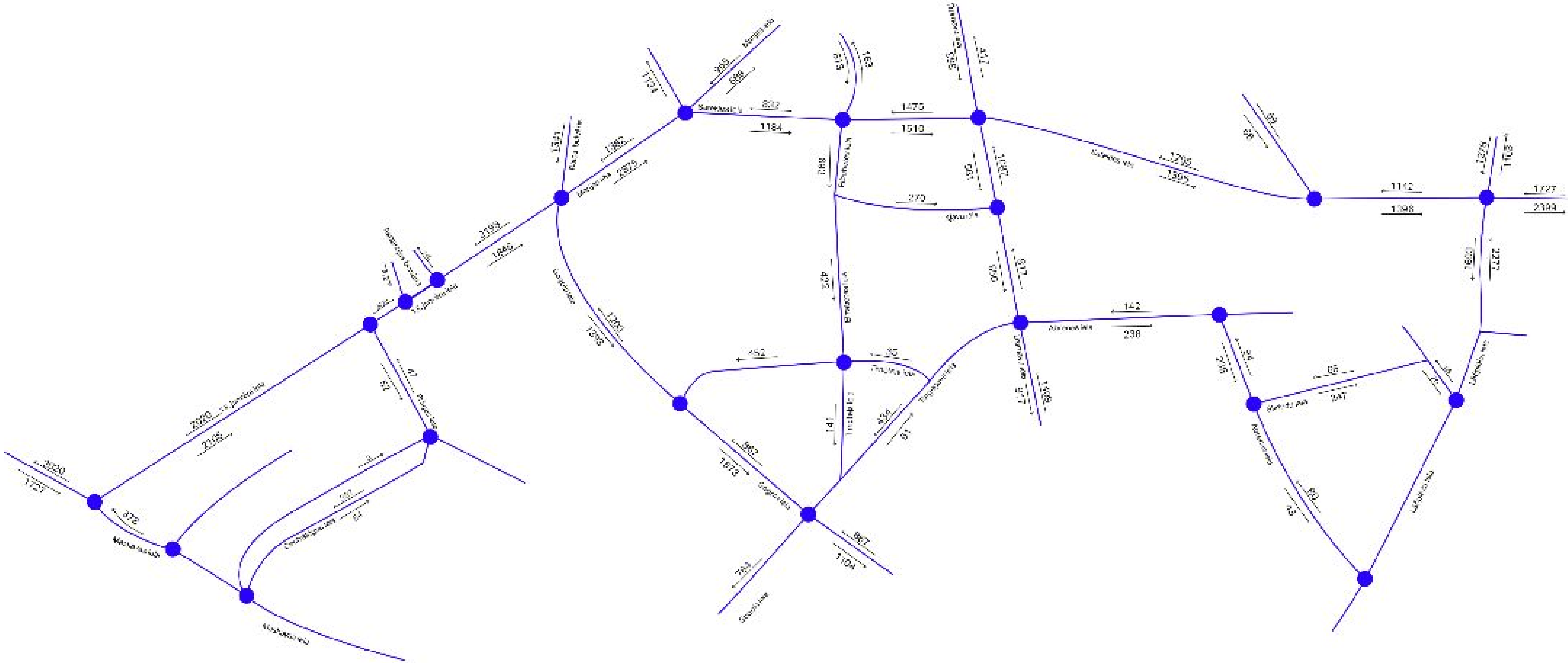

RPTH Study Area Traffic Link Flows
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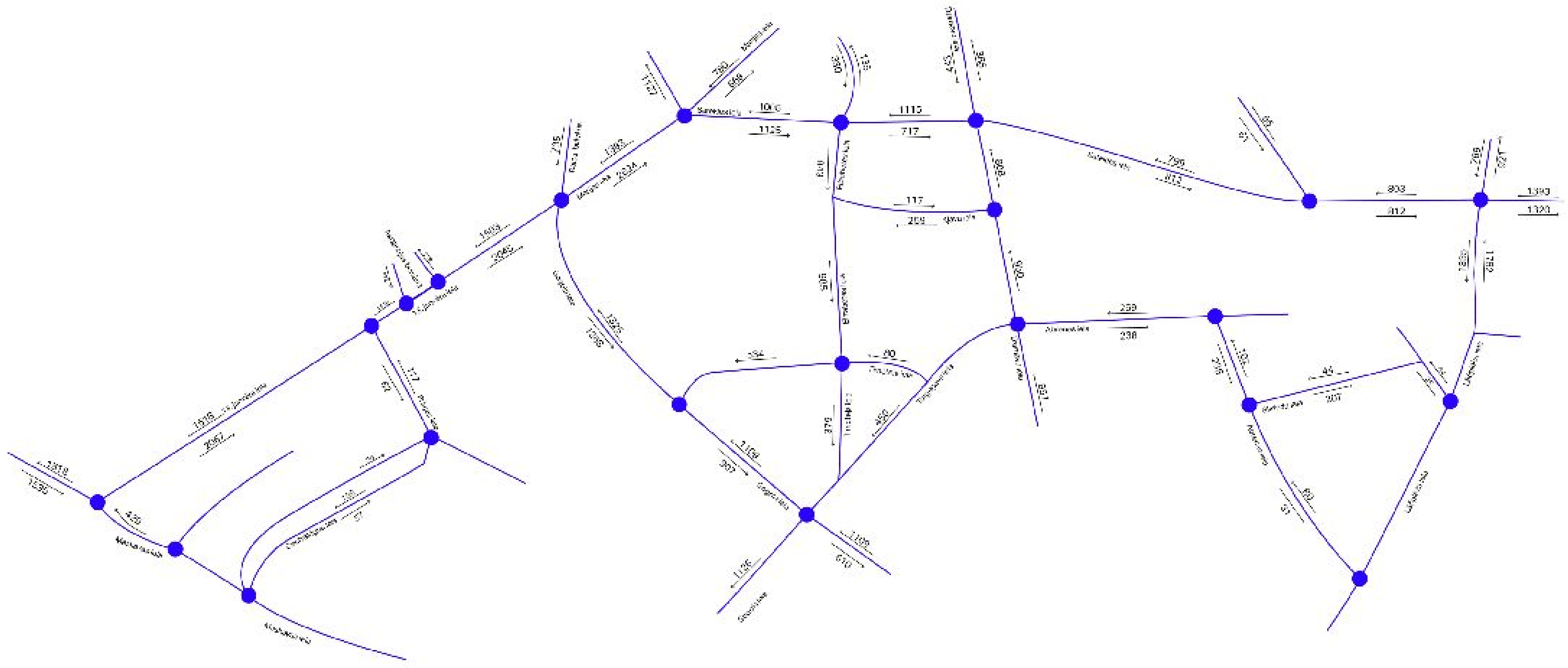

RPTH Study Area Traffic Link Flows

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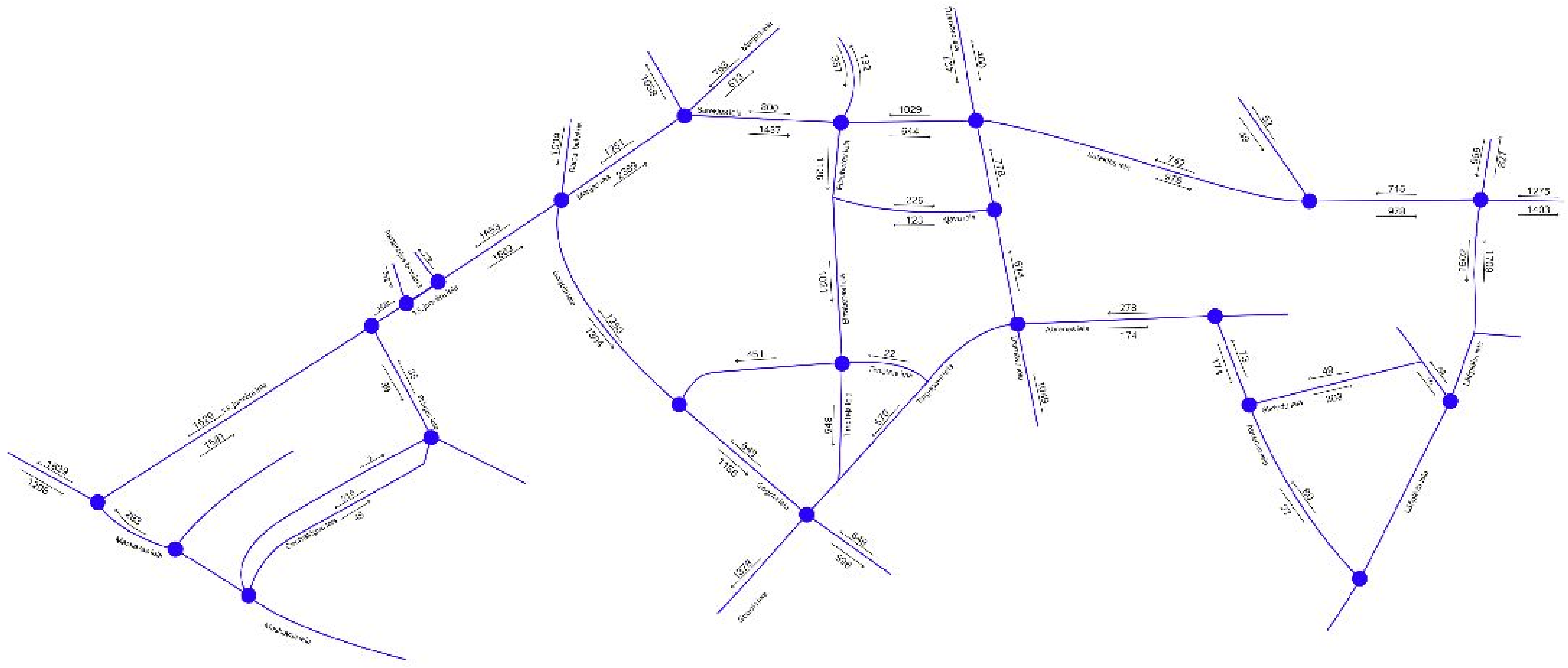

RPTH Study Area Traffic Link Flows

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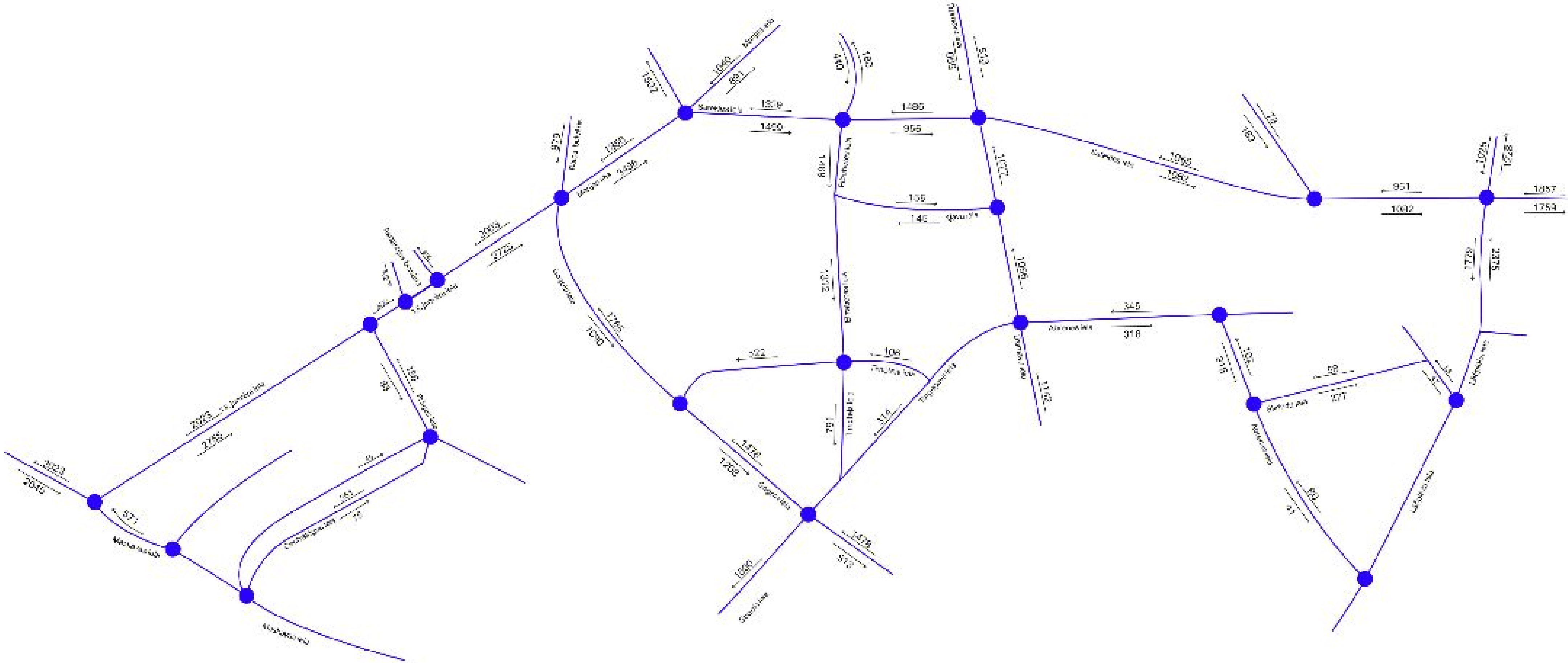

RPTH Study Area Traffic Link Flows

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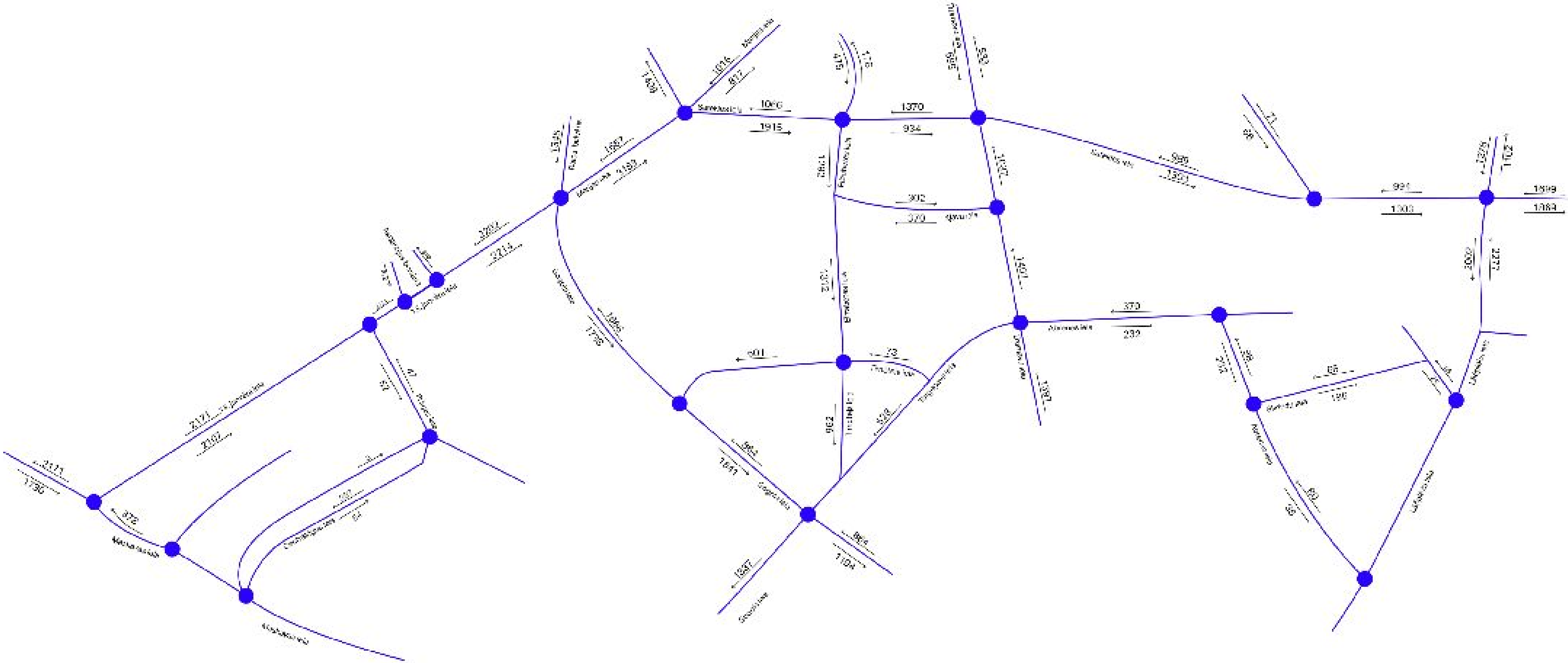


Appendix WP 2.1 – Multi-Modal Hub Alternatives

RPTH RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

WP2.1 – Elaboration of transport hub alternatives

WP2.5 – Elaboration of selected alternatives of the transport hub

WP2.6 – Feasibility study of the best solutions and selection of the preferred option

AECOM

RPTH RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

1. URBAN ANALYSIS

2. DEVELOPMENT OF THE ALTERNATIVES: URBAN PROPOSALS & MULTIMODAL OPTIONS
   - 2.1. Urban proposals
   - 2.2. Traffic studies
   - 2.3. Multimodal alternatives
   - 2.4. Options for the front plaza
   - 2.5. Conclusions and Recommendations

3. CONSTRUCTION SYSTEMS AND TRACK CROSS SECTION

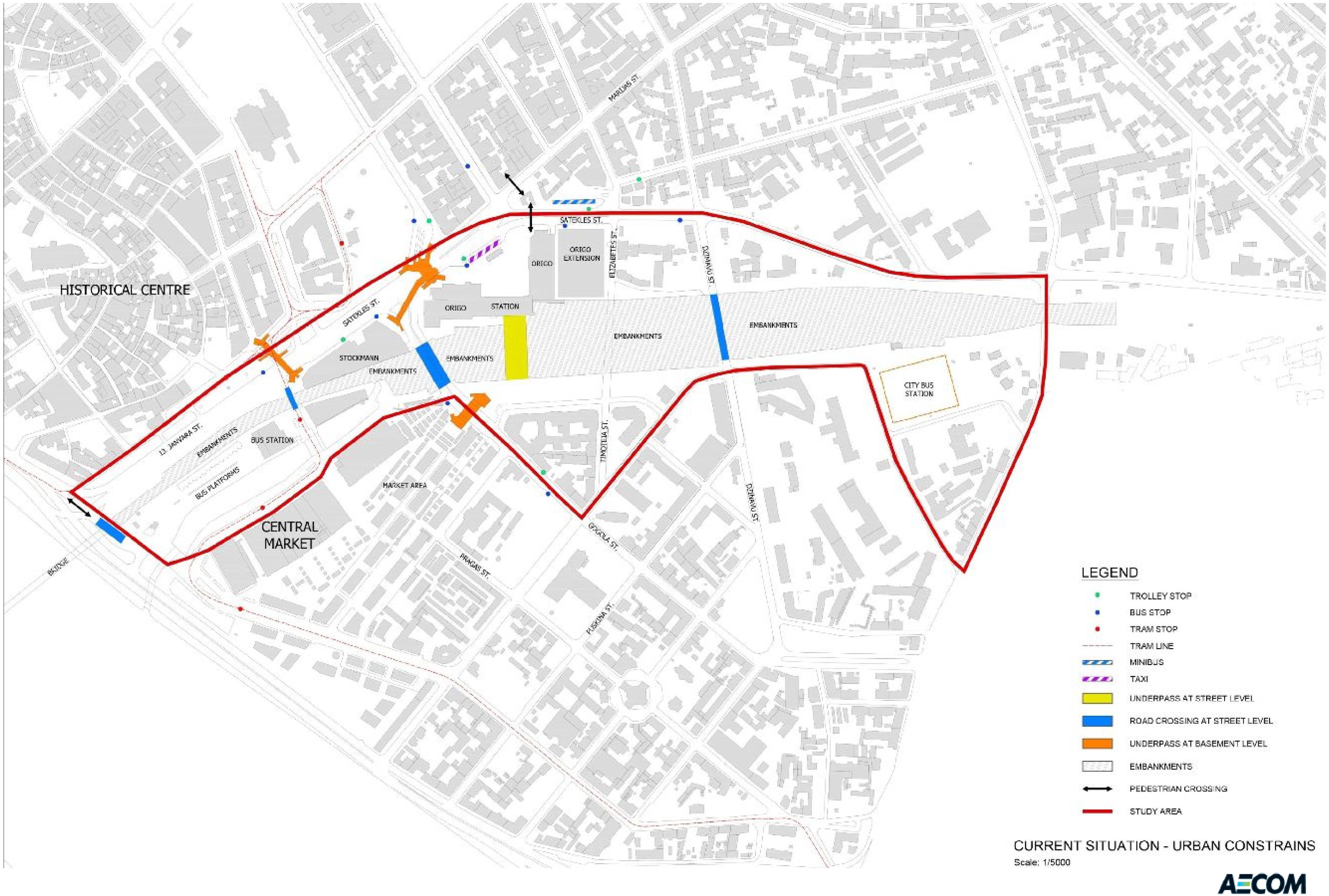
4. DESIGN PROCESS SKETCHES

26th October, 2015

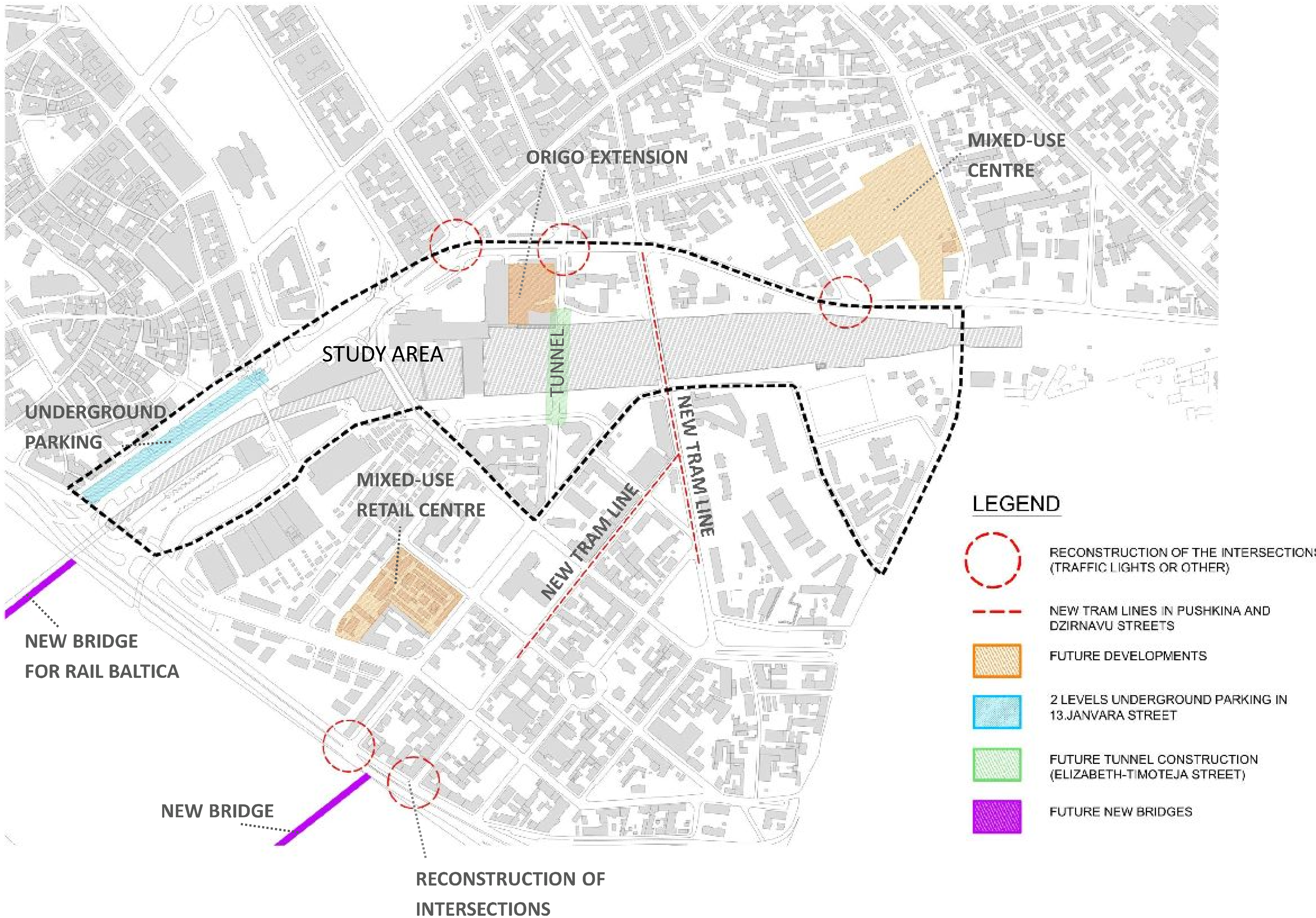
AECOM

1.URBAN ANALYSIS

1.1. Urban Constrains Analysis



1.2. Future potential projects



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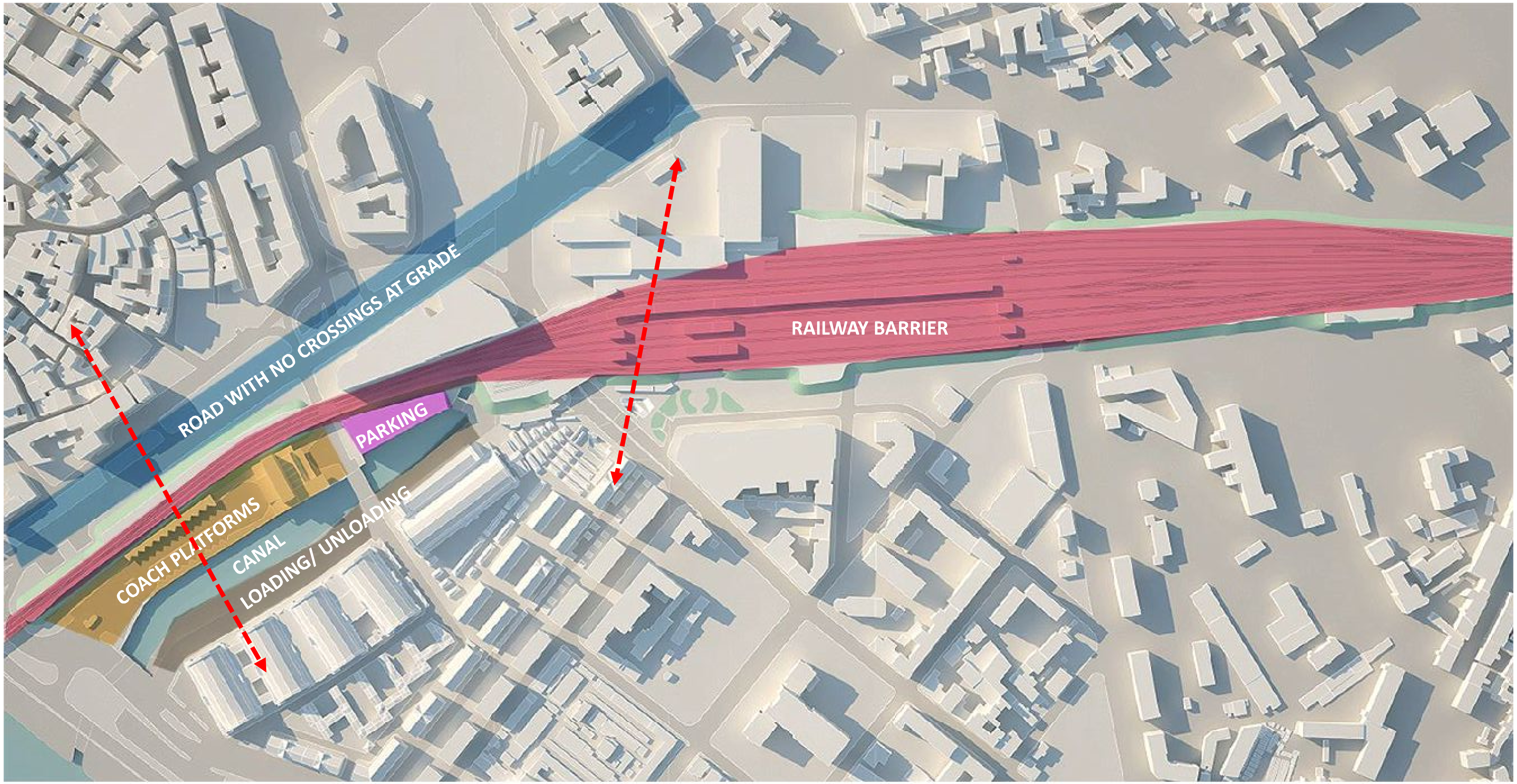


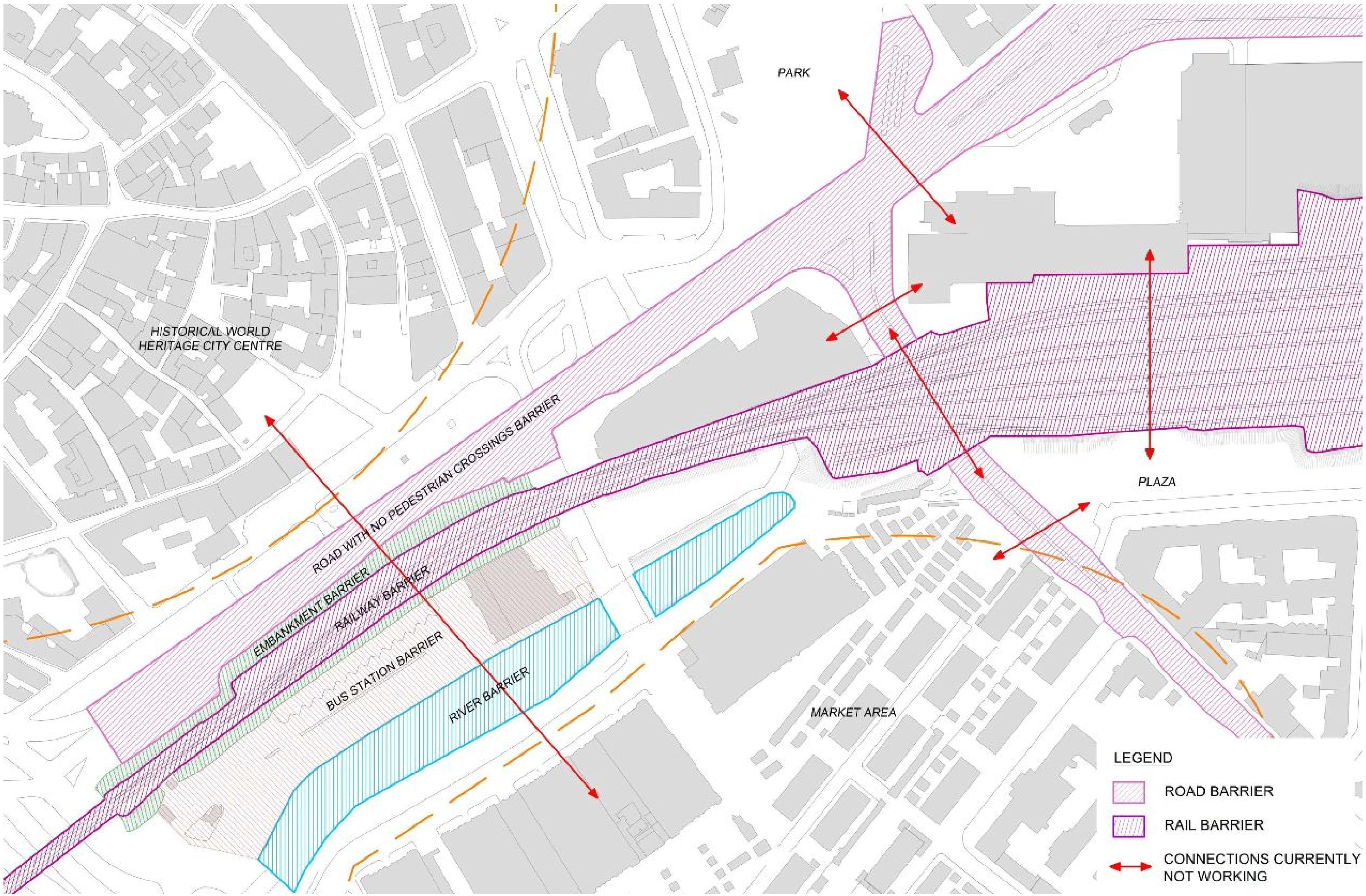
Unsafe Underpasses.

No pedestrian crossings

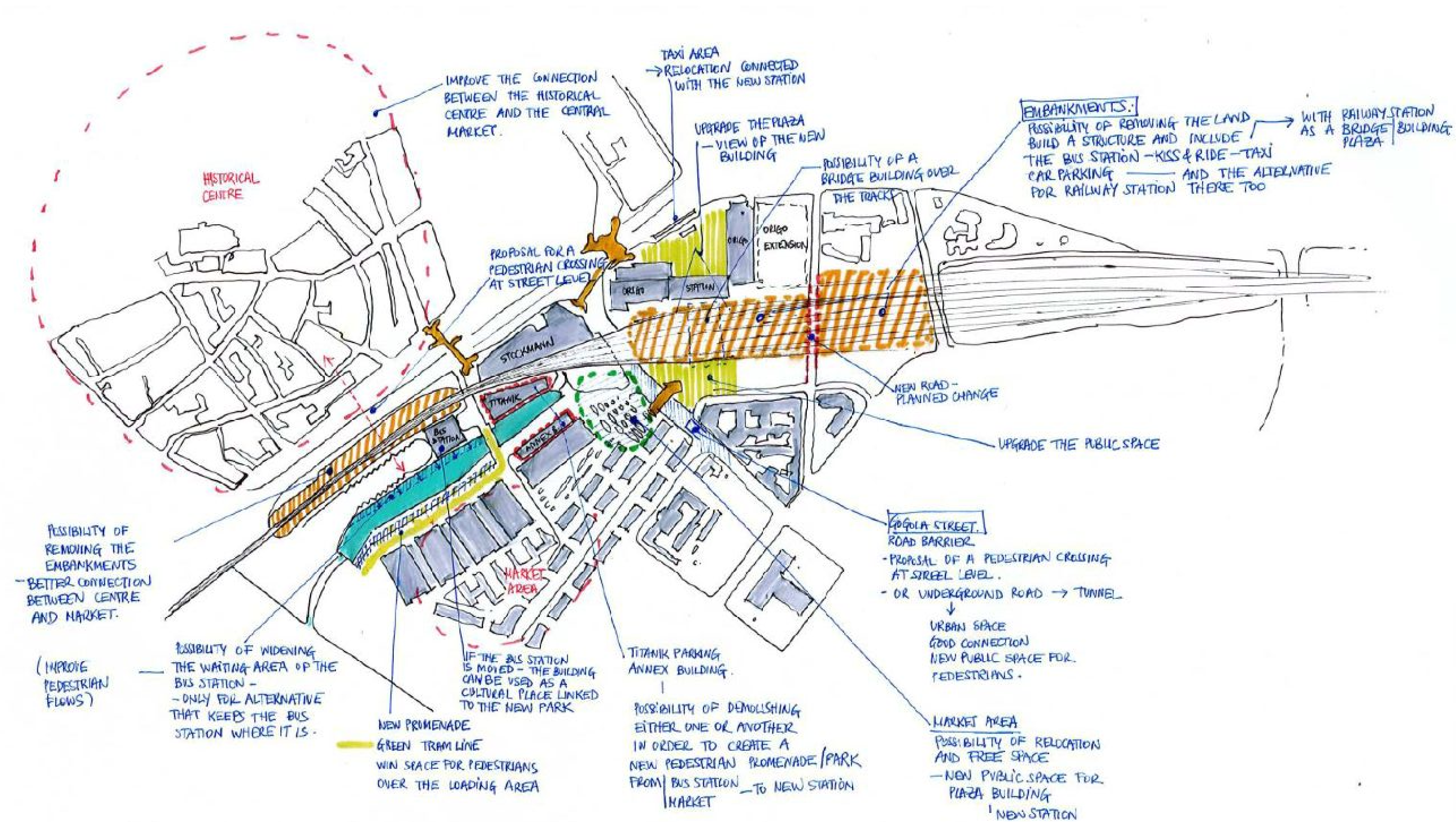
Weak connections between urban areas

AECOM

1.4. Urban Barriers Analysis



1.5. First Concept Ideas

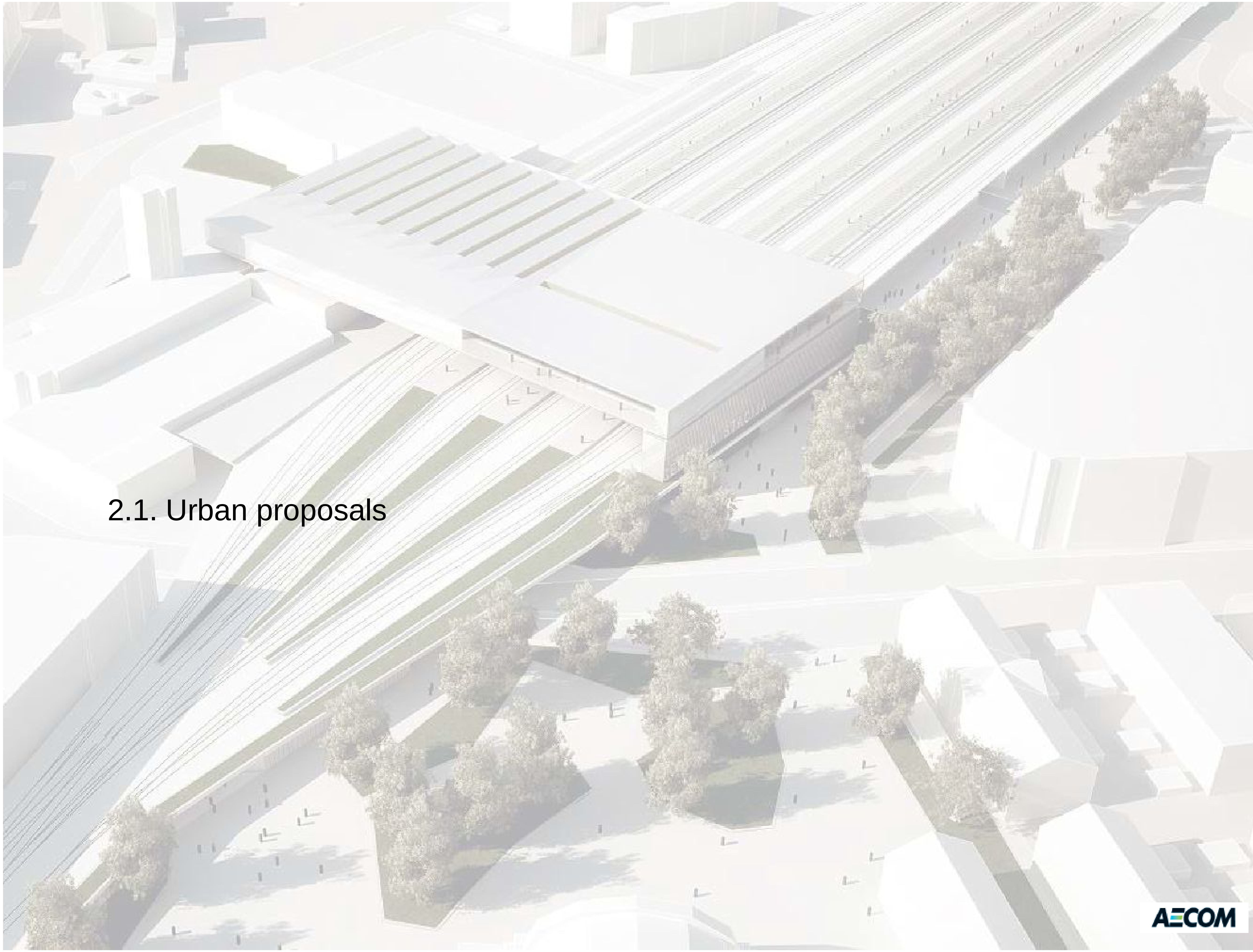


2. DEVELOPMENT OF THE ALTERNATIVES:

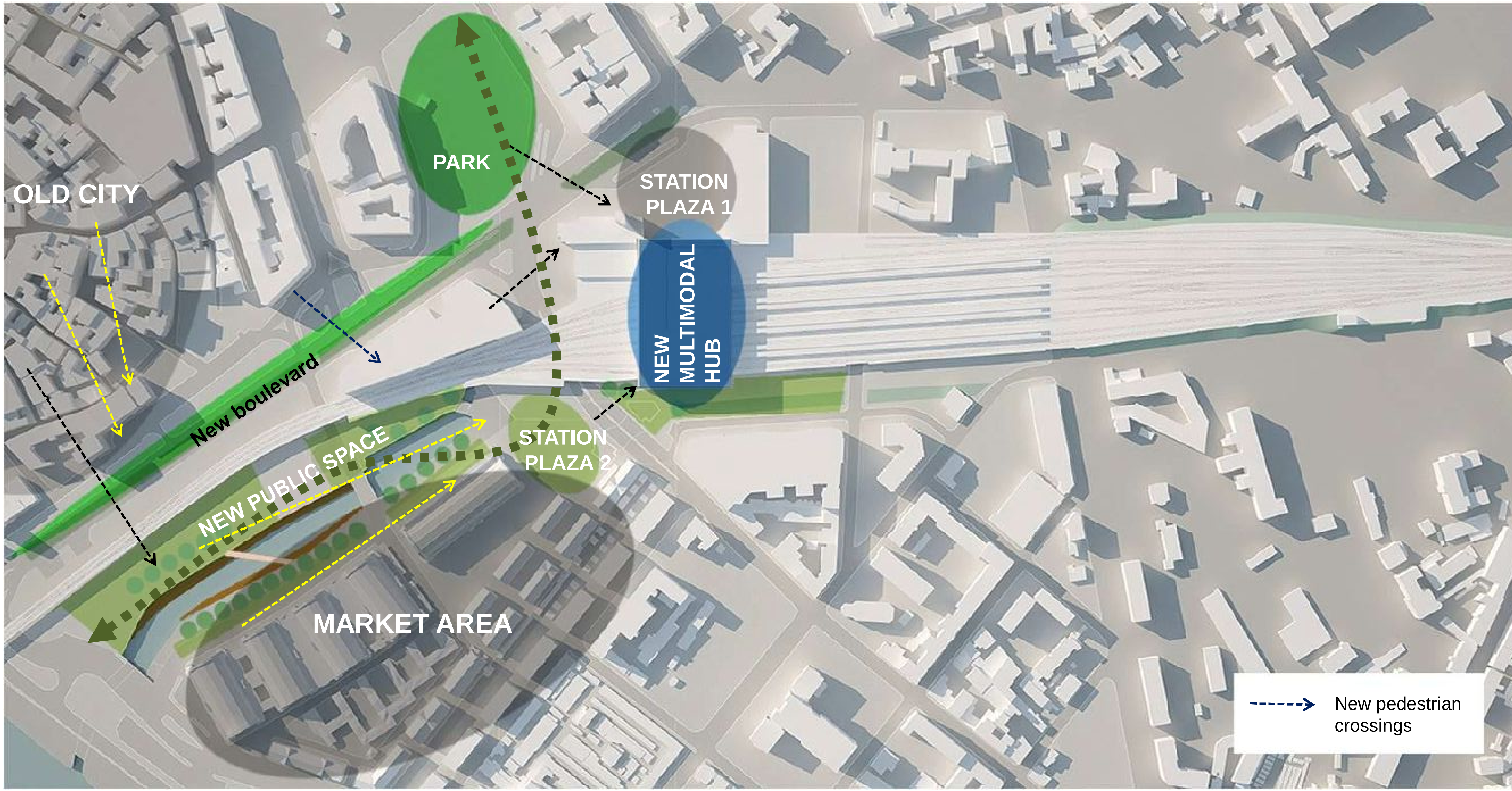
URBAN PROPOSALS & MULTIMODAL OPTIONS

AECOM

2.1. Urban proposals



URBAN PROPOSALS_ Public Space and Urban integration



URBAN PROPOSALS_ Public Space and Urban integration

ZURICH VIADUCT

INTEGRATION OF THE RAILWAY IN THE CITY

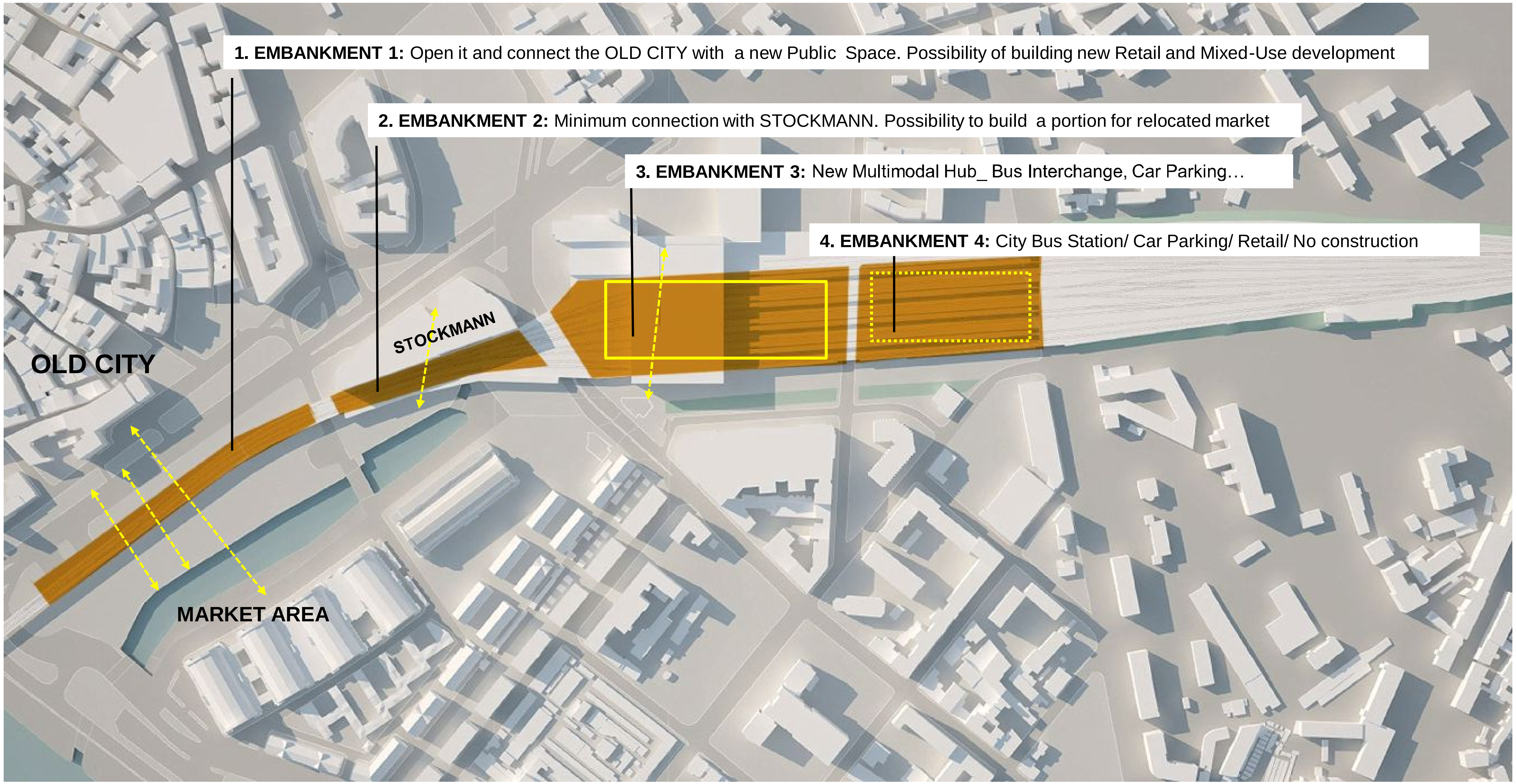
RETAIL AT THE EMBANKMENT

BILBAO RÍA 2000

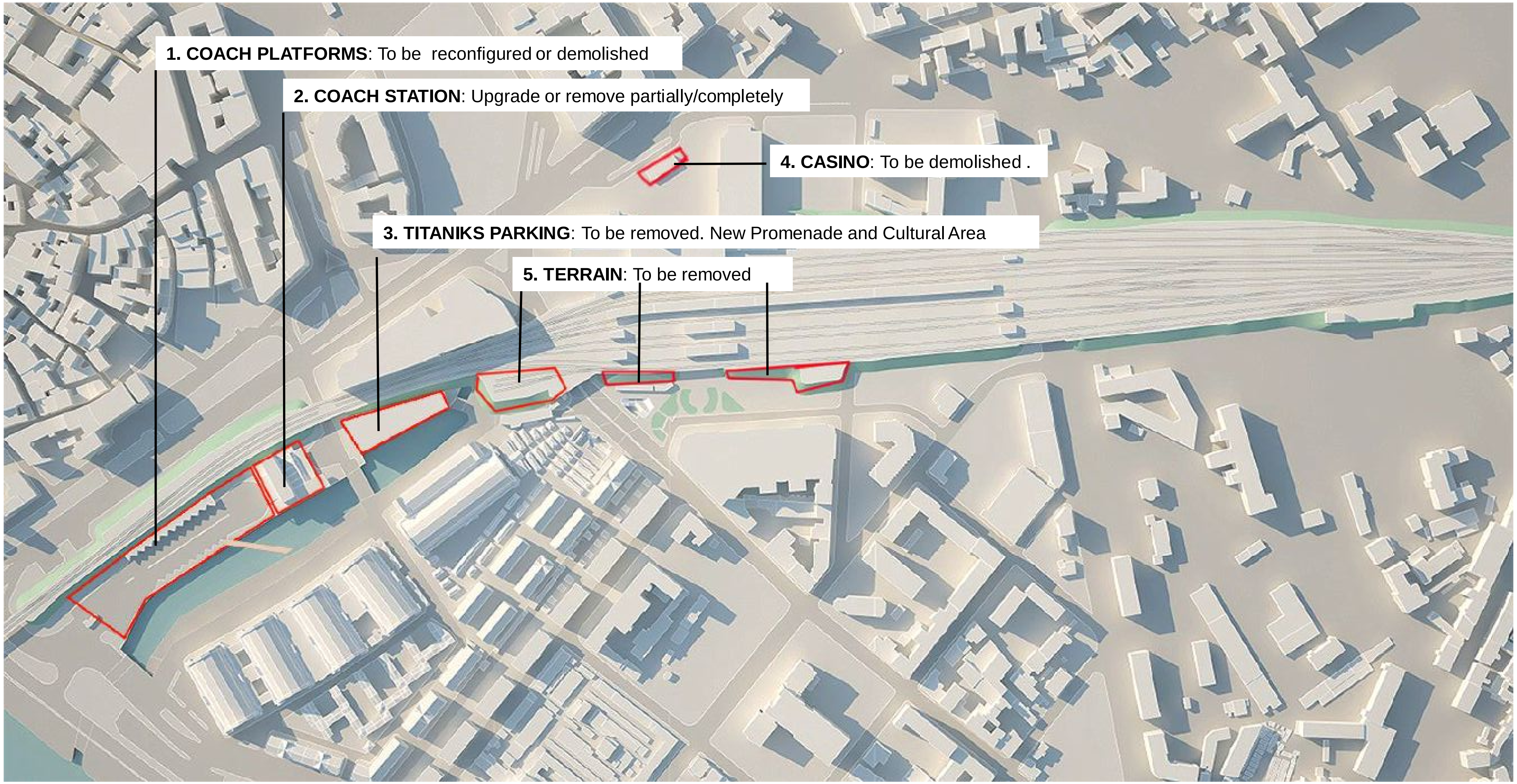
INTEGRATION OF THE RIVER INTO DE CITY

PUBLIC SPACE CONNECTING THE CITY

URBAN PROPOSALS_ Proposals for the Embankments



URBAN PROPOSALS_ Demolitions



URBAN PROPOSALS_ Demolitions

Coach platforms: To be reconfigured due to Rail Baltica tracks, or to be completely demolished for a new public urban space.

Coach Station: 1. Minimum reconstruction of the building due to Rail Baltica tracks and interior renovation (opening the basement towards the river). 2. To be completely demolished

.

Titanik Car Parking: To be completely removed and Car places relocated in the new parking of the Multimodal Hub.

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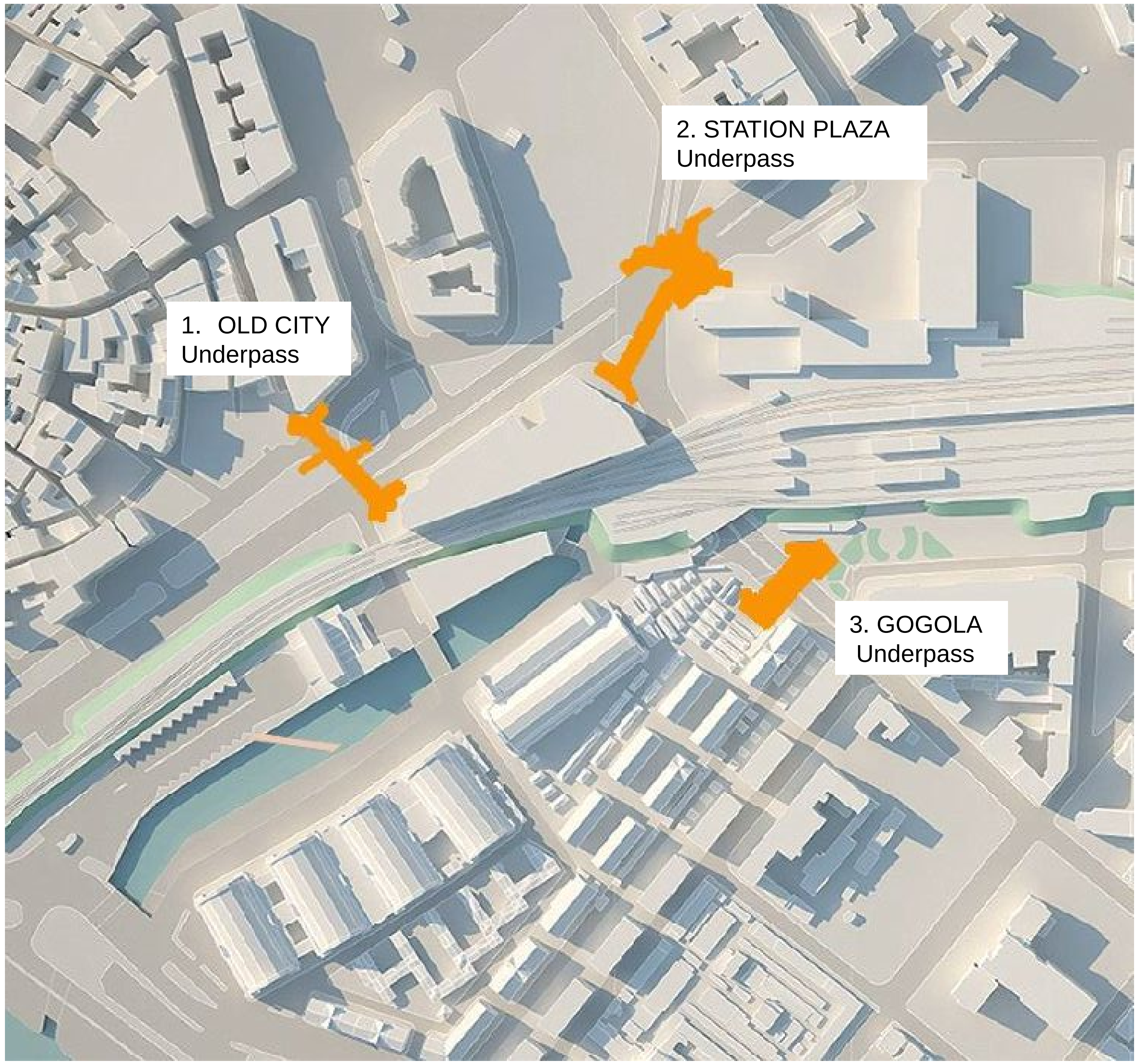
URBAN PROPOSALS_ Underpasses



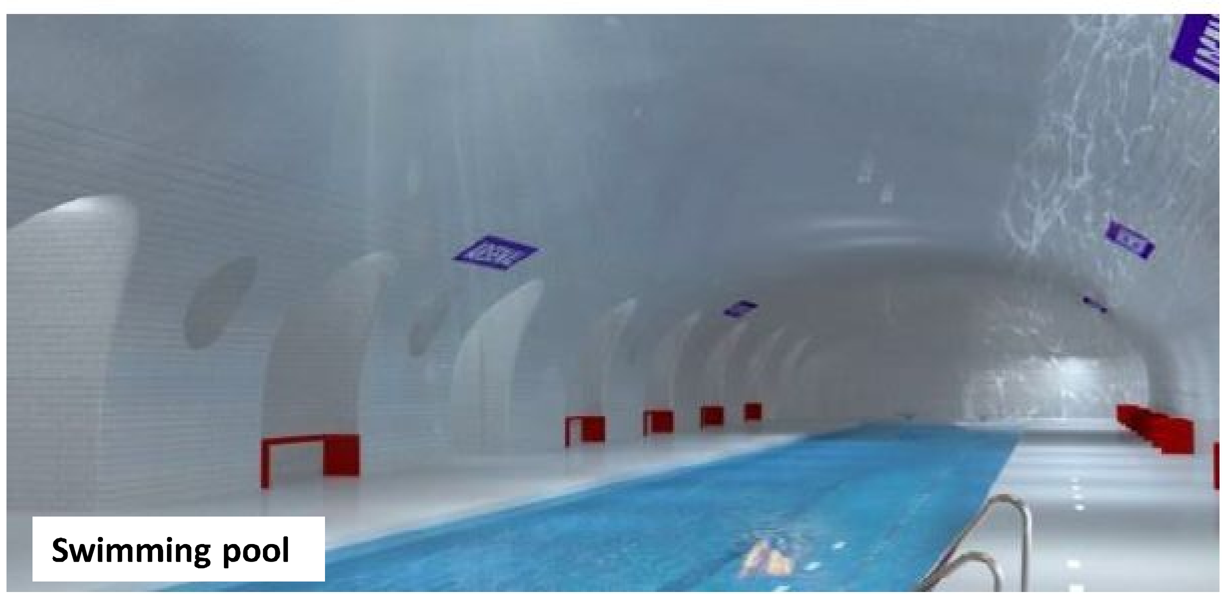
PROBLEMS: Dark, unsafe, unconfortable connections

PROPOSALS: Reuse the existing infrastructure for NEW FUNCTIONS related to cultural uses, for example.

Pedestrians will cross
NEW PEDESTRIAN CROSSINGS AT GRADE

URBAN PROPOSALS_ Underpasses References for New functions

Abandoned metro stations in Paris will become swimming pools, restaurants and other cultural and leisure centres:



AECOM

NEW PEDESTRIAN PROMENADES ALONG THE RIVERSIDES

Urban regeneration of the Study Area

CULTURAL PARK:
Exhibition galleries, Building renovated for cultural use

GARDENS: and access to ramp down to the water feature

LEISURE AREA: and access to Stockmann

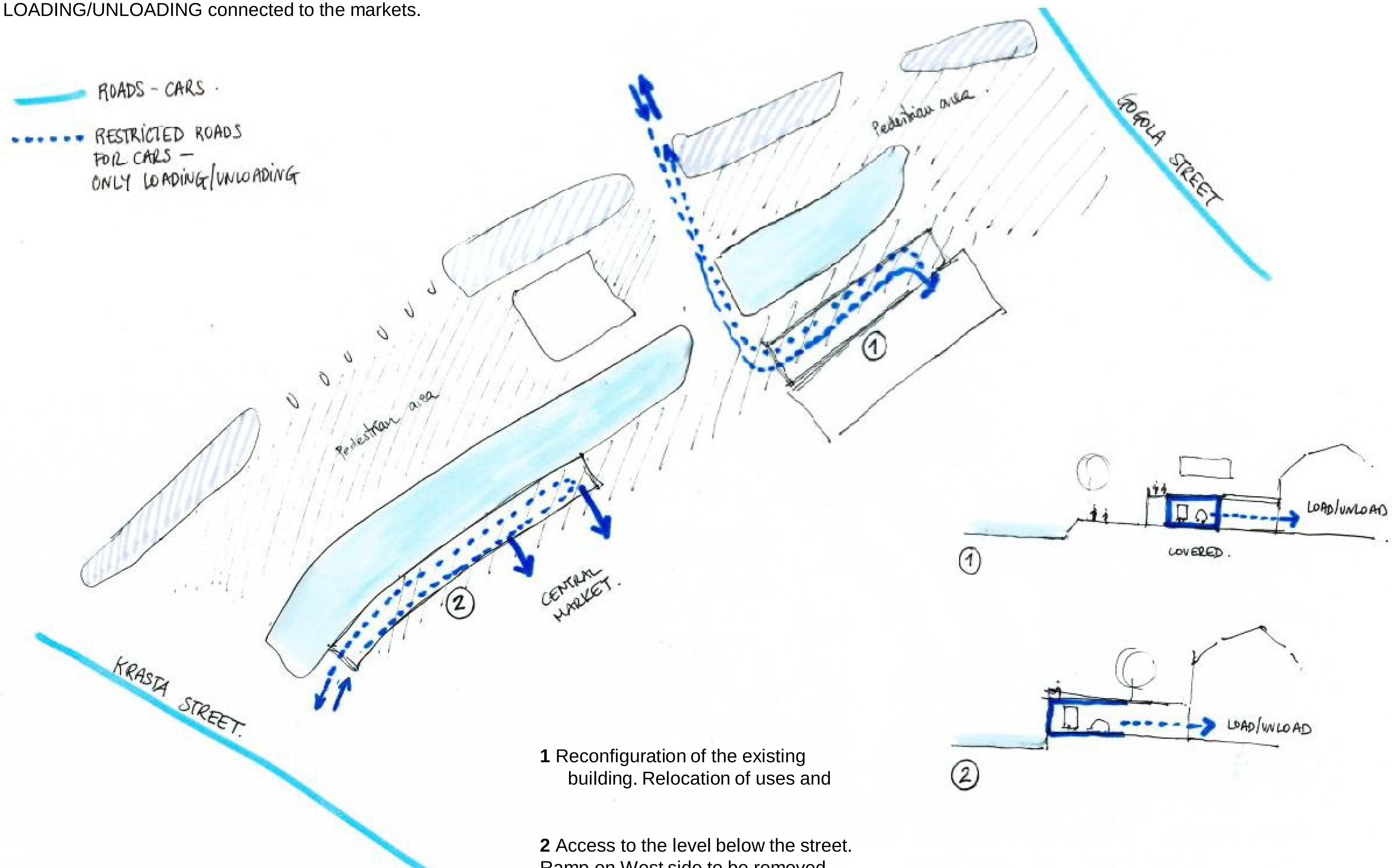
NEW PROMENADES and new QUAI

PEDESTRIAN BRIDGE

WP2.1 – Elaboration of transport hub alternatives **PROCESS**

Car/Lorries accesses for LOADING / UNLOADING

Proposal of an area **mainly pedestrian** with restricted access for LOADING/UNLOADING connected to the markets.

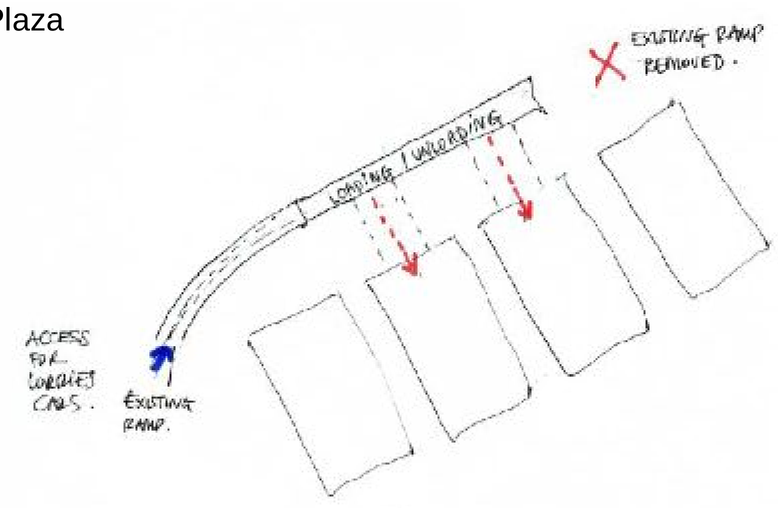


1 Reconfiguration of the existing building. Relocation of uses and

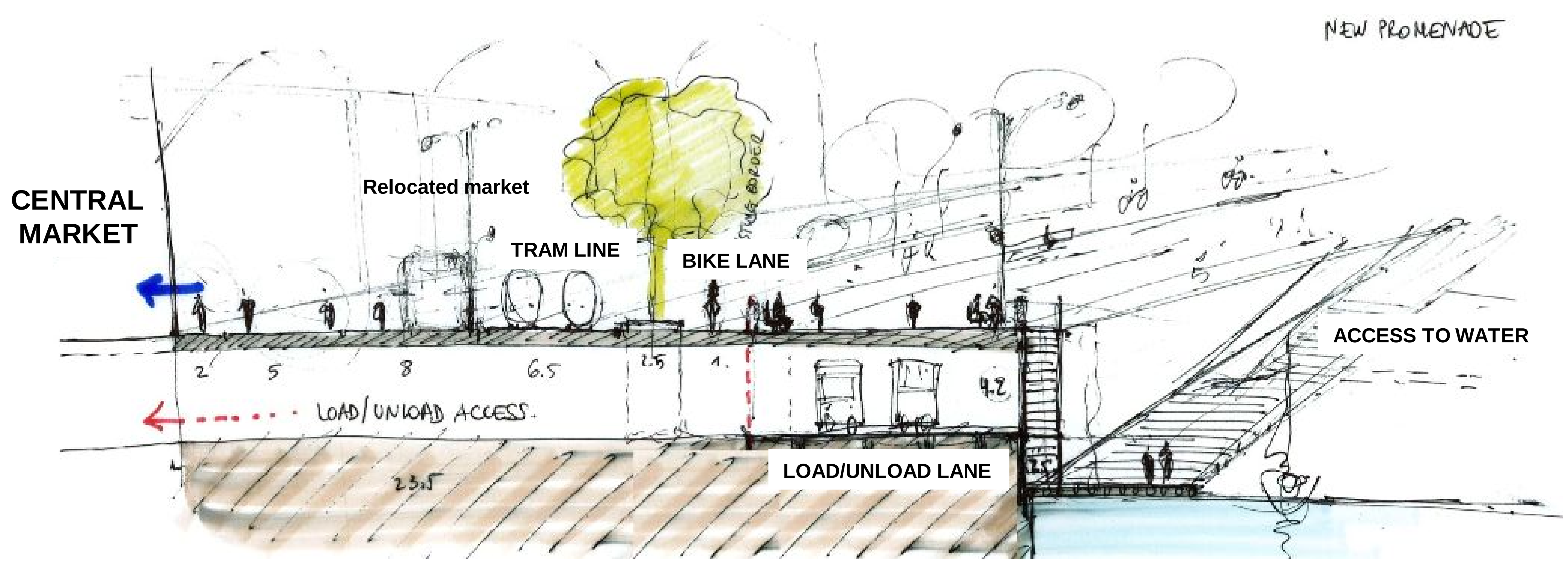
2 Access to the level below the street. Ramp on West side to be removed and only use one

Market riverside

New promenade from the Market to the Station Plaza
Pedestrian area
Possibility of relocated market
Tram Line
Bike Lane
Promenade – benches towards the water
Access to the water – Quai
Loading/ Unloading BELOW the promenade



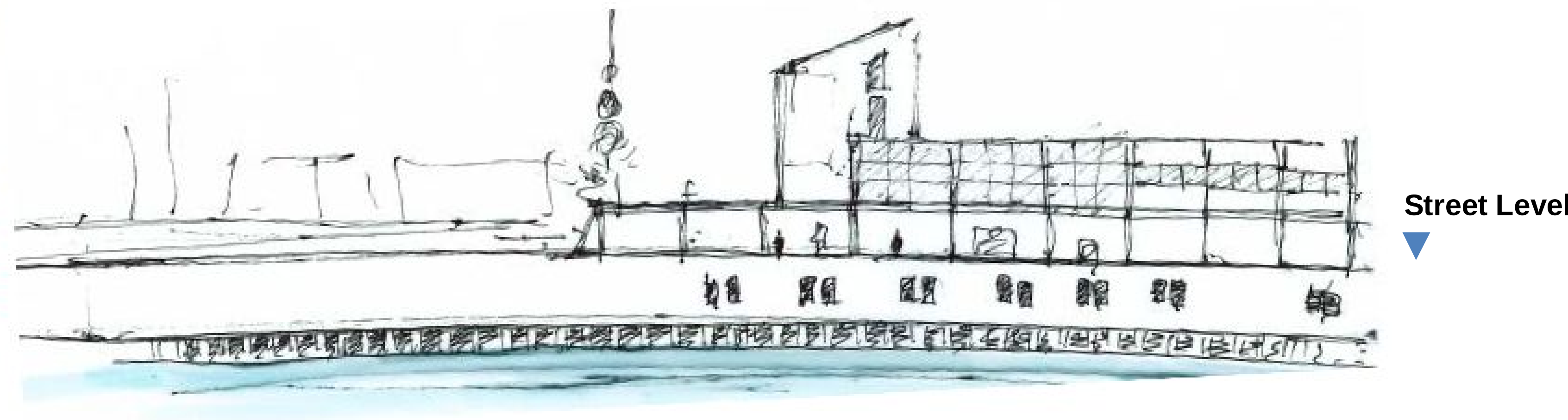
Loading/Unloading through the existing ramp
The other to be removed and assure the continuity of the promenade



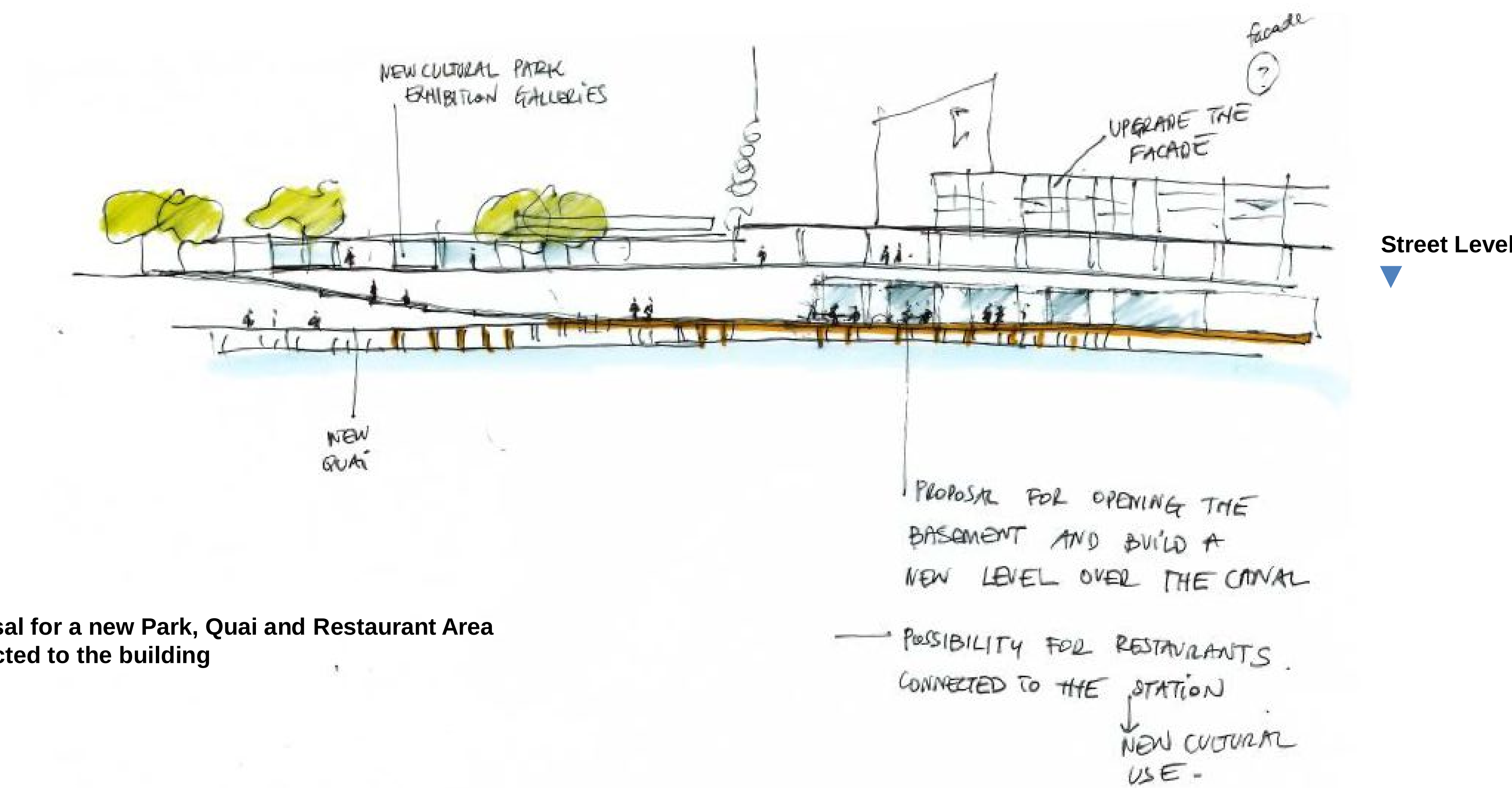
Market section: Proposal of wining pedestrian promenade over the LOAD/UNLOAD lane existing at a level below the street

Current Coach Station Riverside

Current Coach Station
Windows at basement level – Proposal of opening them



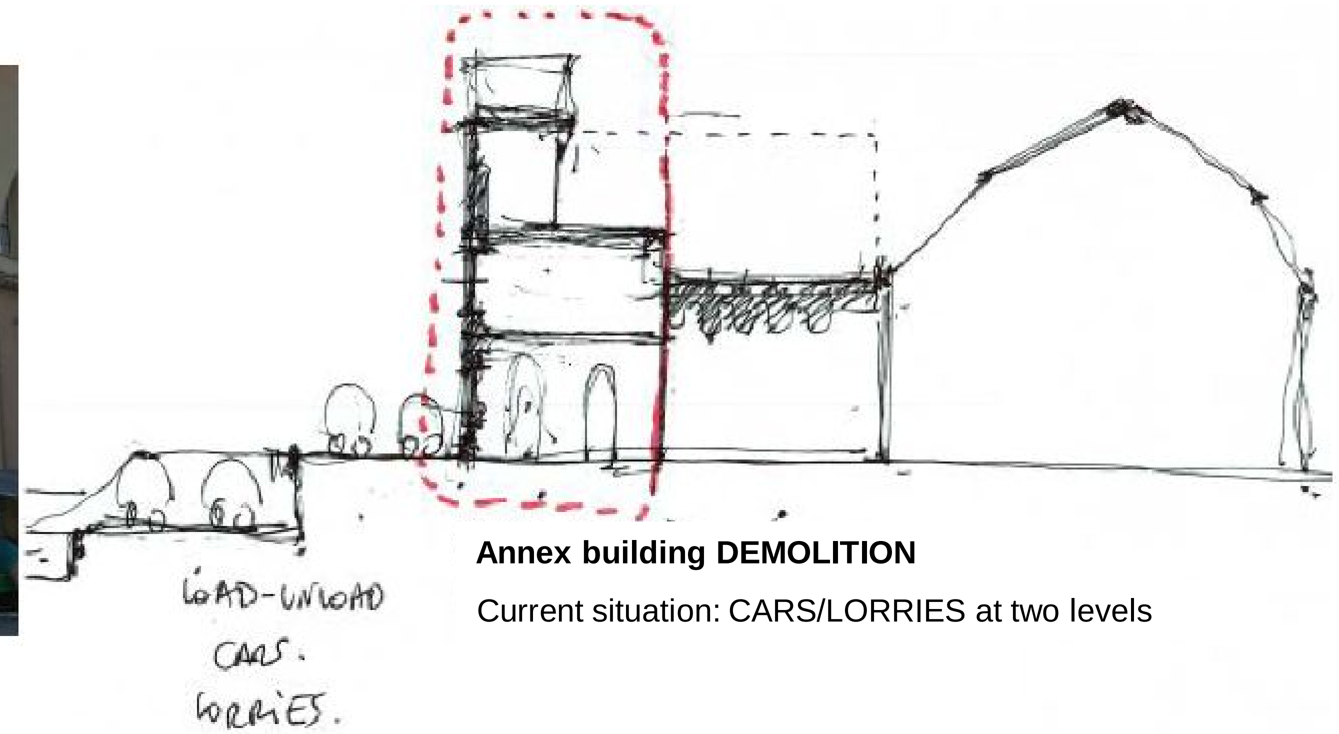
Current Coach Station Elevation



Proposal for a new Park, Quai and Restaurant Area connected to the building

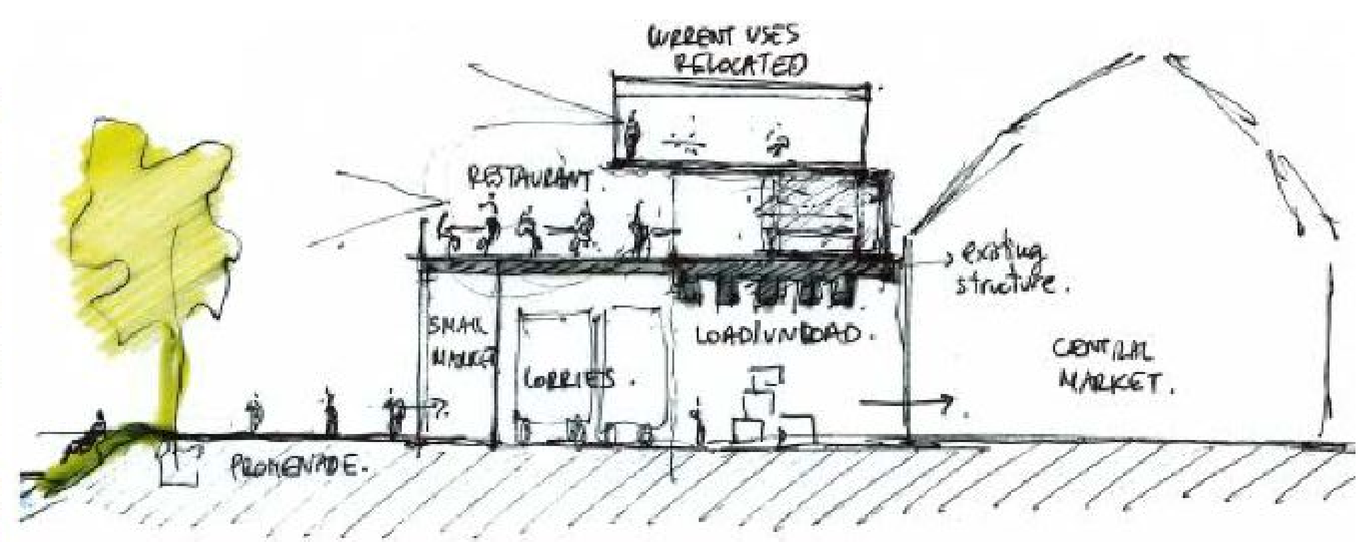
WP2.1 – Elaboration of transport hub alternatives **PROCESS**

Annex volume to Market building



Annex building DEMOLITION

Current situation: CARS/LORRIES at two levels



Solution for LOADING/UNLOADING AT THE NEW PROMENADE
Keep the existing concrete structure – platform and build above a restaurant area.
Extend the deck of the platform level and cover the LOADING/UNLOADING AREA

General view of the Current Situation

General view of the proposed Urban Planning

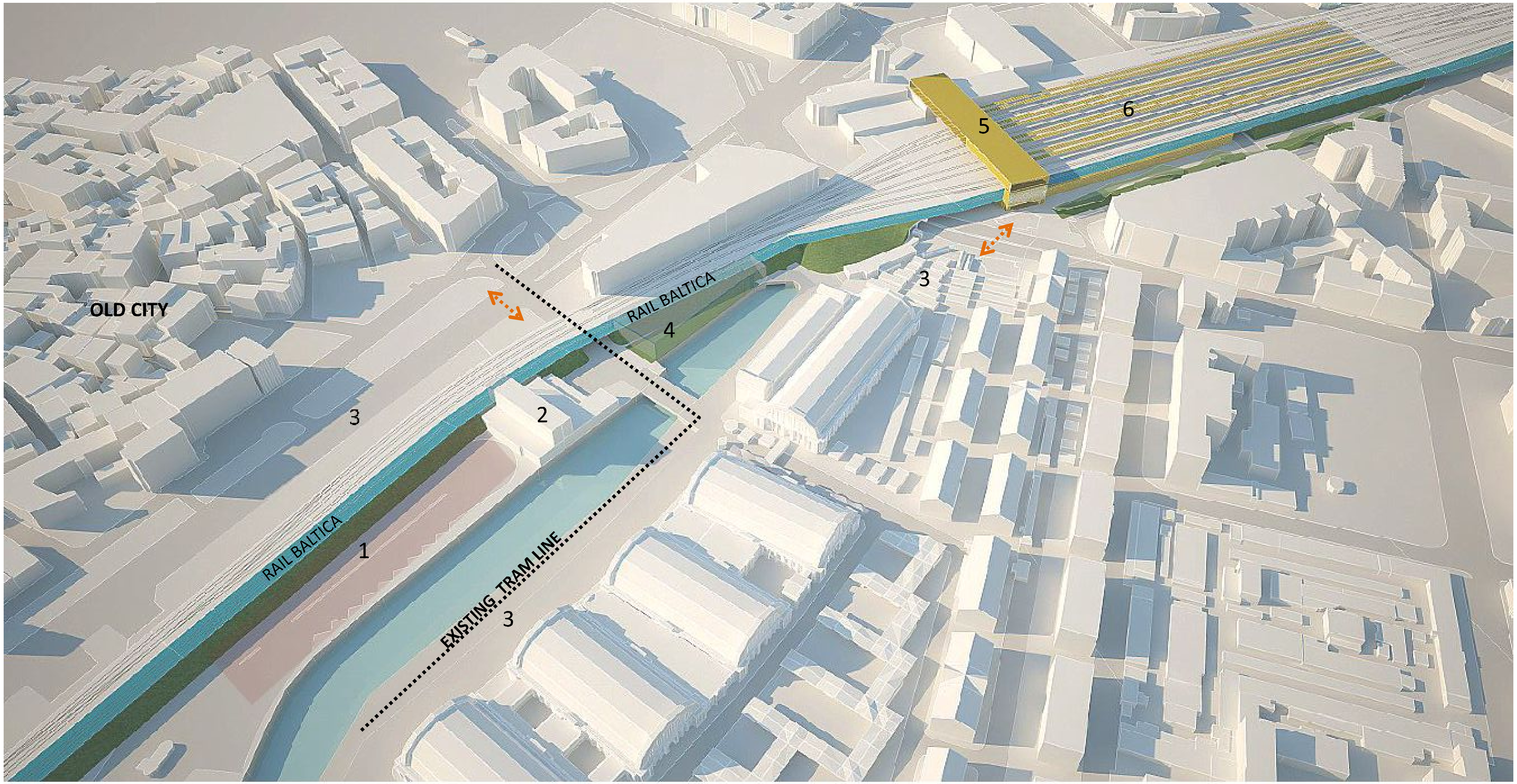
RPTH – RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

Minimum intervention

AECOM

RPTH – RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

Minimum intervention



1. **COACH PLATFORMS**: Some platforms to be removed due to Rail Baltica tracks. Area to be reconfigured.
2. **COACH STATION**: Part of the building to be removed due to Rail Baltica tracks.
3. **MARKET RIVERSIDE – 13. JANVARA STREET – FLEE MARKET:** No intervention.
4. **TITANIK**: To be removed due to Rail Baltica tracks. New green public space.
5. **NEW MULTIMODAL HUB**: Elevated Station connected to existing one.
6. **PLATFORMS**: - Platforms to be lifted up for accesibility.
   - New longitudinal canopies for covering the platforms

NEW PEDESTRIAN CROSSINGS: At 13. Janvara Street and Gogola Street

AECOM

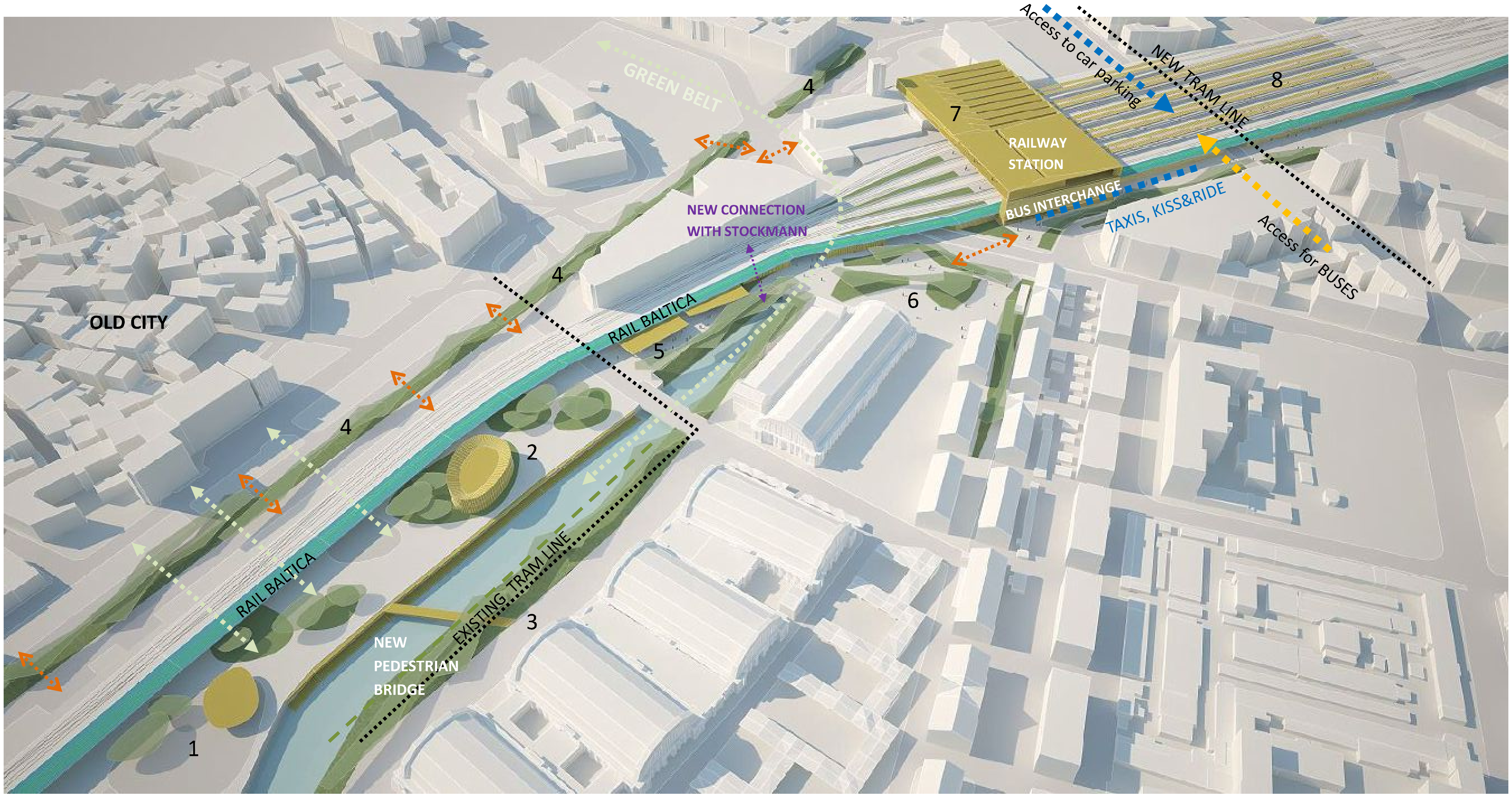
RPTH – RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

Maximum intervention

AECOM

RPTH – RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

Maximum intervention

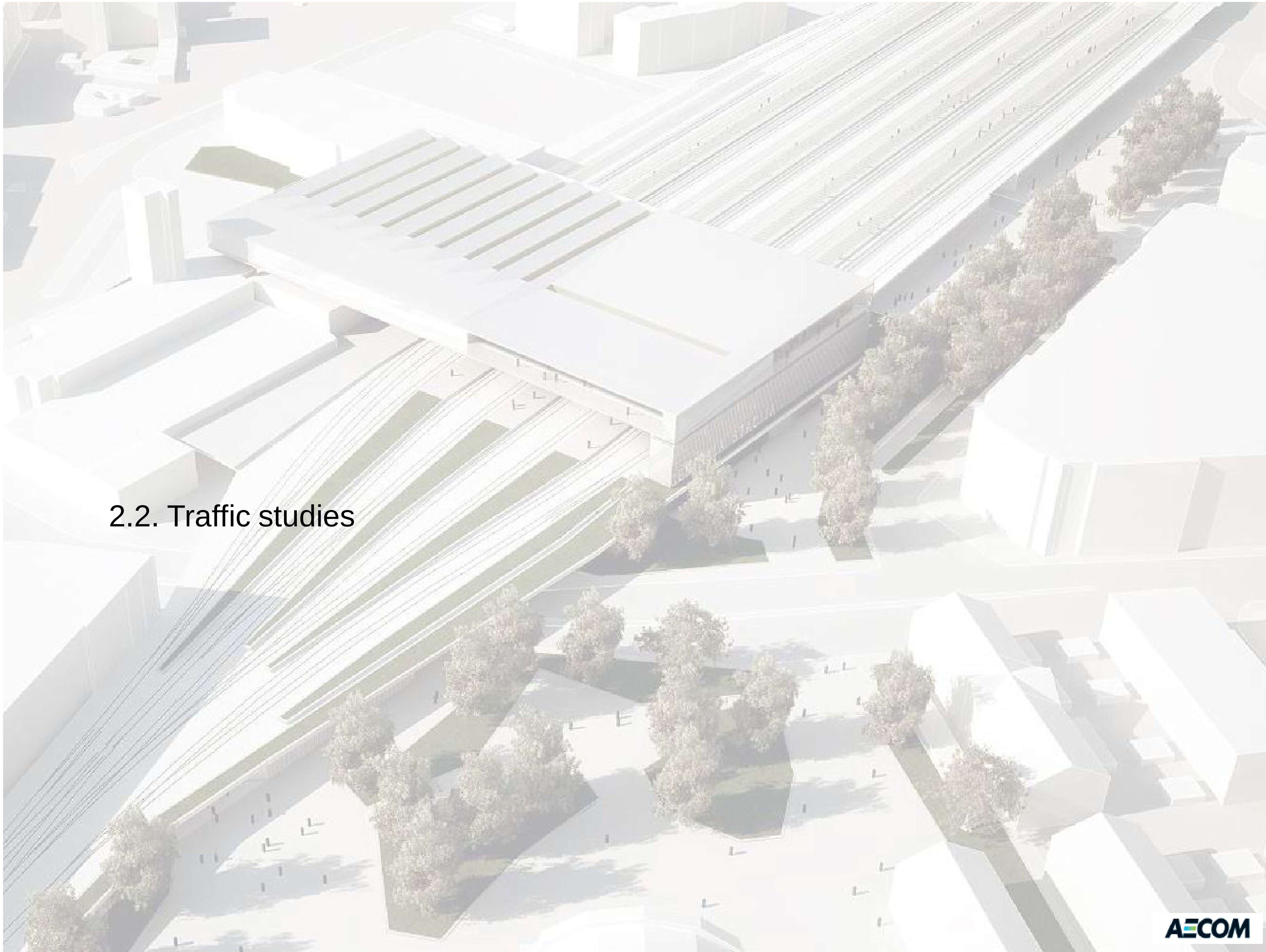


1. **COACH PLATFORMS:** - Completely Removed. Touristic Buses and Tourist Information Point.
   - New Green Public Space liked with the old city
2. **COACH STATION**: Completely Removed. New Cultural Building (f.e. Museum of Baltic Heritage)
3. **MARKET RIVERSIDE:** Regenerated area. Win sidewalk covering loading area and. Line of trees.
4. **13. JANVARA STREET**: New traffic configuration. Boulevard for better pedestrian connection.
5. **TITANIK:** Cantilevered roof for housing relocated flee markets.
6. **FLEE MARKET:** Relocated. New station Plaza.
7. **MULTIMODAL HUB**: Elevated Railway Station-Bus Interchange at Street level (removing the embankment) and Car Parking at a basement.
8. **PLATFORMS**: - Platforms to be lifted up for accesibility.
   - New longitudinal canopies for covering the platforms

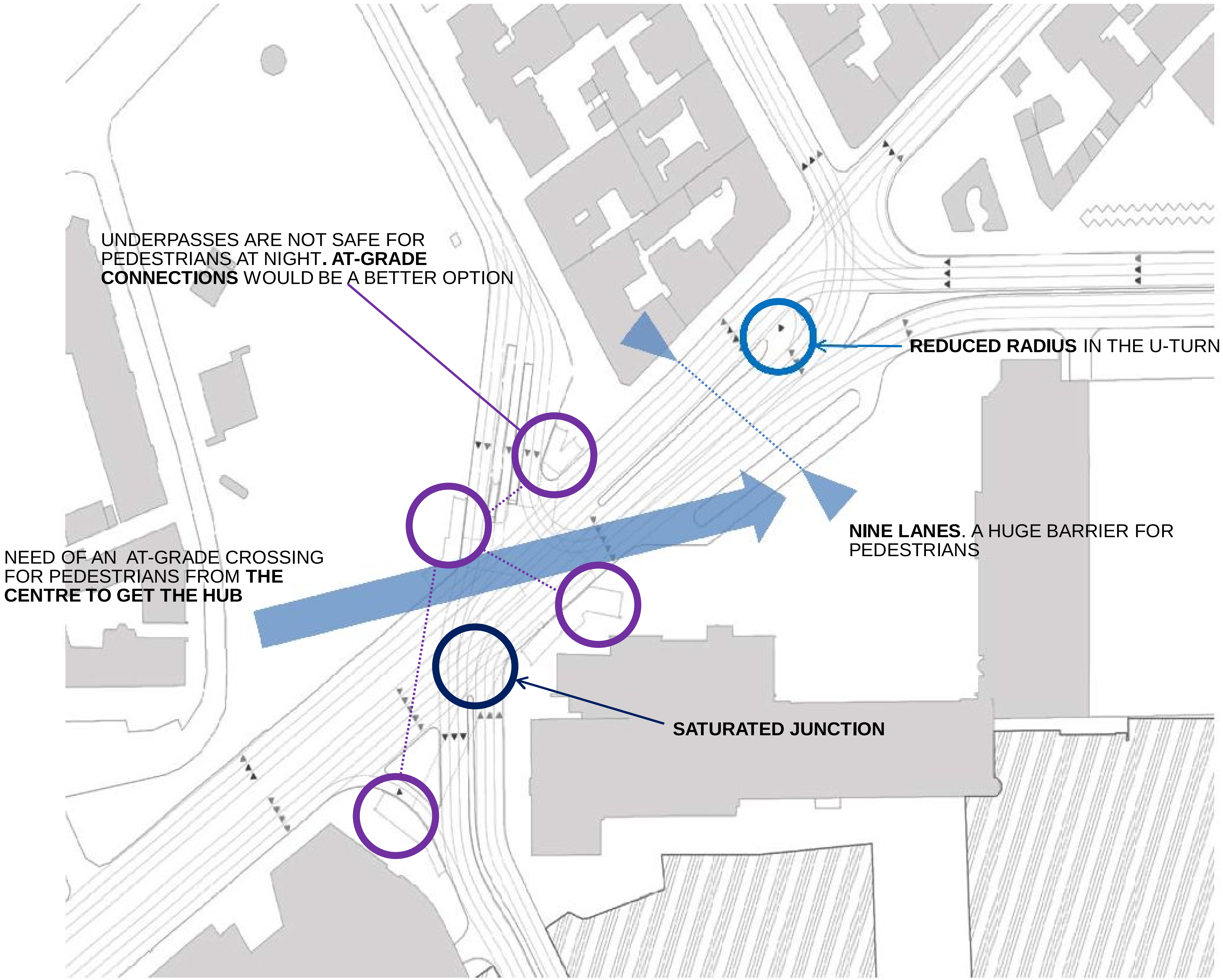
NEW PEDESTRIAN CROSSINGS: At 13. Janvara Street and Gogola Street

AECOM

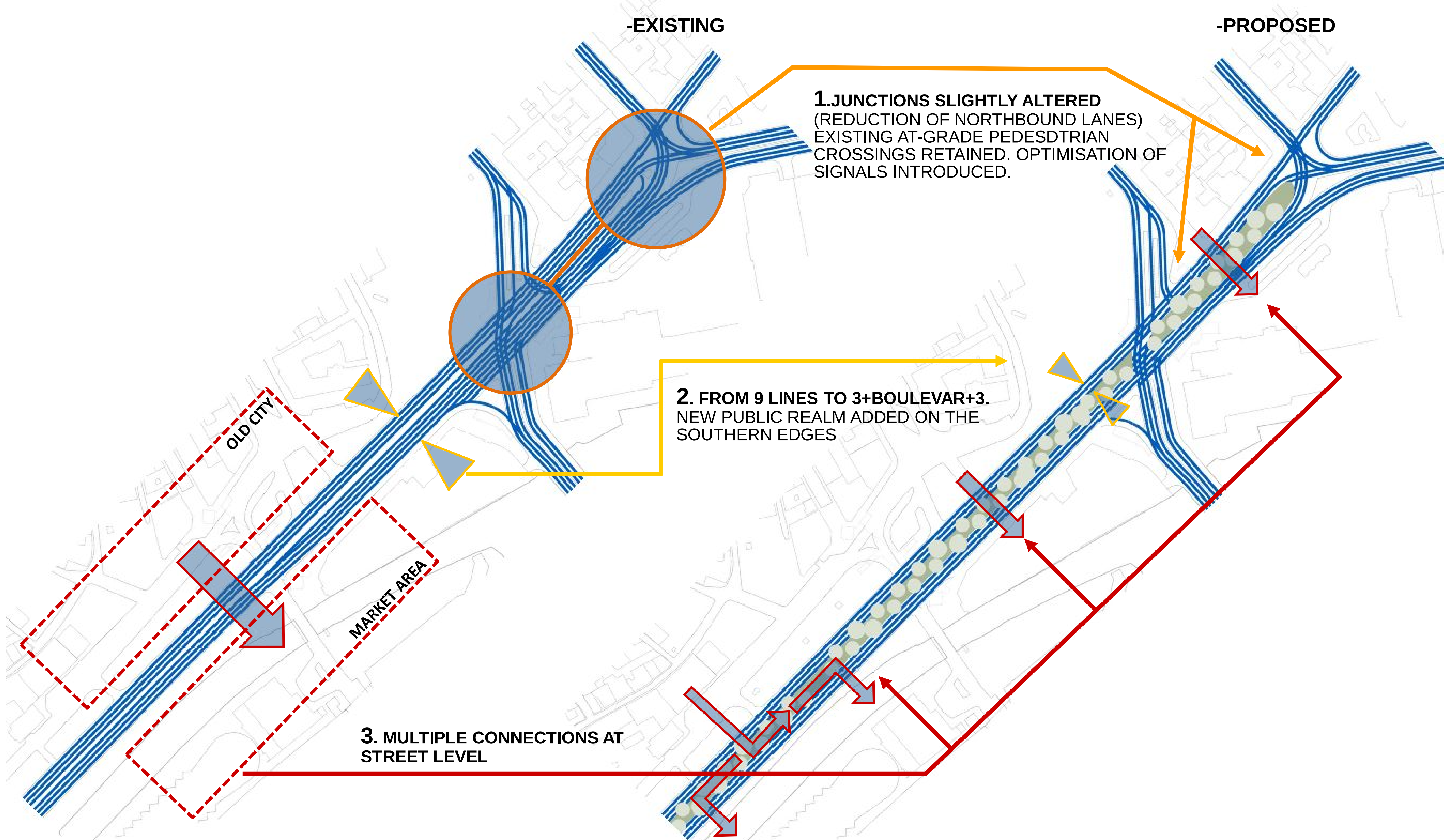
2.2. Traffic studies



URBAN PROPOSALS_ Existing situation

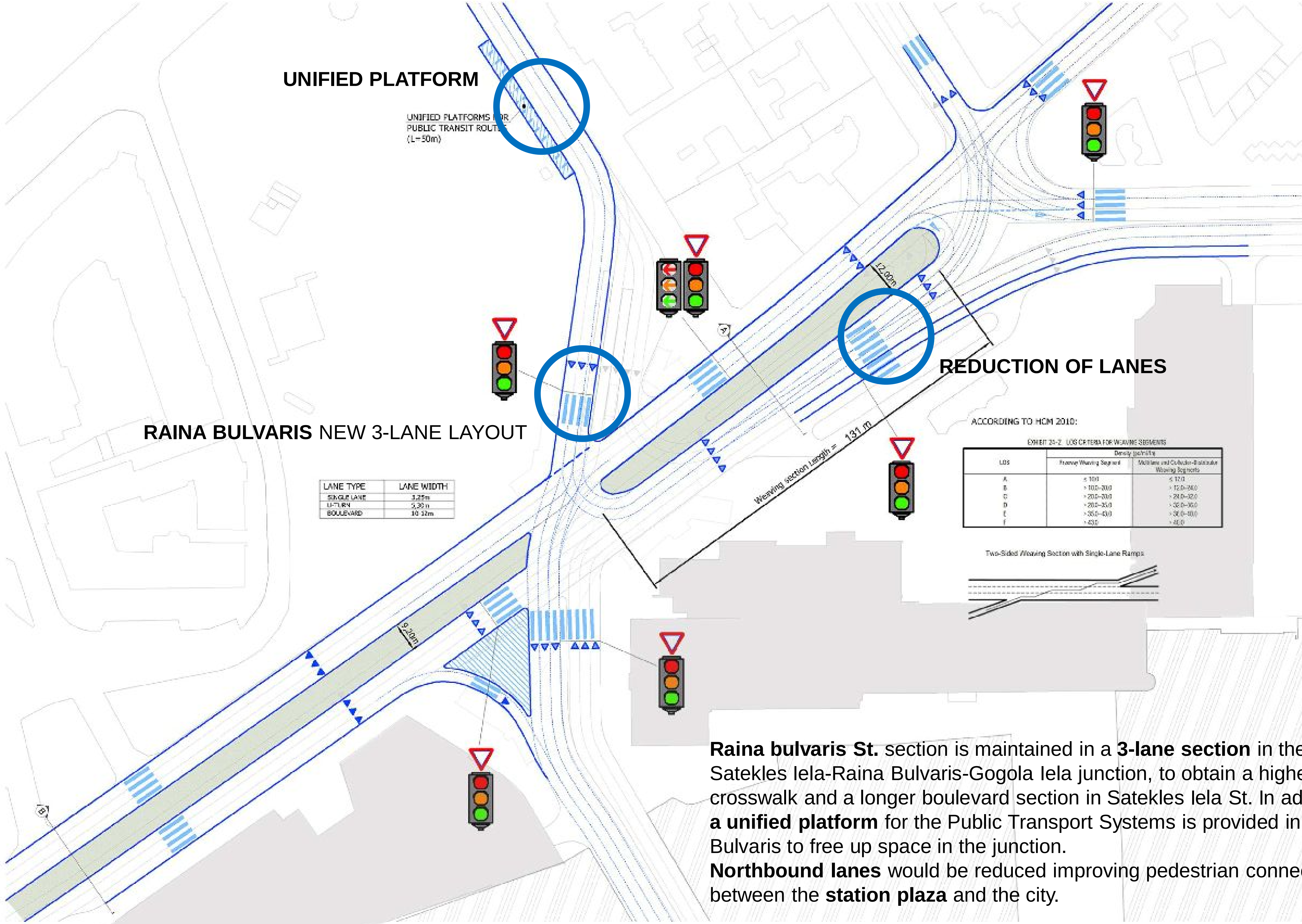


URBAN PROPOSALS_ Traffic proposals: **"NEW GREEN AXIS"**



The boulevard would function as a **new transition element** separating traffic flows and allowing greater pedestrian connectivity between both parts of the city.
A **green axis** would create a streetscape that improves the image of the street and creatersa greater sense of place

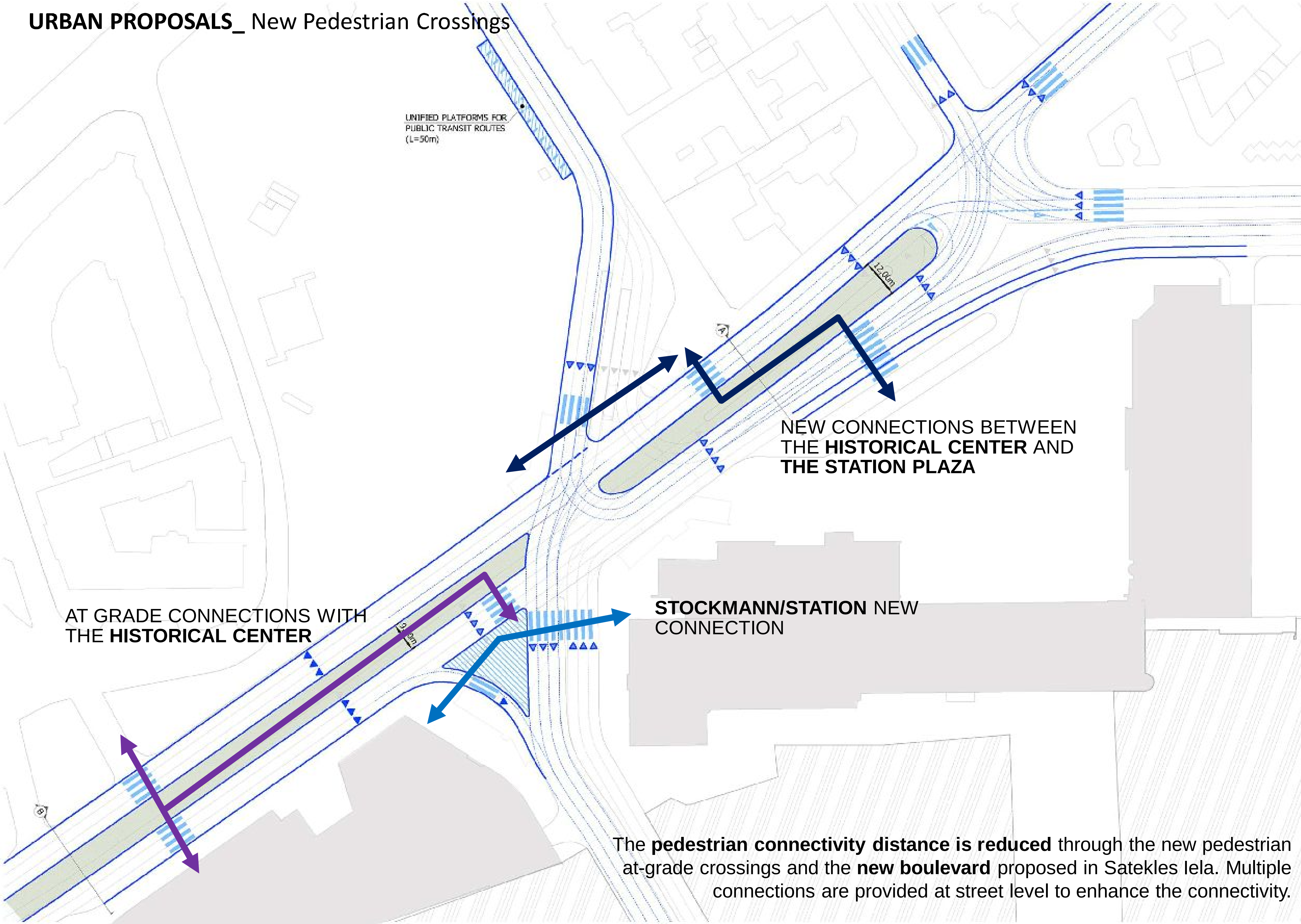
URBAN PROPOSALS_ New proposed traffic layout



Raina bulvaris St. section is maintained in a **3-lane section** in the Satekles Iela-Raina Bulvaris-Gogola Iela junction, to obtain a higher crosswalk and a longer boulevard section in Satekles Iela St. In addition **a unified platform** for the Public Transport Systems is provided in Raina Bulvaris to free up space in the junction.
Northbound lanes would be reduced improving pedestrian connection between the **station plaza** and the city.

AECOM

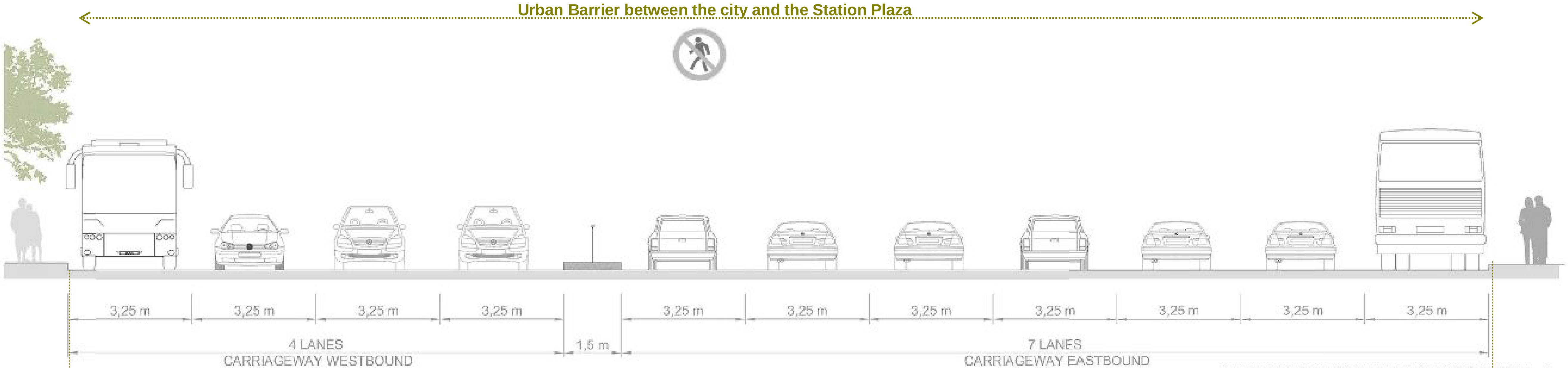
URBAN PROPOSALS_ New Pedestrian Crossings



The **pedestrian connectivity distance is reduced** through the new pedestrian at-grade crossings and the **new boulevard** proposed in Satekles Iela. Multiple connections are provided at street level to enhance the connectivity.

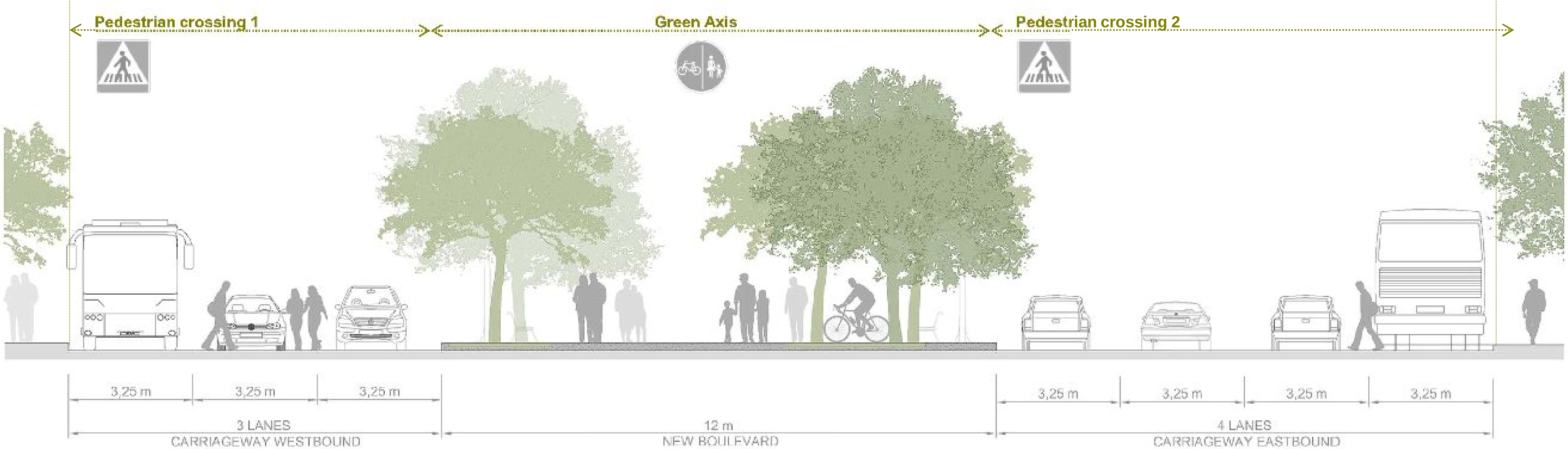
URBAN PROPOSALS_ Satekles Iela Section

-EXISTING



SATEKLES IELA STREET EXISTING SECTION - A
E: 1/100

-PROPOSED: **The New Boulevar will allow to define an at-grade connection between the city and the Station Plaza**

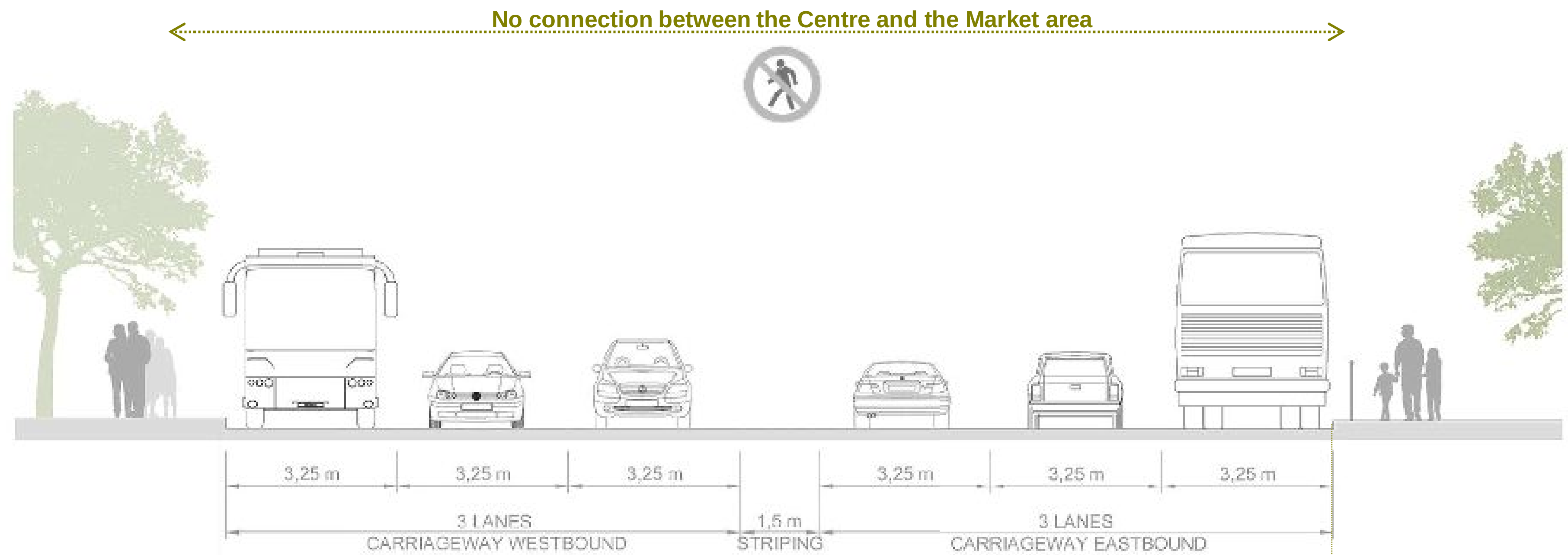


SATEKLES IELA STREET PROPOSED SECTION - A
E: 1/100

AECOM

URBAN PROPOSALS_ Janvara Iela Section

-EXISTING



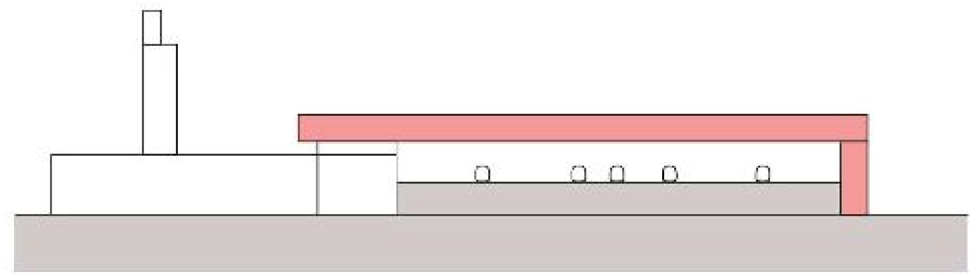
JANVARA IELA STREET TYPICAL SECTION
E: 1/100

-PROPOSED: The New Boulevar will allow to define an at-grade connection between the Historical centre and the Market Area

JANVARA IELA STREET PROPOSED SECTION - B
E: 1/100

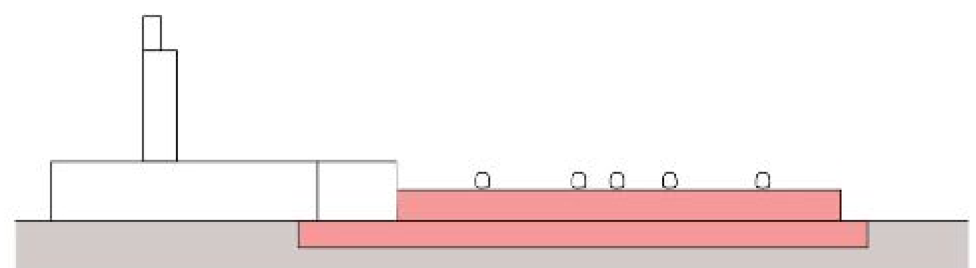
2.3. Multimodal alternatives

Alternatives: 3 Groups



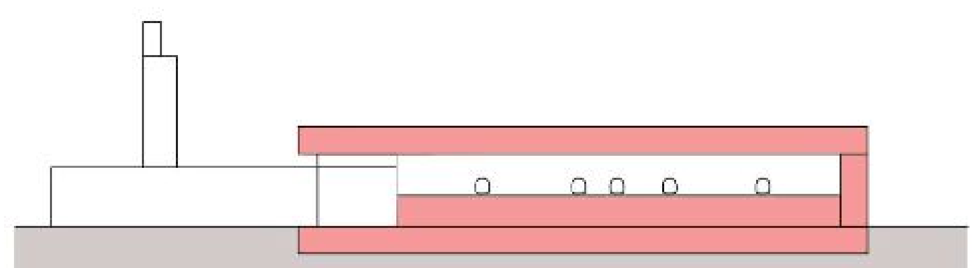
GROUP A
Over the tracks

Alternative 1



GROUP B
Below the tracks

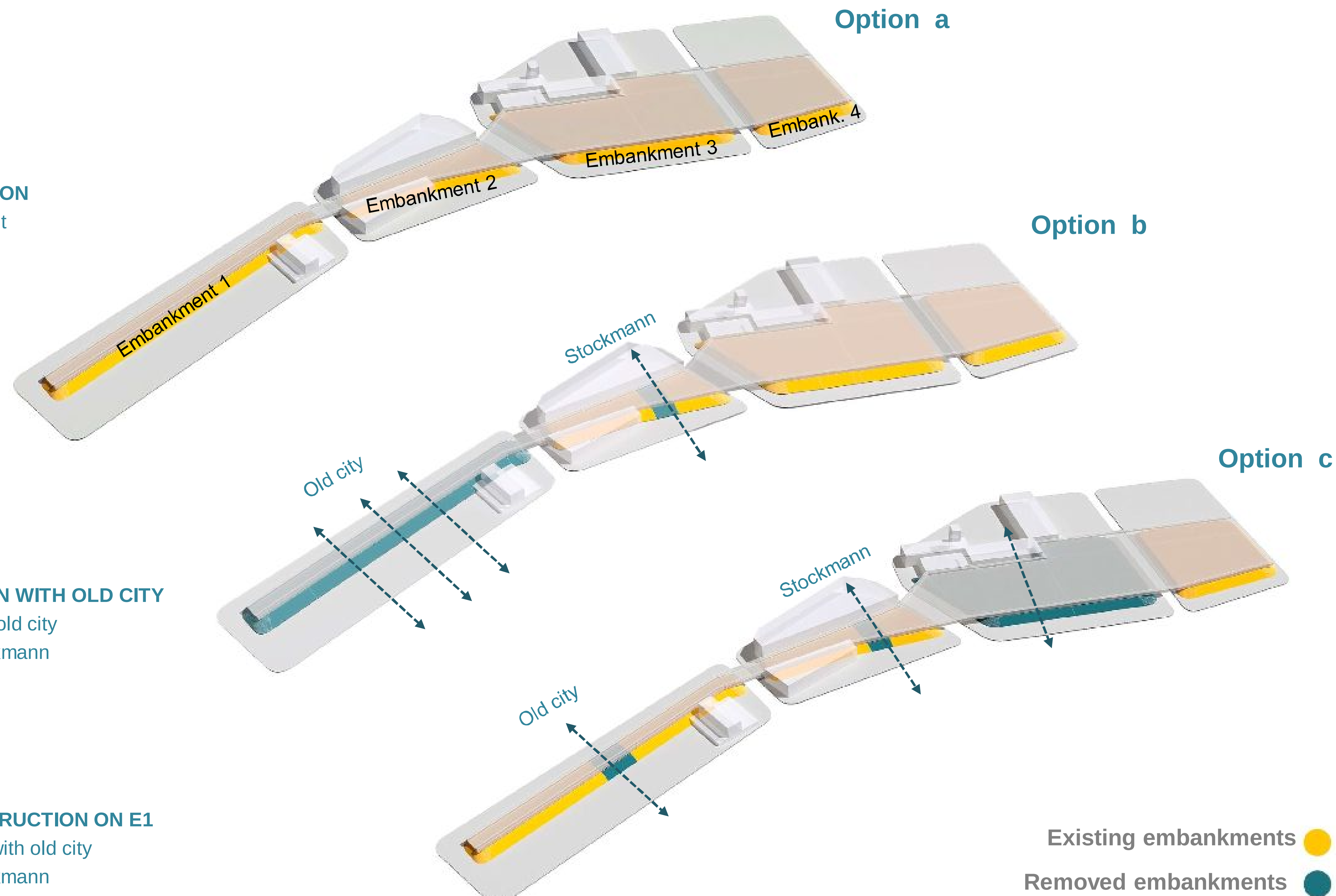
Alternatives 2.1, 2.2



GROUP C
Over and Below the tracks

Alternatives 3, 4, 5 & 6

ALTERNATIVES_ Embankments part 1



Option a
NO CONSTRUCTION
at any embankment

Option b
WIDE CONNETION WITH OLD CITY
E1: Wide link with old city
E2: Link with Stockmann

Option c
MINIMUM CONSTRUCTION ON E1
E1: Minimum link with old city
E2: Link with Stockmann
E3: Coach-Public Transit Stations

ALTERNATIVES_ Embankments part 2

Option d

WIDE CONNECTION WITH OLD CITY+ E3

E1: Wide link with old city, very opened
E2: Link with Stockmann
E3: Coach-Public Transit Stations

Option e

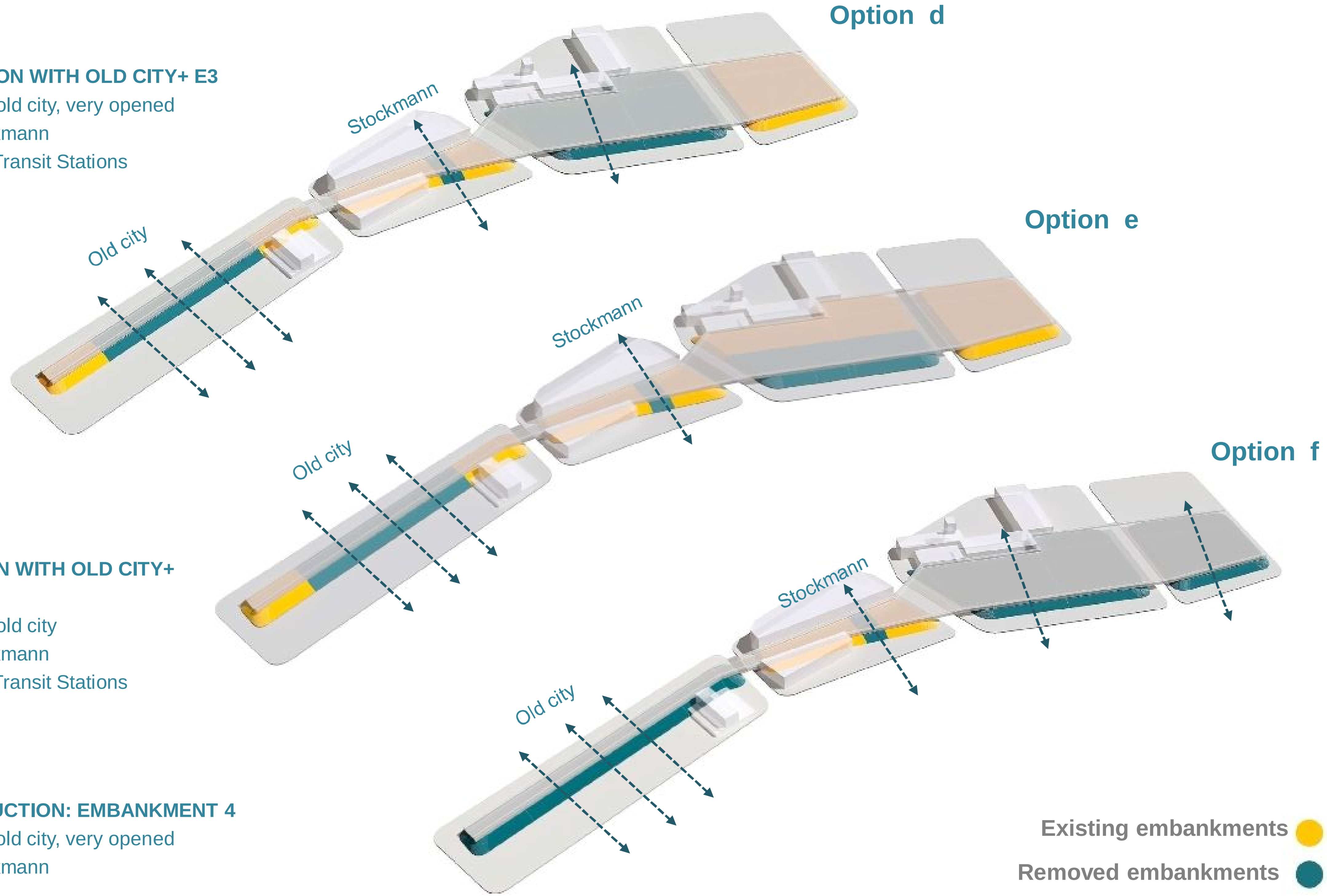
WIDE CONNETION WITH OLD CITY+ HALF OF E3

E1: Wide link with old city
E2: Link with Stockmann
E3: Coach-Public Transit Stations

Option f

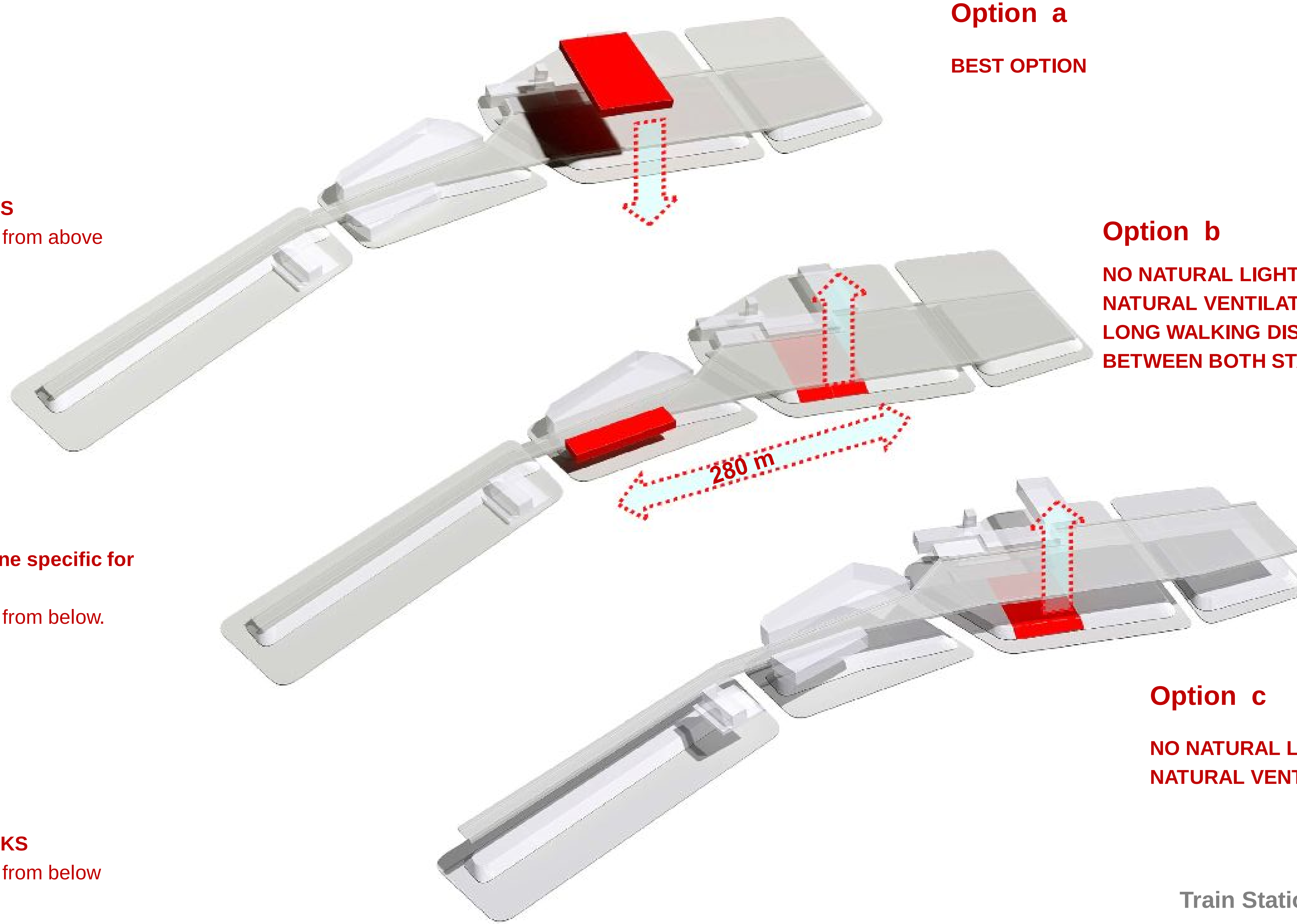
EXTRA CONSTRUCTION: EMBANKMENT 4

E1: Wide link with old city, very opened
E2: Link with Stockmann
E3: Coach Station
E4: Car Parking or Public Transit



AECOM

ALTERNATIVES_ Railway station



Option a

BEST OPTION

Option b

NO NATURAL LIGHT OR
NATURAL VENTILATION
LONG WALKING DISTANCE
BETWEEN BOTH STATIONS

Option c

NO NATURAL LIGHT OR
NATURAL VENTILATION

Option a
OVER THE TRACKS
Access to platforms from above

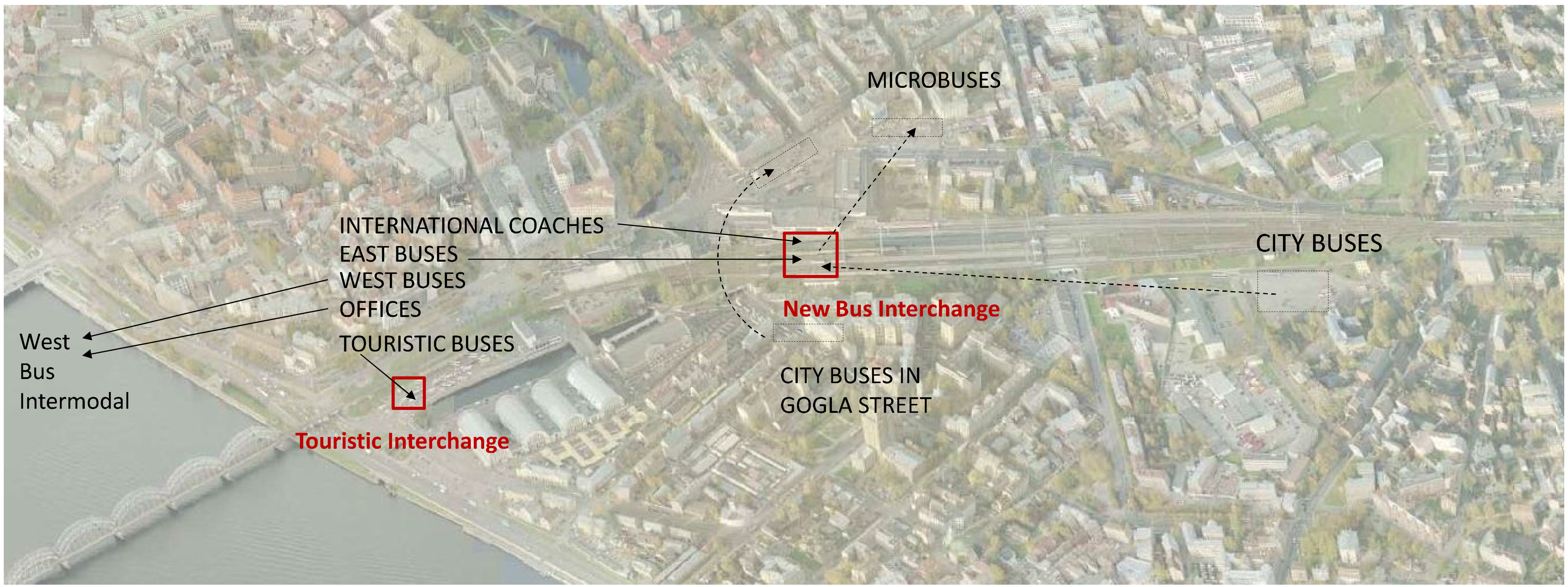
Option b
TWO STATIONS (one specific for RaiLBaltica)
Access to platforms from below.

Option c
UNDER THE TRACKS
Access to platforms from below

Train Station

AECOM

ALTERNATIVES_ Bus Strategy



- - - -→ Partially relocated

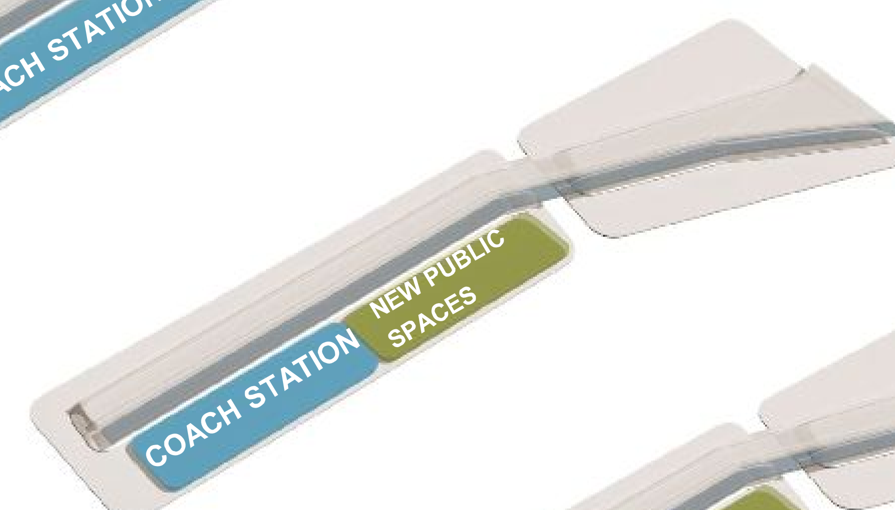
——→ Completely relocated

East Buses 30%	West Buses 30%	International Coaches and Touristic Buses 40%

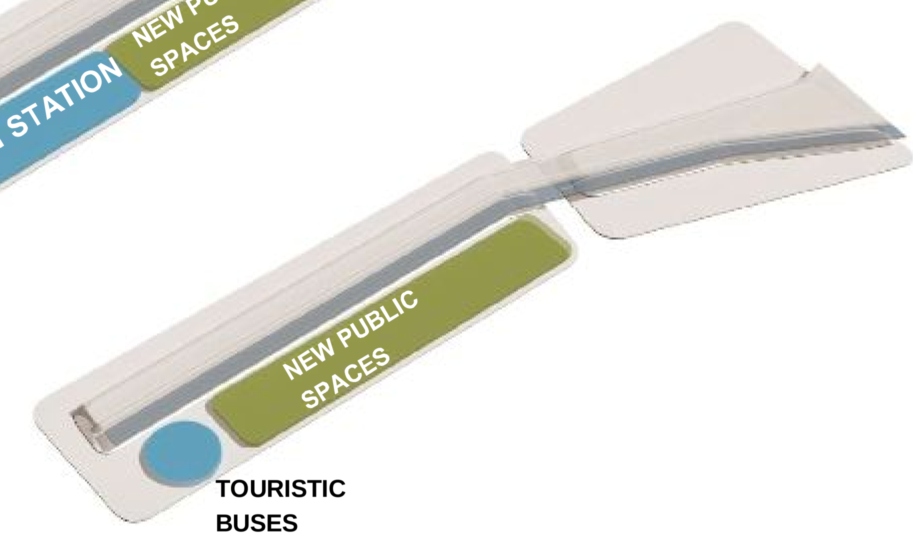
ALTERNATIVES_ Existing Coach platform options

Option a

Option b



Option c



Coach Station

New Public Spaces

<u>Option a</u>
COACH STATION AT THE SAME PLACE
New layout regarding the impact of the Rail Baltica tracks

<u>Option b</u>
INTERNATIONAL COACHES RELOCATED AT THE EMBANKMET 3
The rest of the lines remain at the same place with a new layout

<u>Option c</u>
ONLY TOURIST BUSES REMAIN.
The rest of Bus Lines to be relocated at the embankment 3

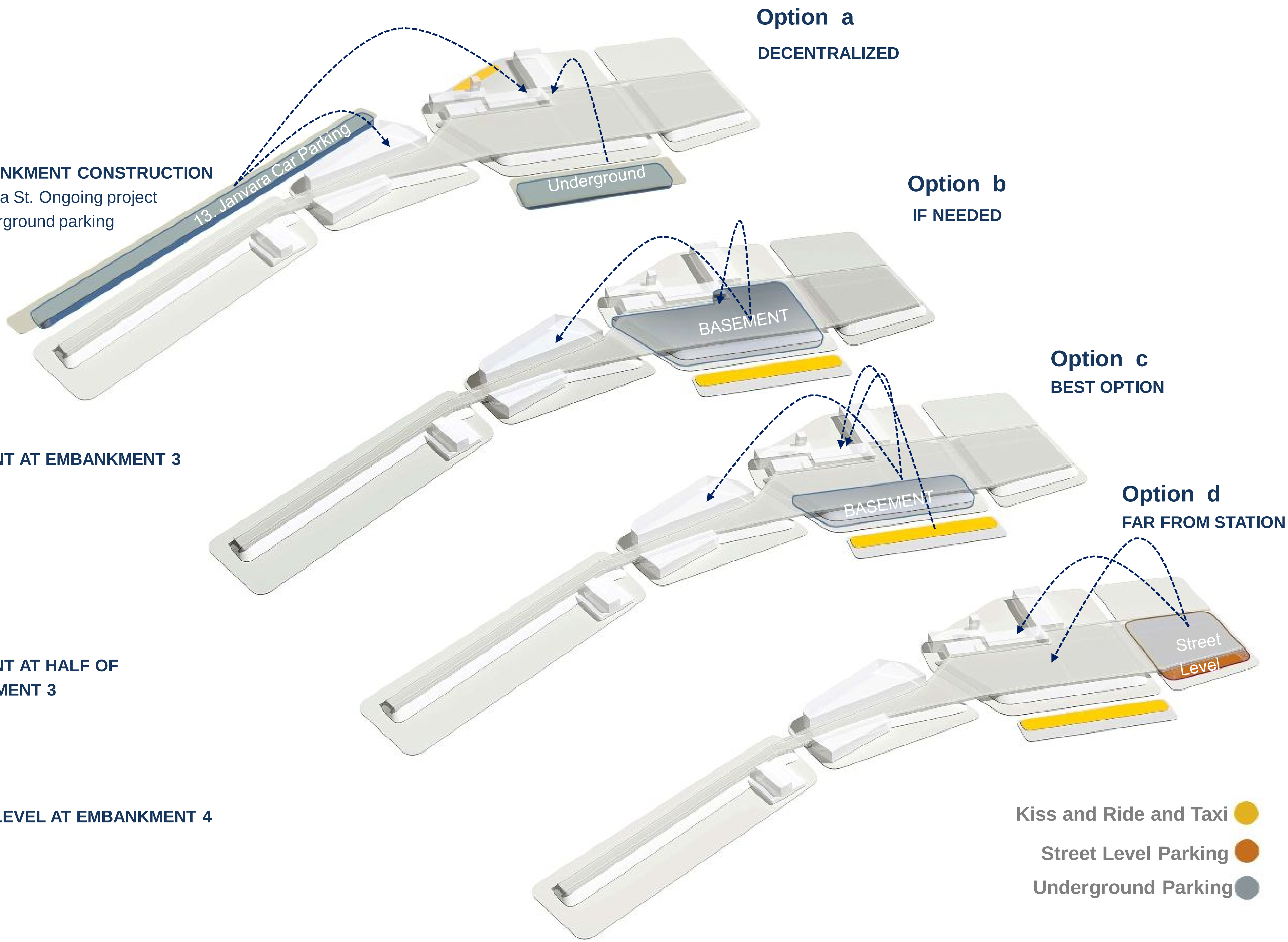
ALTERNATIVES_ Car Parking

<u>**Option a**</u>
NO EMBANKMENT CONSTRUCTION
13, Janvara St. Ongoing project
New underground parking

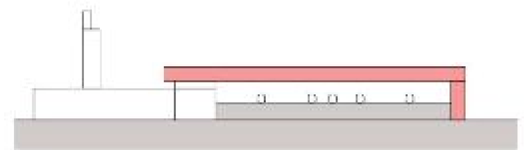
<u>**Option b**</u>
BASEMENT AT EMBANKMENT 3

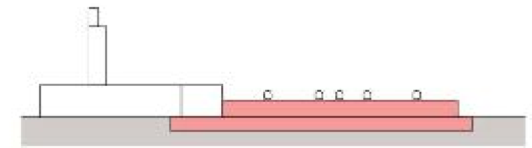
<u>**Option c**</u>
BASEMENT AT HALF OF EMBANKMENT 3

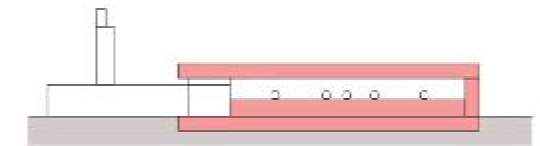
<u>**Option d**</u>
STREET LEVEL AT EMBANKMENT 4



ALTERNATIVES_ List







GROUP A
Minimum intervention proposal

GROUP B
Multimodal Hub Below the tracks
2.1 Box type canopies

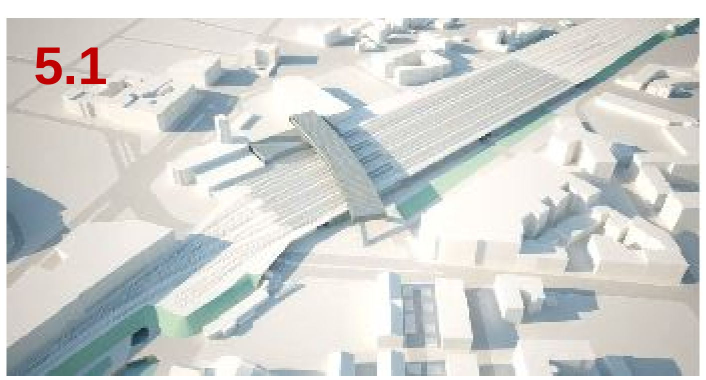
Multimodal Hub Below the tracks
2.2 Longitudinal canopies

GROUP C
Box type Station

Box type Station (Variation)

Elevated Plaza and Station

Bridge Building Station - Short

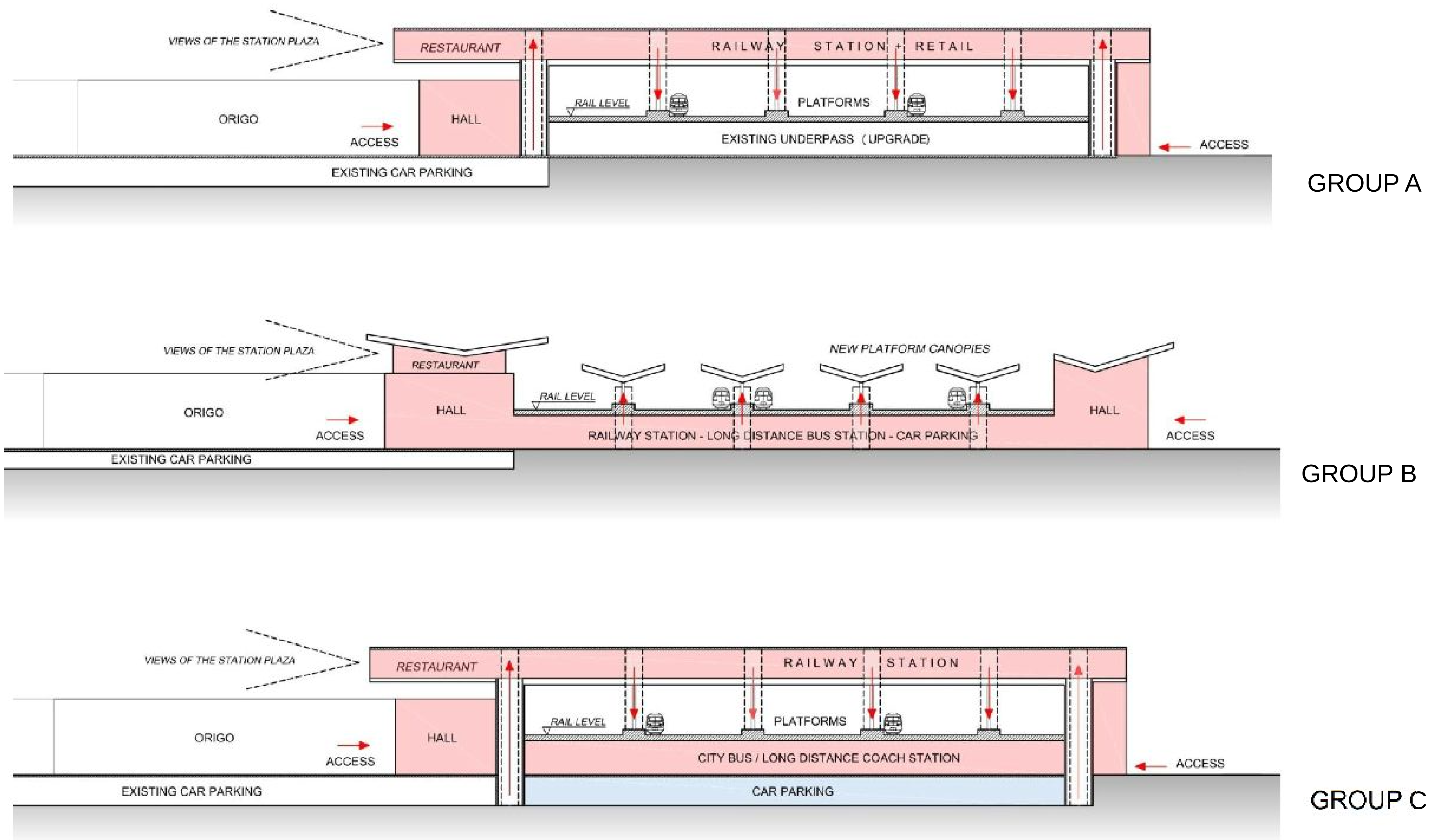


Bridge Building Station – Long variation

Elevated Promenade and Station

AECOM

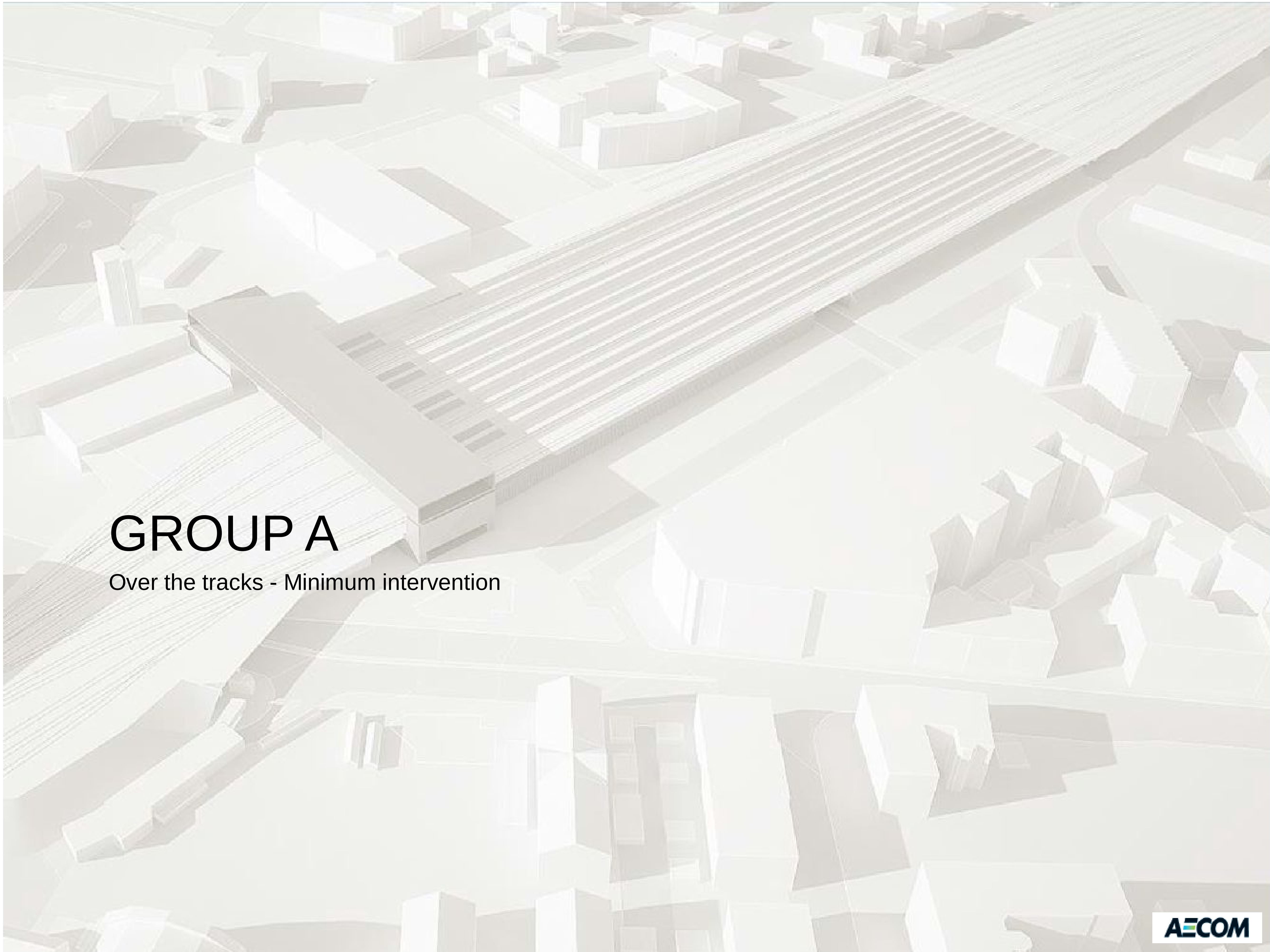
CROSS SECTIONS
GROUPS A, B & C



AECOM

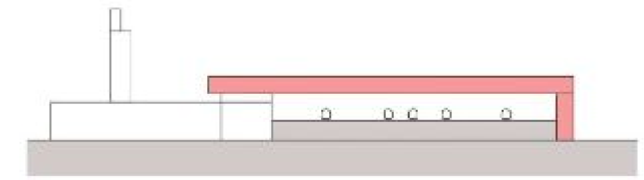
GROUP A

Over the tracks - Minimum intervention

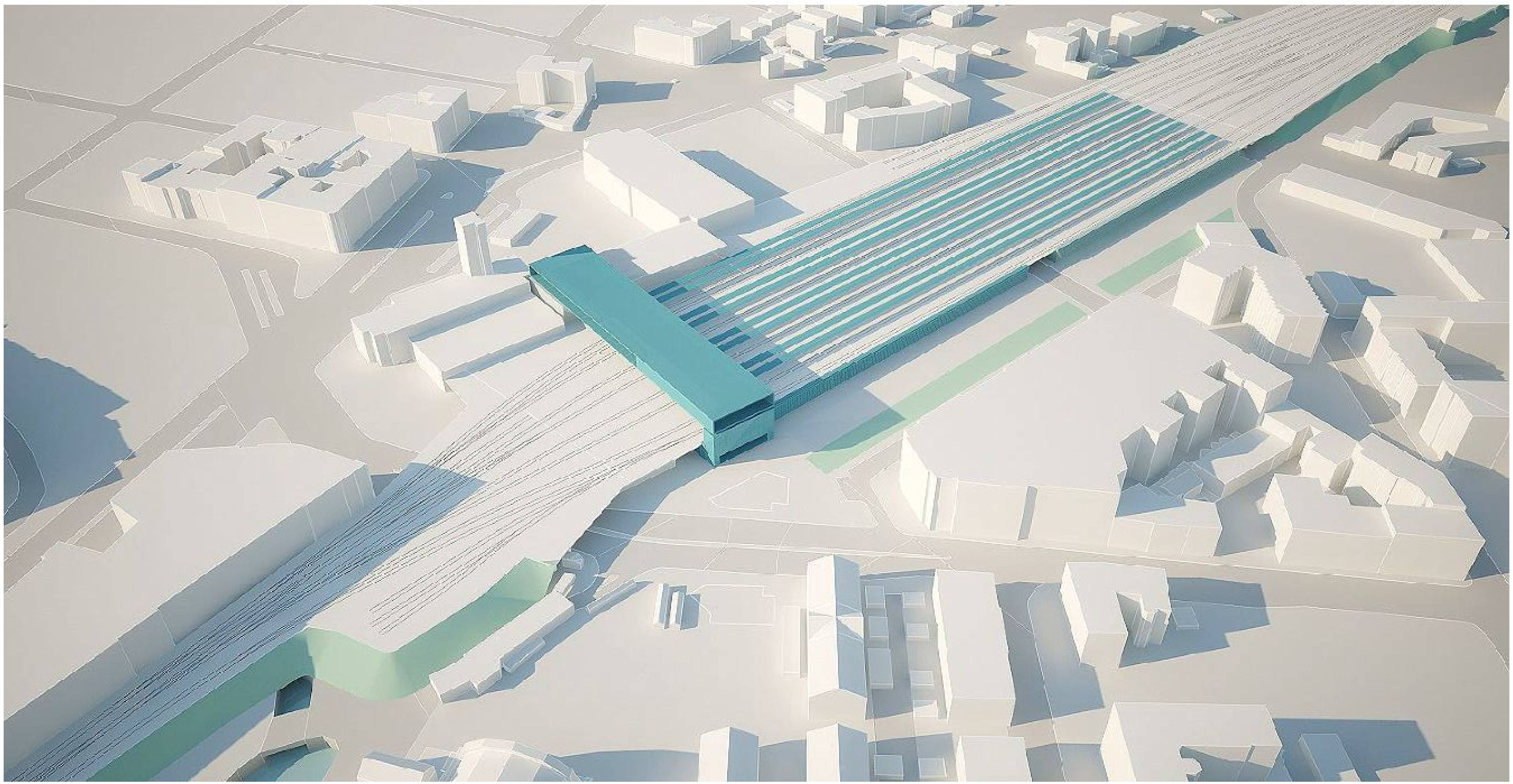


GROUP A: COACH STATION NOT RELOCATED. STATION OVER THE TRACKS.

Alternative 1 Minimum operation proposal

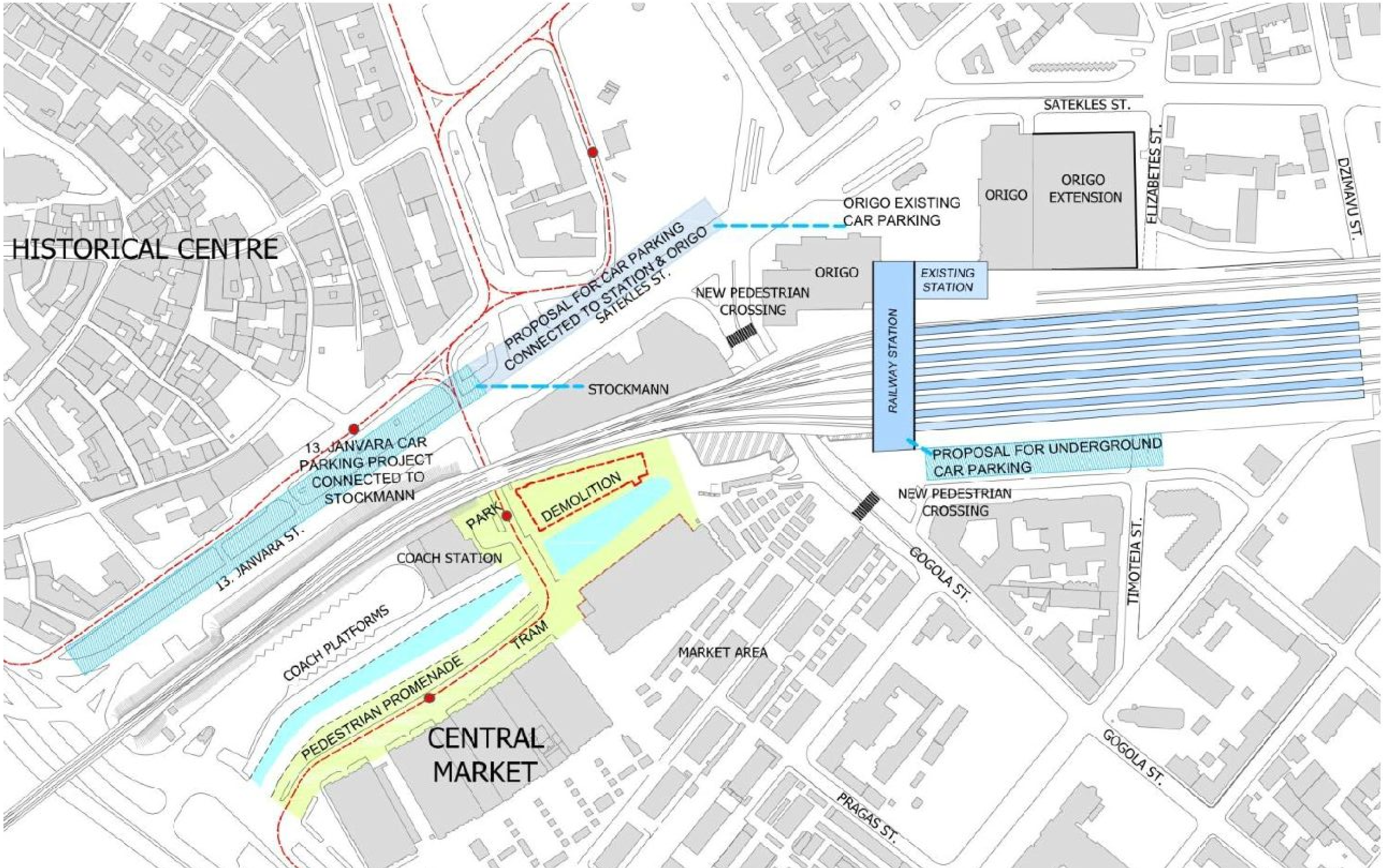


GROUP A



GROUP A: COACH STATION NOT RELOCATED. STATION OVER THE TRACKS.

Alternative 1 Minimum operation proposal



AECOM

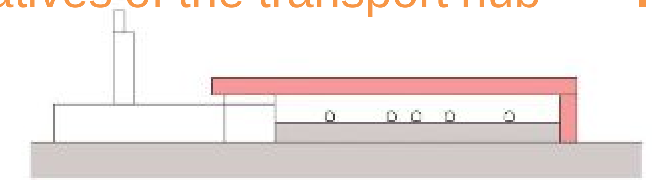
WP2.5 – Elaboration of selected alternatives of the transport hub

PROCESS

GROUP A

Alternative 1

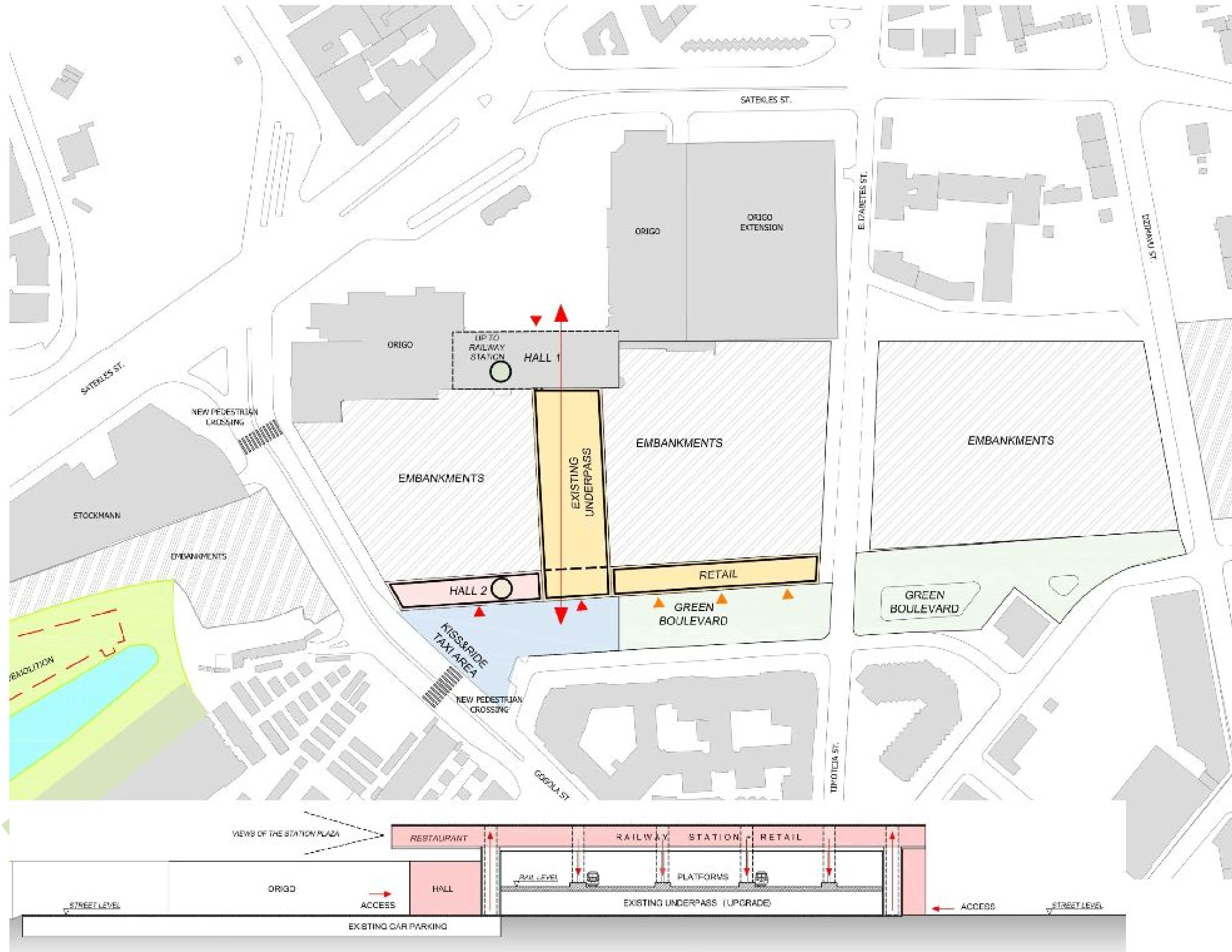
STREET LEVEL FLOOR PLAN (+0.00 m)



GROUP A

Renovation of the existing underpass with new functions.

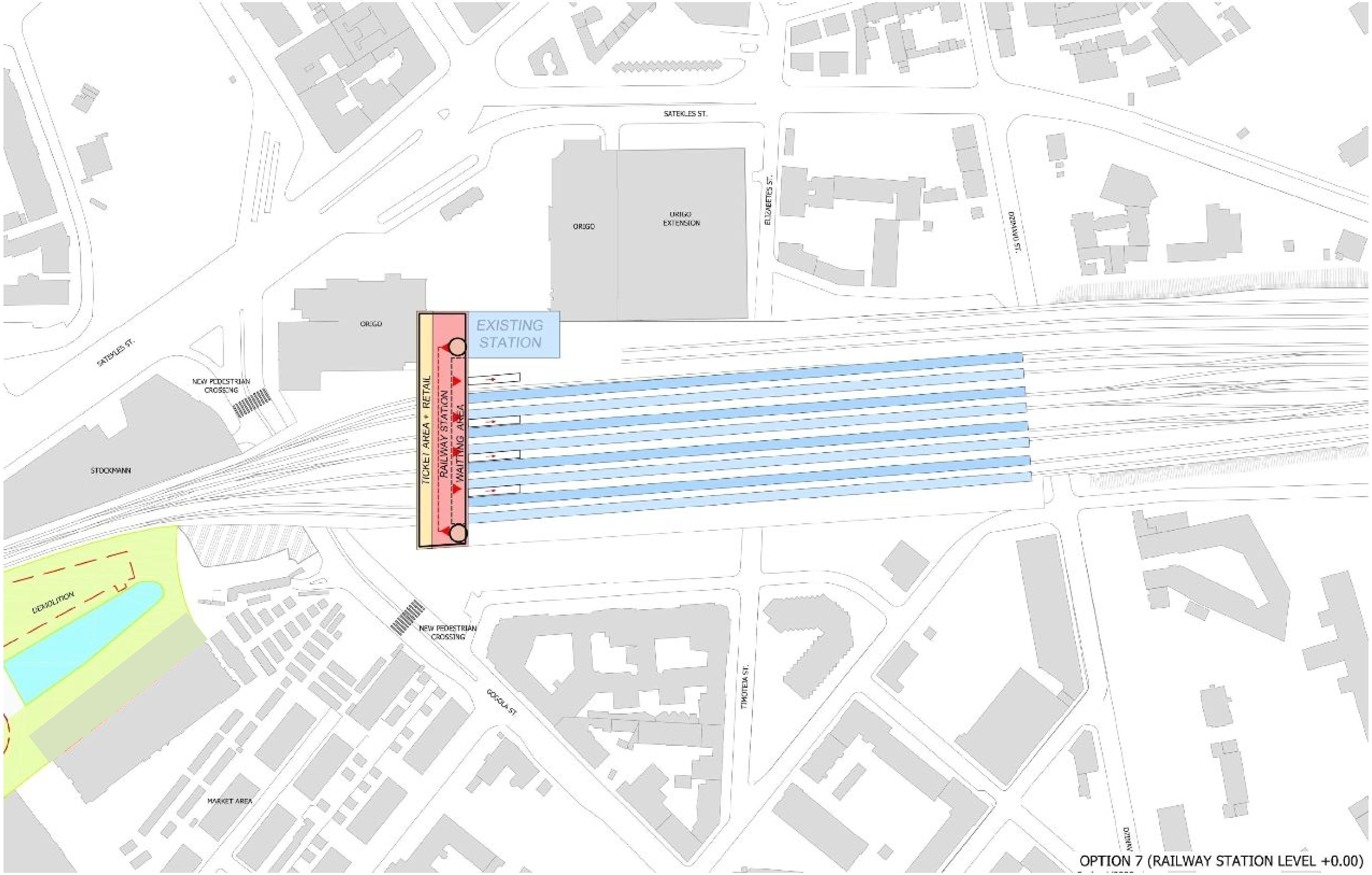
Coach Station, Public Transit and Car Parking not solved, no space



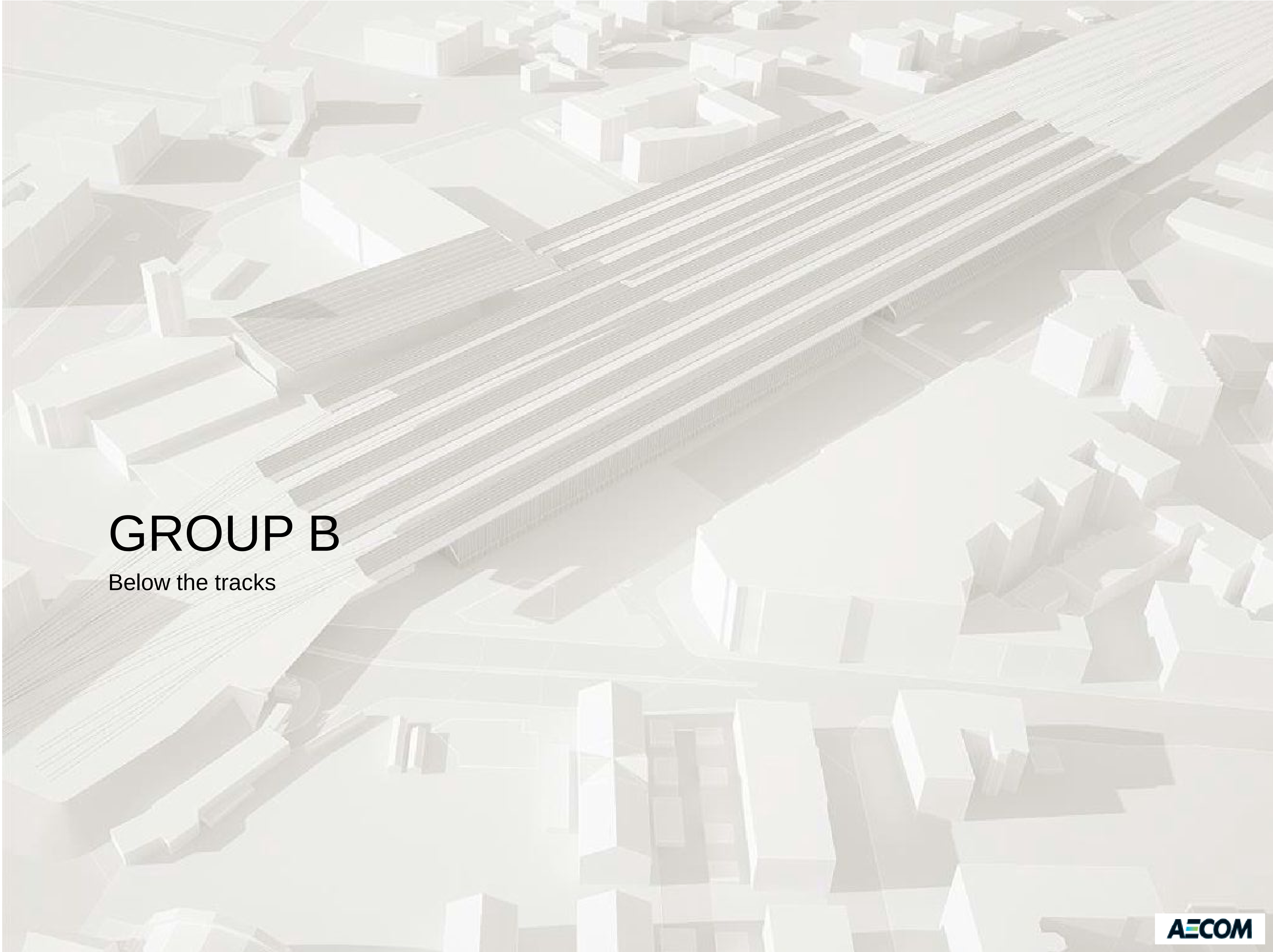
Areas	
Current Situation	
Train station +Retail(without offices)	8300
Long Distance Bus Station +Retail	3900
Long Distance Platforms	11700
City Bus Station+Platforms	9500
Parking Janvara Street	17600
Titanik´s Parking	7020
Alternative 1	
Train station +Retail(without offices)	11200
Long Distance Bus Station +Retail	-
Long Distance Platforms	-
City Bus Station+Platforms	-
New Parking	27600
New Street level Retail	1600
Increased area	
Train station +Retail(without offices)	2900
Long Distance Bus Station +Retail	-
Long Distance Platforms	-
City Bus Station+Platforms	-
Parking	2980
New Street level Retail	1600
TOTAL	7680

GROUP A: COACH STATION NOT RELOCATED. STATION OVER THE TRACKS.

Alternative 1 Minimum operation proposal



Railway Station Level



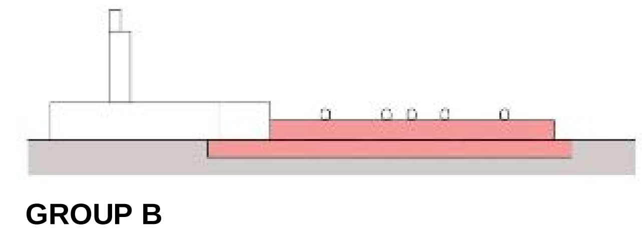
GROUP B

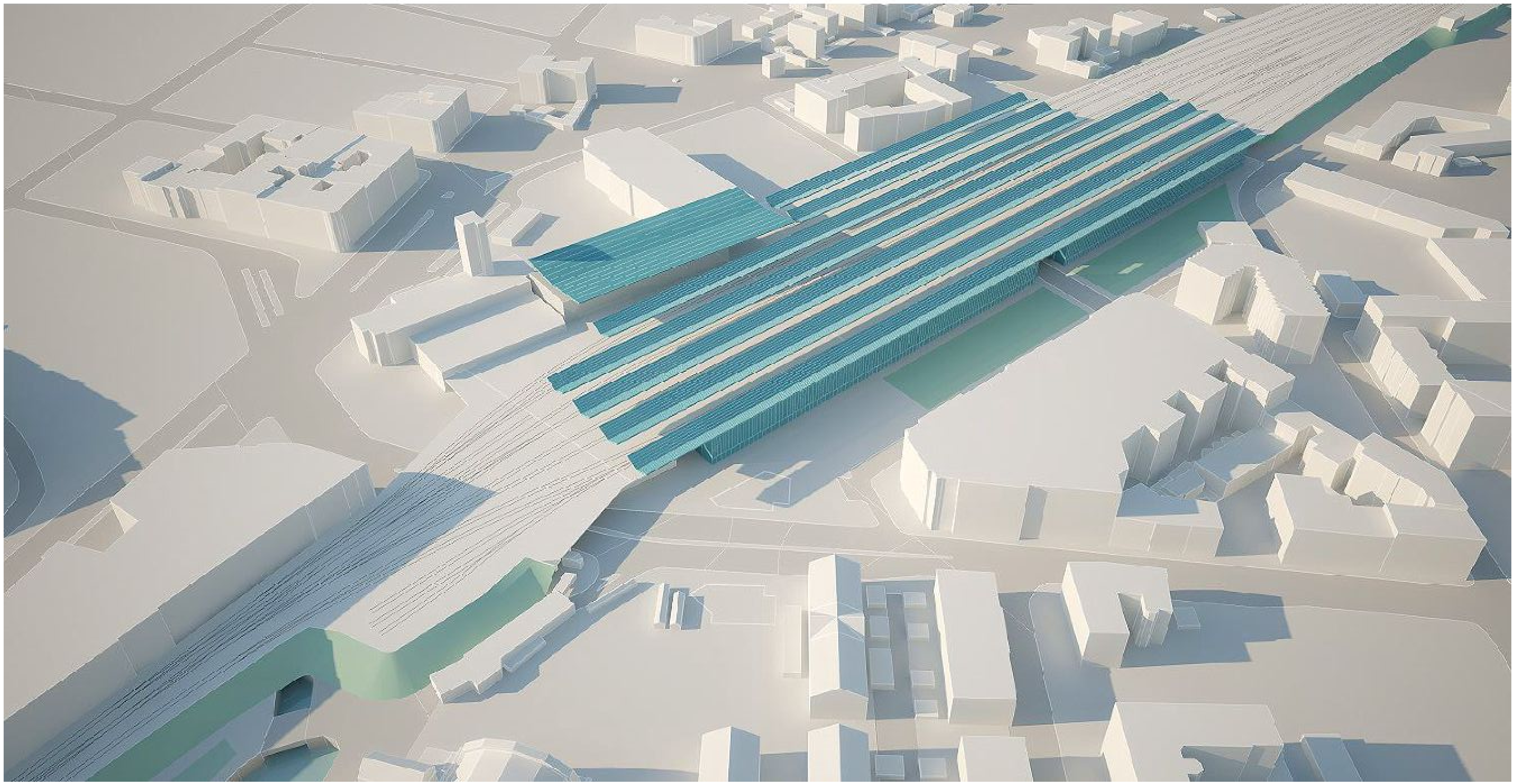
Below the tracks

GROUP B: COACH STATION RELOCATED. NO CONSTRUCTION OVER THE TRACKS

Alternative 2.1 and 2.2 - Multimodal Hub at Street Level

Longitudinal canopies solution. No construction over the tracks, except the new platform canopies

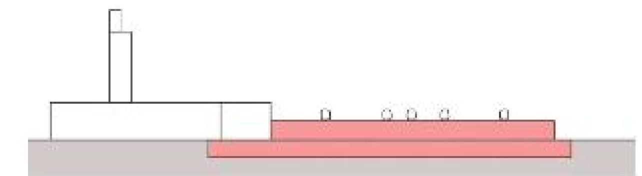


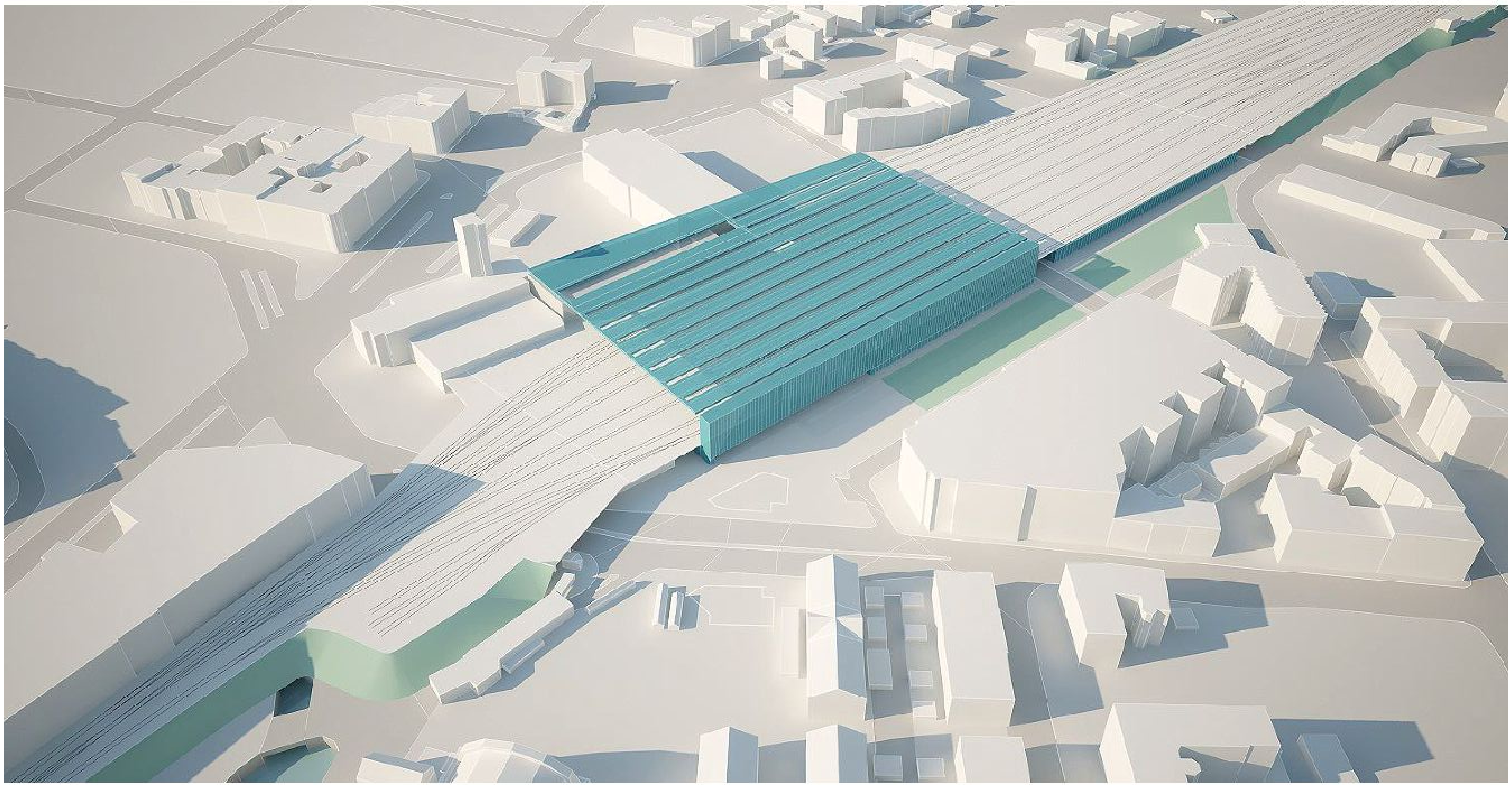


GROUP B: COACH STATION RELOCATED. NO CONSTRUCTION OVER THE TRACKS

Alternative 2.1 and 2.2 - Multimodal Hub at Street Level

Longitudinal canopies solution. No construction over the tracks, except the new platform canopies

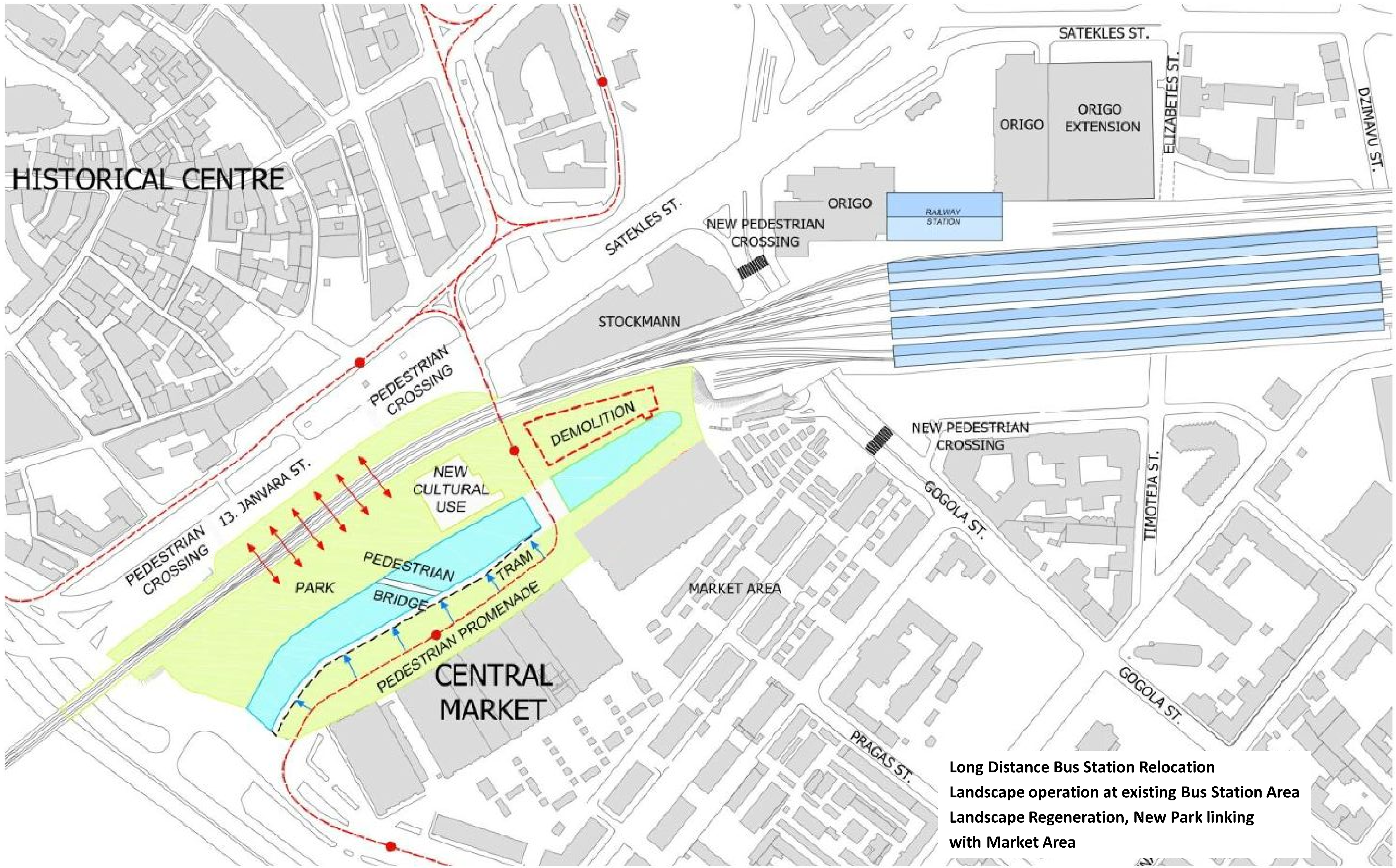

GROUP B



GROUP B: COACH STATION RELOCATED. NO CONSTRUCTION OVER THE TRACKS. With BASEMENT

Alternative 2.1 and 2.2 - Multimodal Hub at Street Level

Longitudinal canopies solution. No construction over the tracks, except the new platform canopies



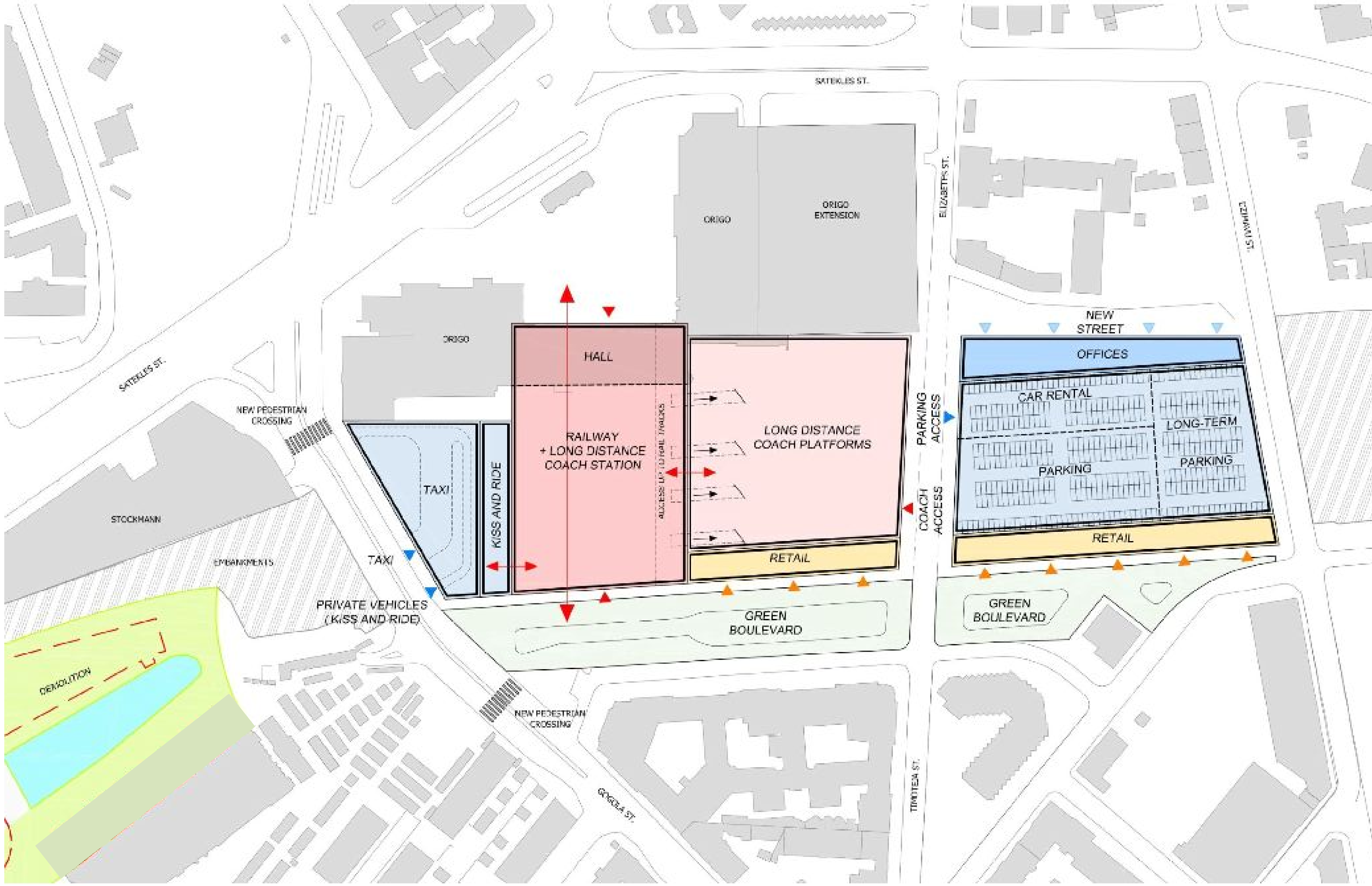
AECOM

WP2.5 – Elaboration of selected alternatives of the transport hub PROCESS

GROUP B: COACH STATION RELOCATED. NO CONSTRUCTION OVER THE TRACKS. NO BASEMENT

Alternative 2.1 - Multimodal Hub at Street Level

Longitudinal canopies solution. No construction over the tracks, except the new platform canopies



Areas	
Current Situation	
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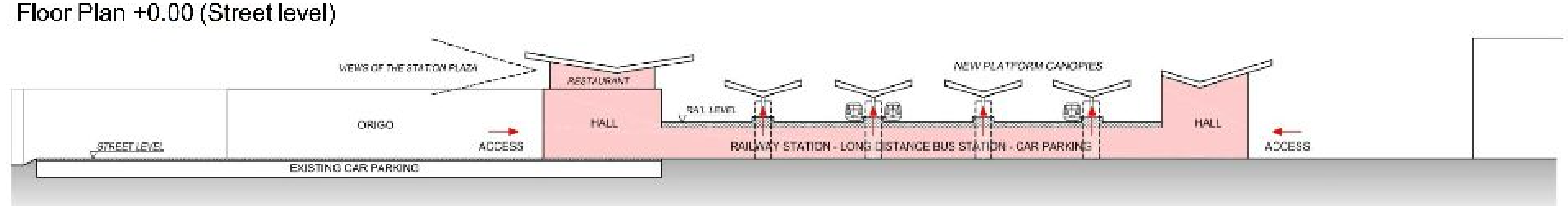
Long Distance Bus Station +Retail	3900
Long Distance Platforms	11700
City Bus Station+Platforms	9500
Parking Janvara Street	17600
Titanik´s Parking	7020
Alternative 2.1	
Train station +Retail+ Long Distance Bus Station	12500
Long Distance Platforms	10500
City Bus Station+Platforms	-
New Parking	10400
New Offices	5000
New Street level Retail	12300
Increased area	
Train station +Retail+ Long Distance Bus Station	300
Long Distance Platforms	-1300
City Bus Station+Platforms	-
Parking	-14220
New Offices	5000
New Street level Retail	12300
TOTAL	2080

Floor Plan +0.00 (Street level)



Cross section 2.1

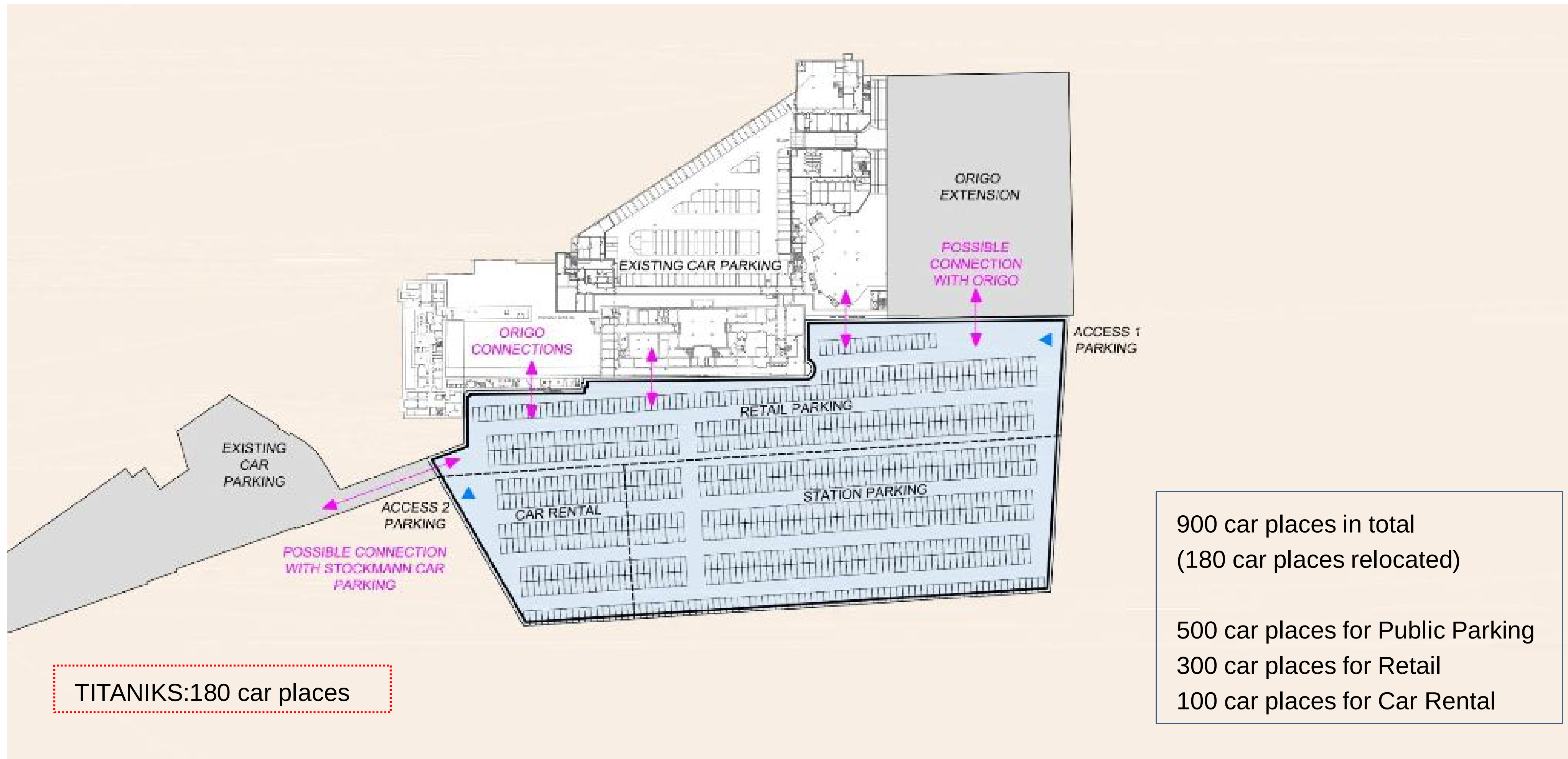
AECOM

WP2.5 – Elaboration of selected alternatives of the transport hub PROCESS

GROUP B: COACH STATION RELOCATED. NO CONSTRUCTION OVER THE TRACKS

Alternative 2.2 - Multimodal Hub at Street Level

Longitudinal canopies solution. No construction over the tracks, except the new platform canopies



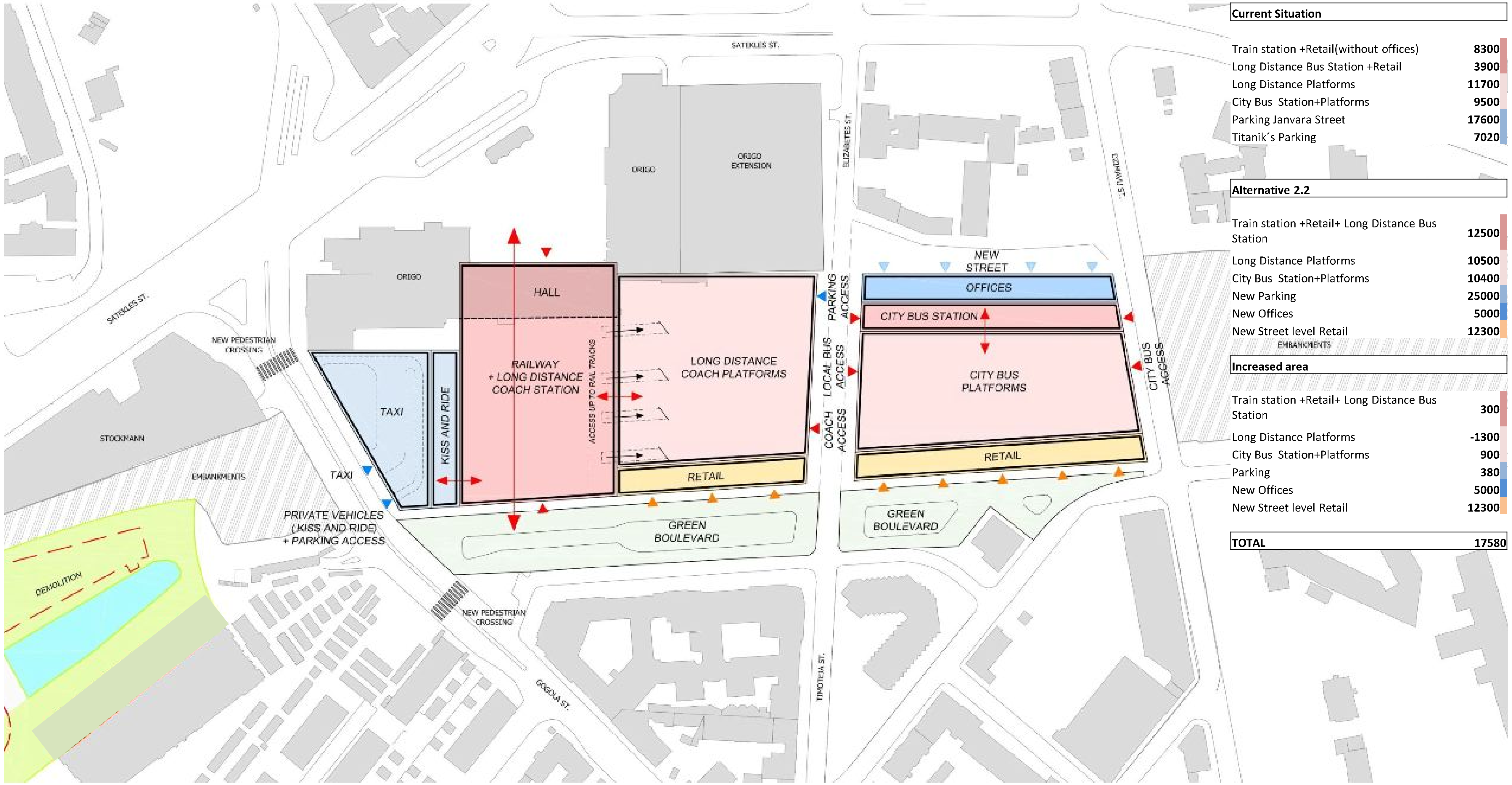
AECOM

WP2.5 – Elaboration of selected alternatives of the transport hub PROCESS

GROUP B: COACH STATION RELOCATED. NO CONSTRUCTION OVER THE TRACKS. With BASEMENT

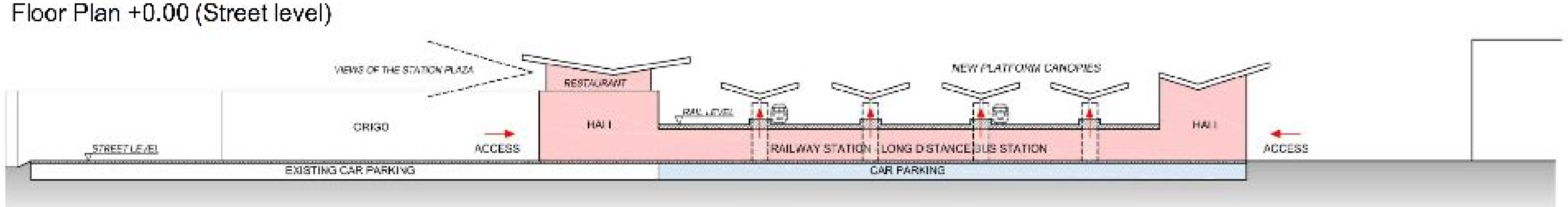
Alternative 2.2 - Multimodal Hub at Street Level

Longitudinal canopies solution. No construction over the tracks, except the new platform canopies



Areas	
Current Situation	
Train station +Retail(without offices)	8300
Long Distance Bus Station +Retail	3900
Long Distance Platforms	11700
City Bus Station+Platforms	9500
Parking Janvara Street	17600
Titanik´s Parking	7020
Alternative 2.2	
Train station +Retail+ Long Distance Bus Station	12500
Long Distance Platforms	10500
City Bus Station+Platforms	10400
New Parking	25000
New Offices	5000
New Street level Retail	12300
Increased area	
Train station +Retail+ Long Distance Bus Station	300
Long Distance Platforms	-1300
City Bus Station+Platforms	900
Parking	380
New Offices	5000
New Street level Retail	12300
TOTAL	17580

Floor Plan +0.00 (Street level)



Cross section 2.2

AECOM

GROUP C

Over and Below the tracks

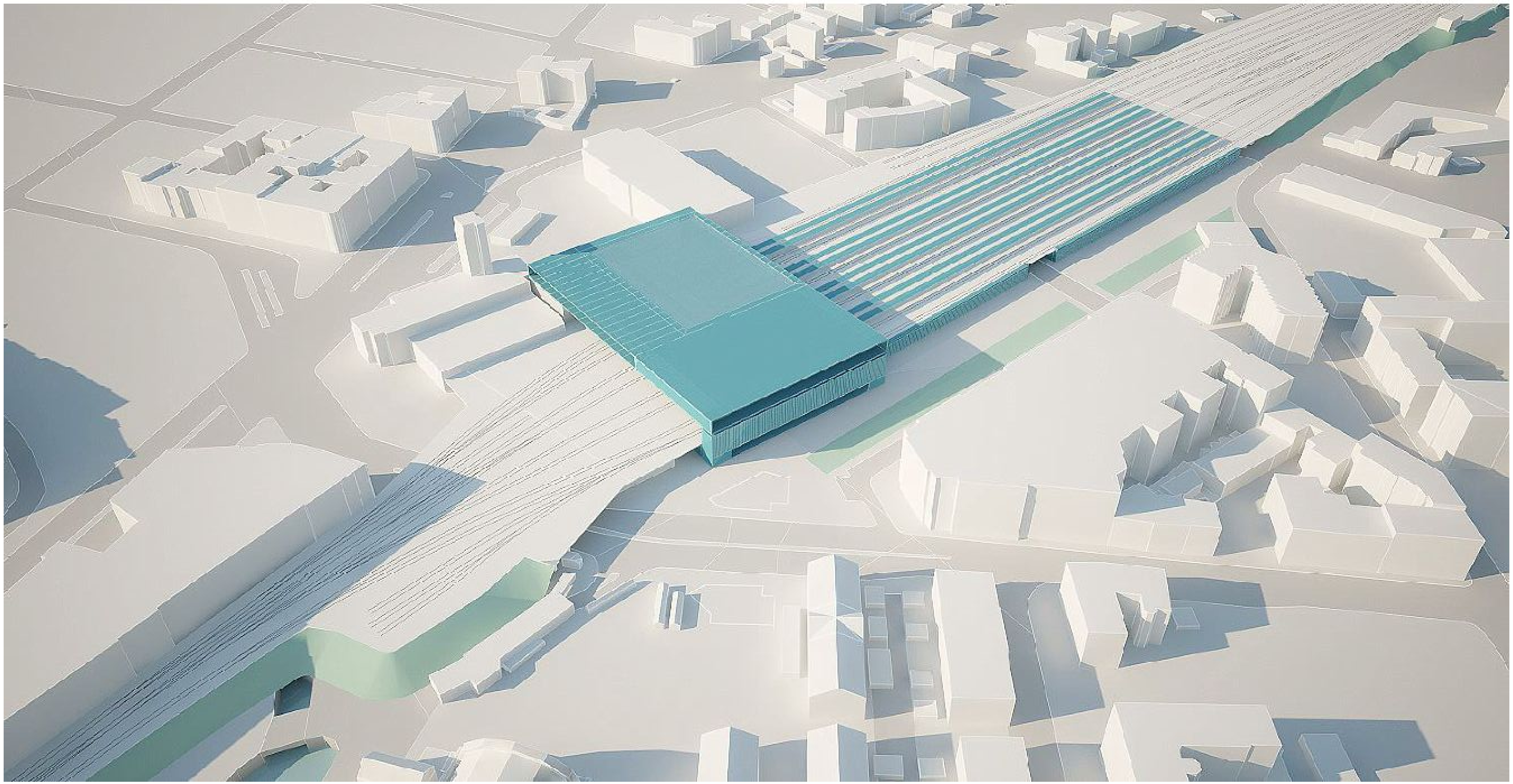
GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 3 - Box type Station

Alternative 3.1 - Closed Box

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.

Elevated station over the tracks for Railway Station and other modes of transportation at Street Level



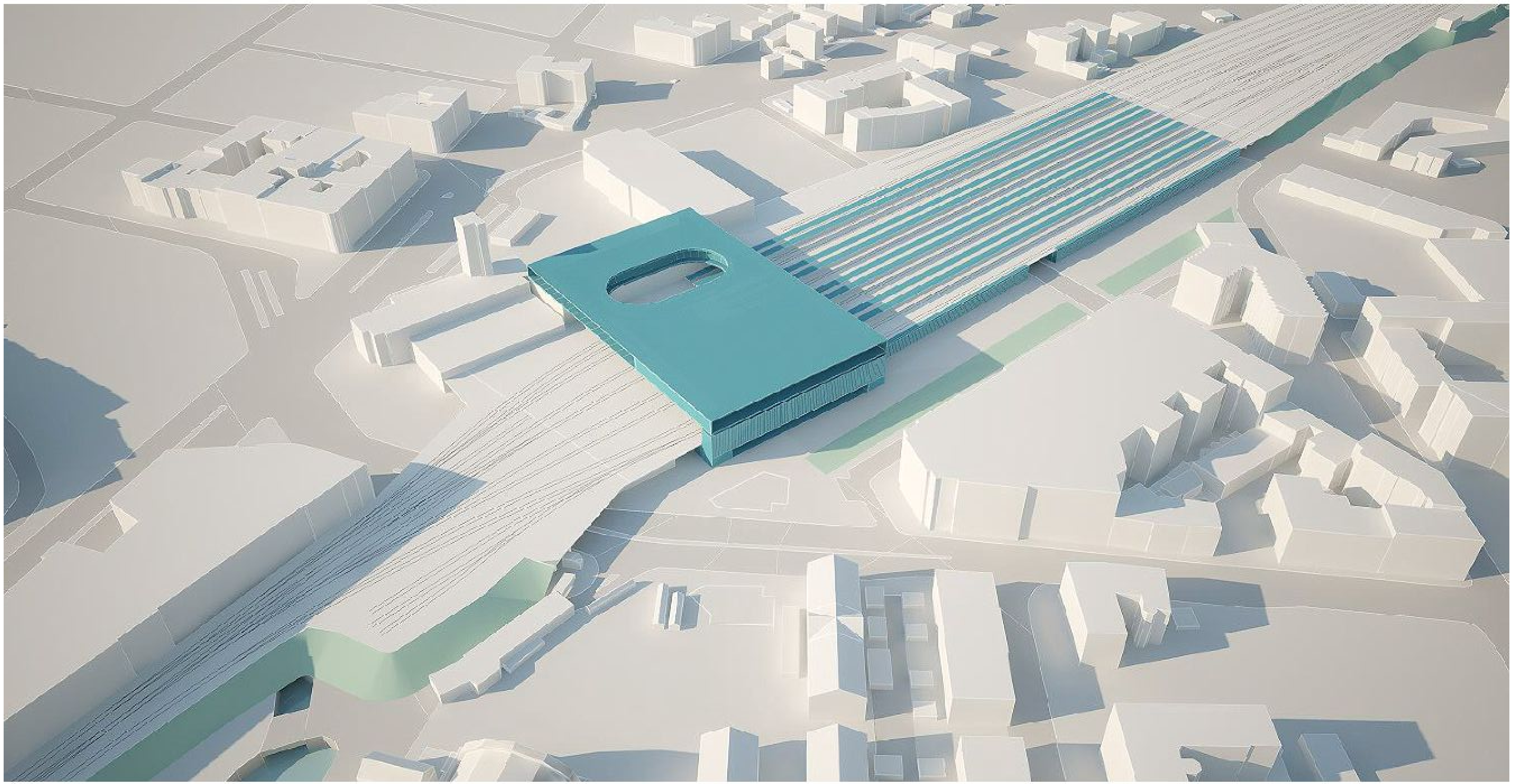
GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 3 - Box type Station

Alternative 3.2 - Court Box

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.

Elevated station over the tracks for Railway Station and other modes of transportation at Street Level



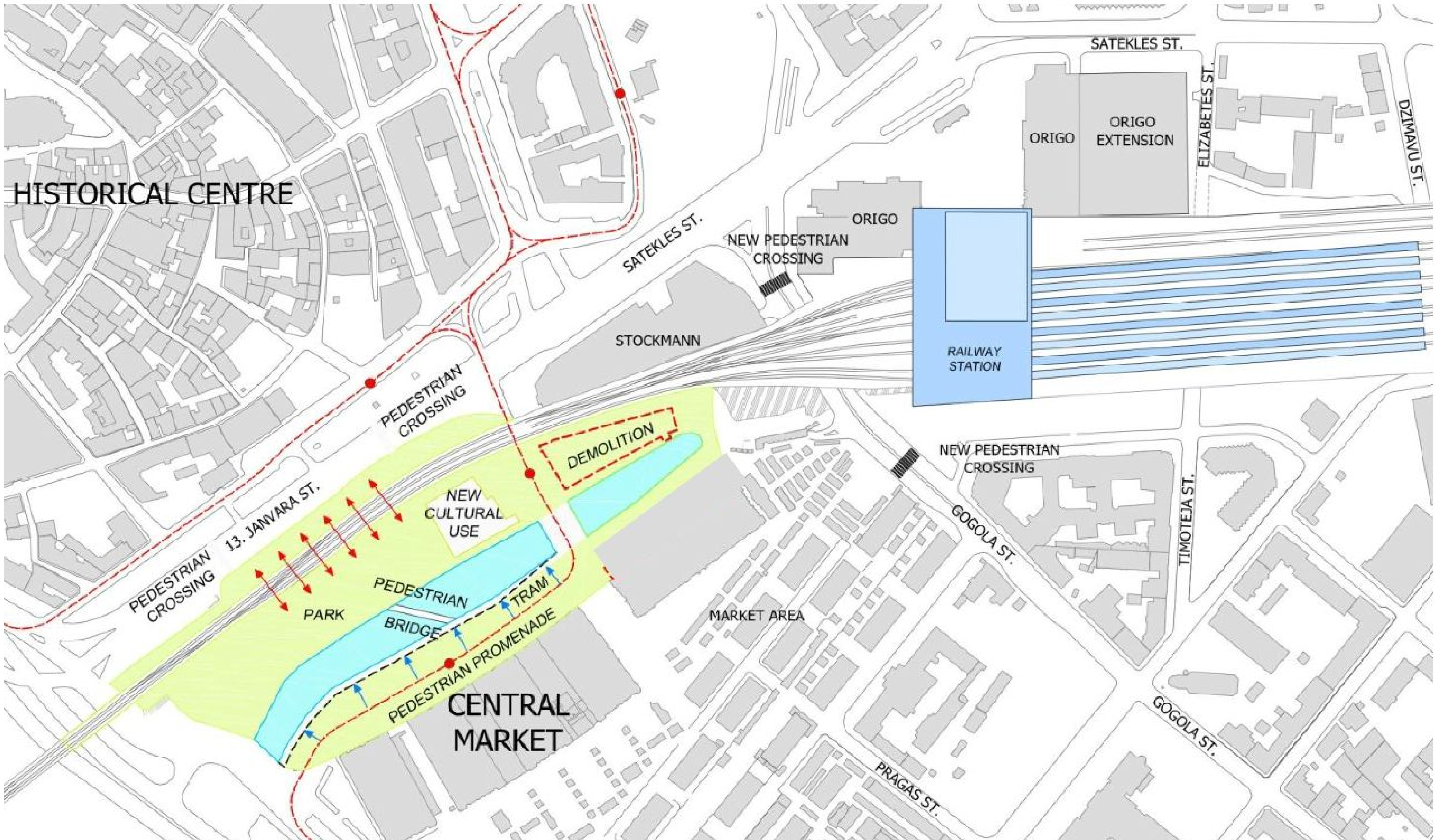
GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 3 - Box type Station

Alternative 3.1 – Closed Box

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.

Elevated station over the tracks for Railway Station and other modes of transportation at Street Level



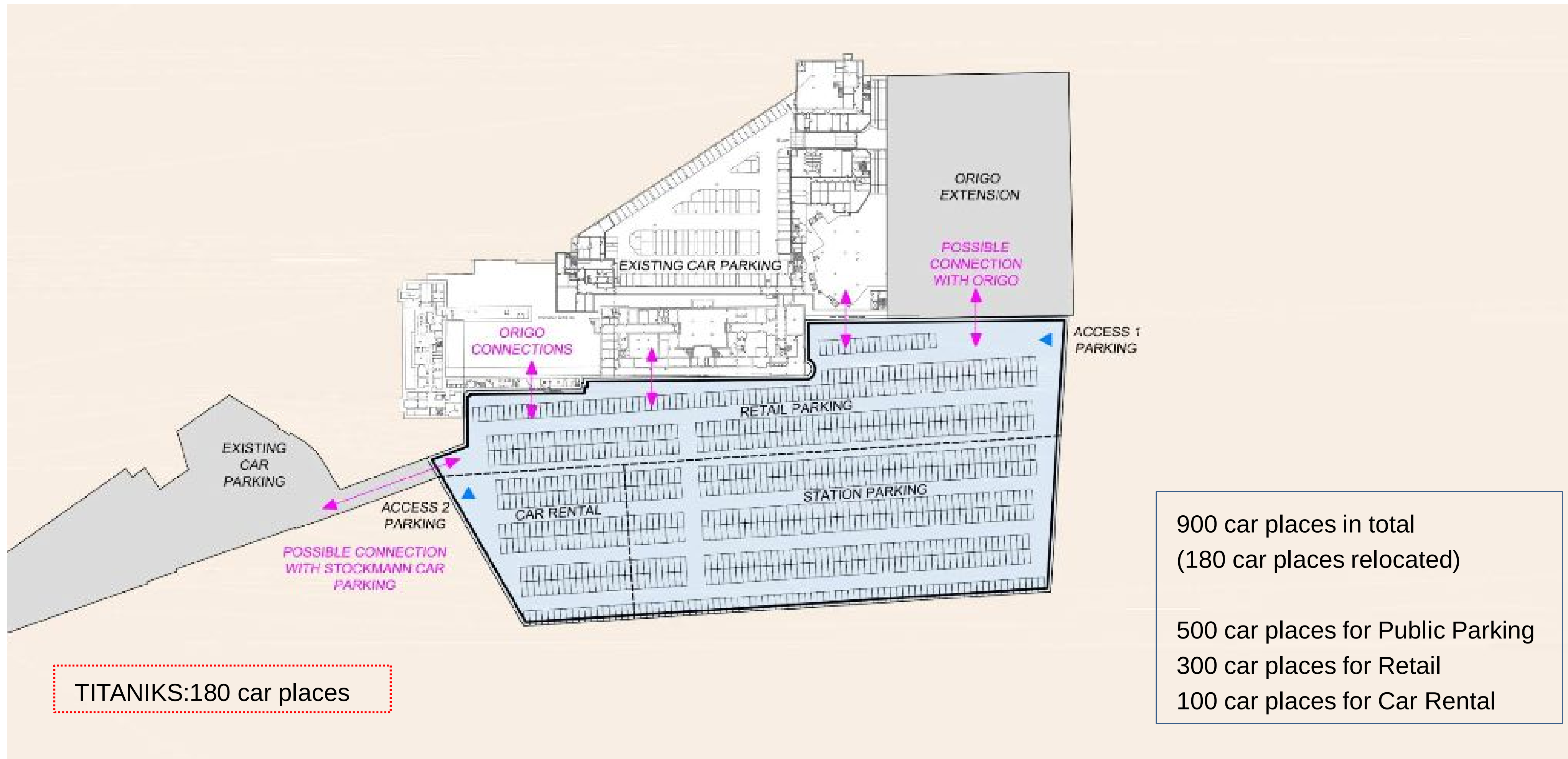
AECOM

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 3 - Box type Station

Alternative 3.1 – Closed Box

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.
Elevated station over the tracks for Railway Station and other modes of transportation at Street Level

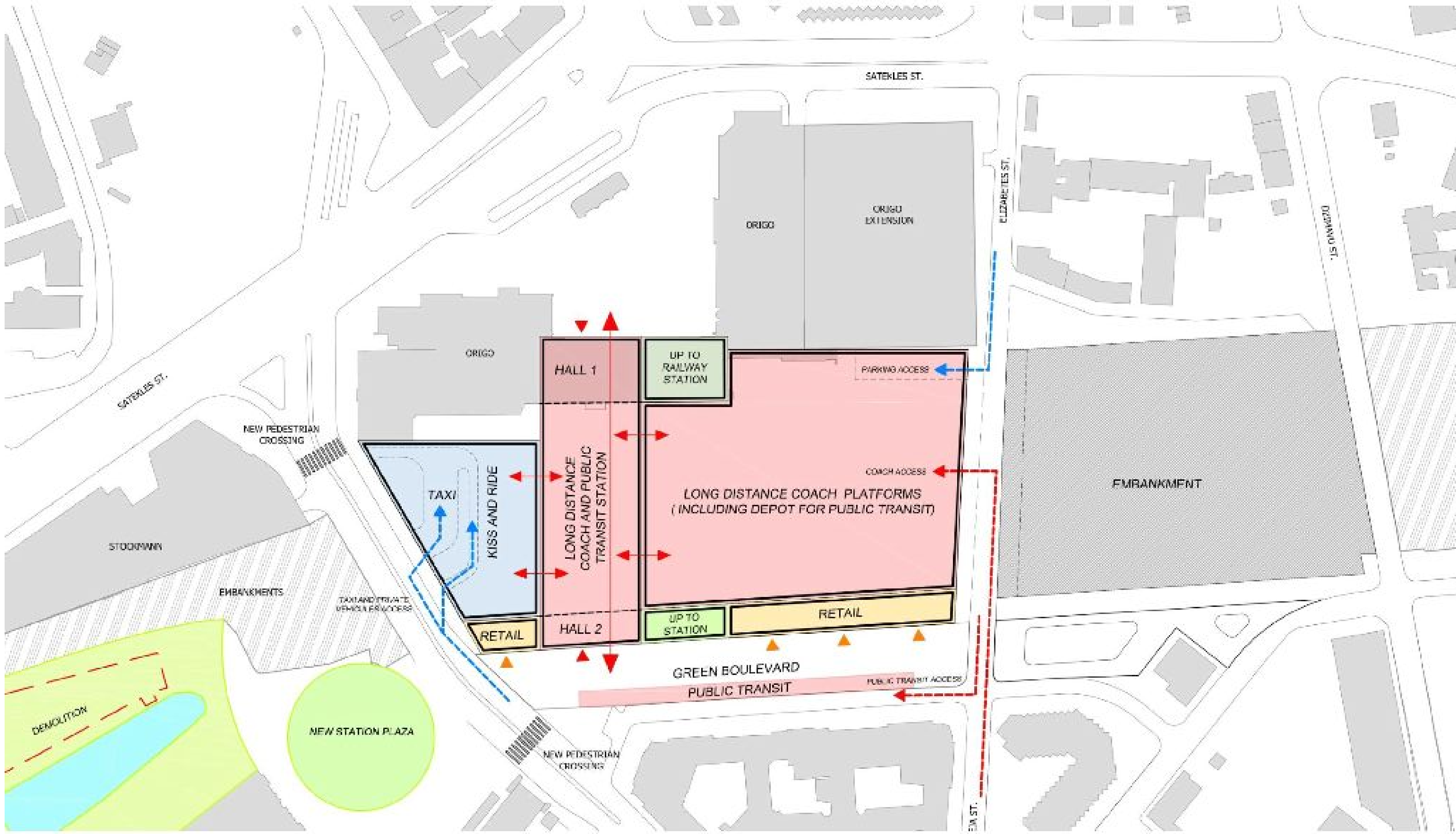


GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

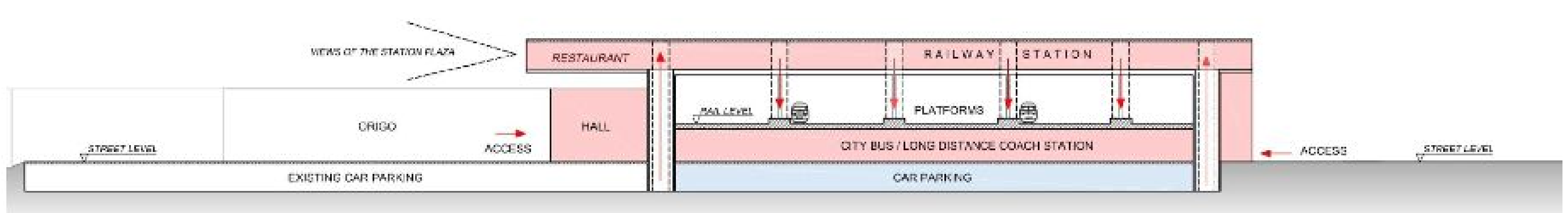
Alternative 3 - Box type Station

Alternative 3.1 – Closed Box

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement.



Areas	
Current Situation	
Train station +Retail(without offices)	8300
Long Distance Bus Station +Retail	3900
Long Distance Platforms	11700
City Bus Station+Platforms	9500
Parking Janvara Street	17600
Titanik´s Parking	7020
Alternative 3	
Train station +Retail(without offices)	12650
Long Distance Bus Station +Retail	6100
Long Distance Platforms	14700
City Bus Station+Platforms	10400
New Parking	25000
New Offices	5000
New Street level Retail	12300
Increased area	
Train station +Retail(without offices)	4350
Long Distance Bus Station +Retail	2200
Long Distance Platforms	3000
City Bus Station+Platforms	900
Parking	380
New Offices	5000
New Street level Retail	12300
TOTAL	28130



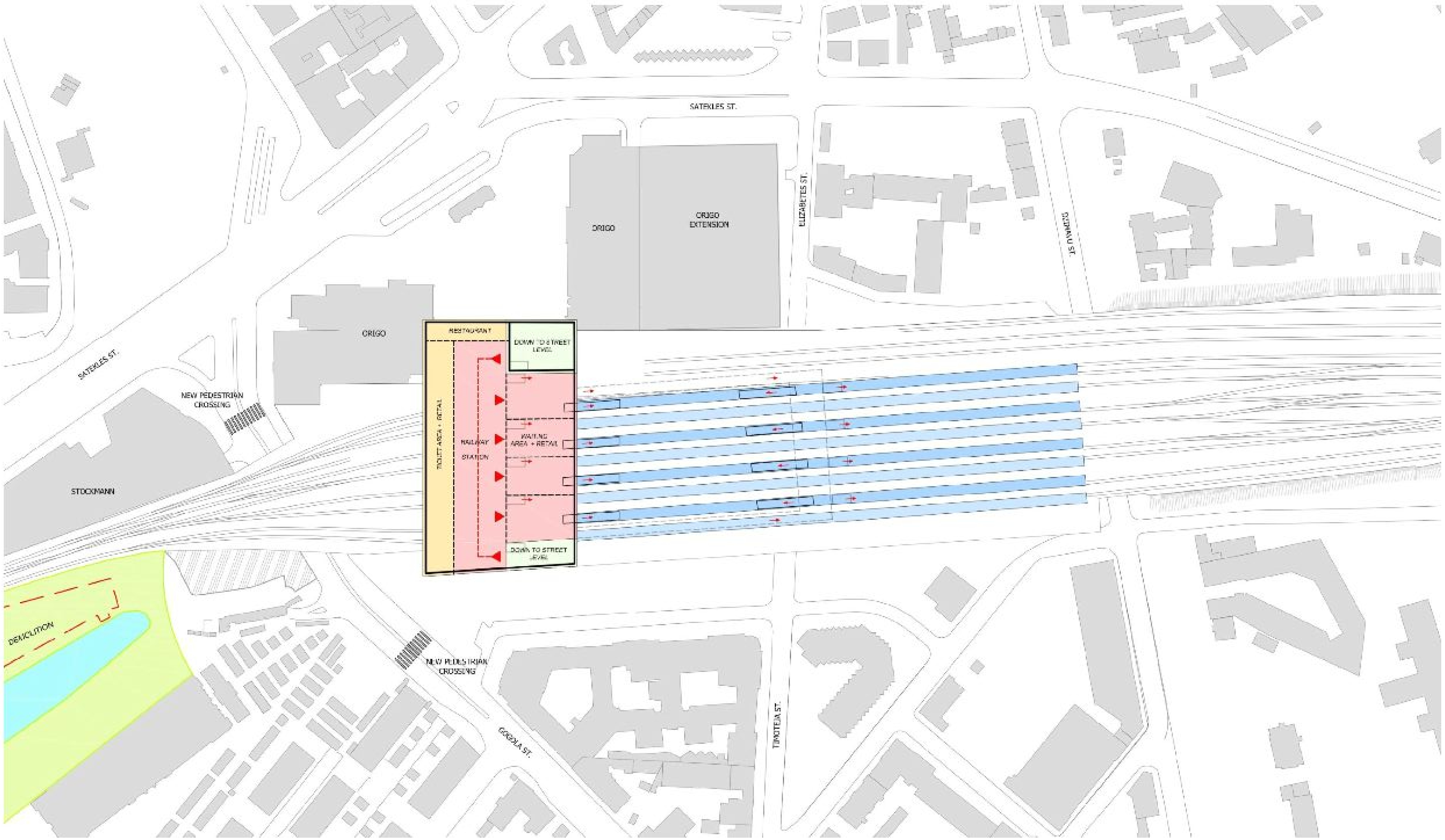
Cross section

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 3 - Box type Station

Alternative 3.1 – Closed Box

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement.

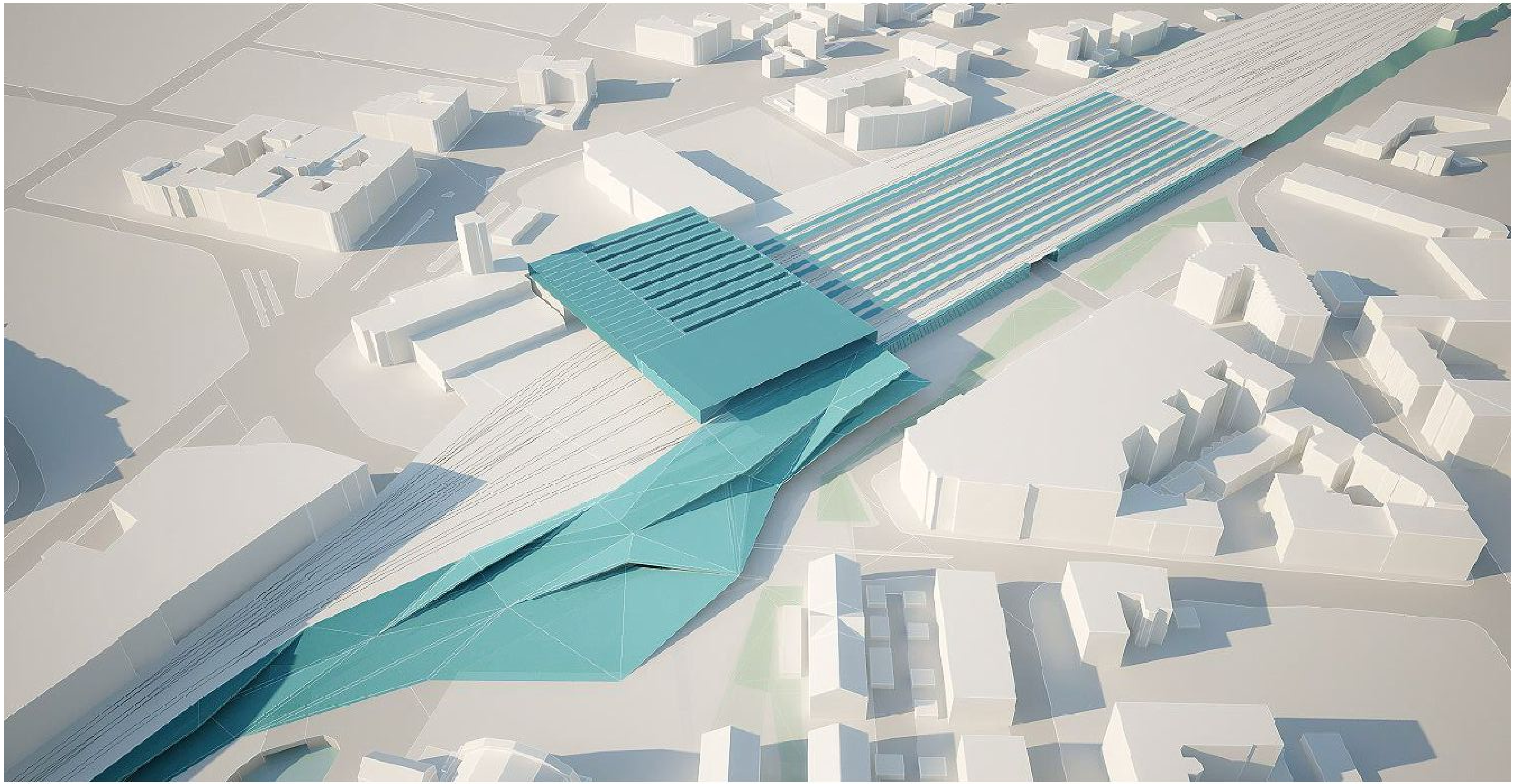


Railway Station Level

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 4 - Elevated Plaza and Station

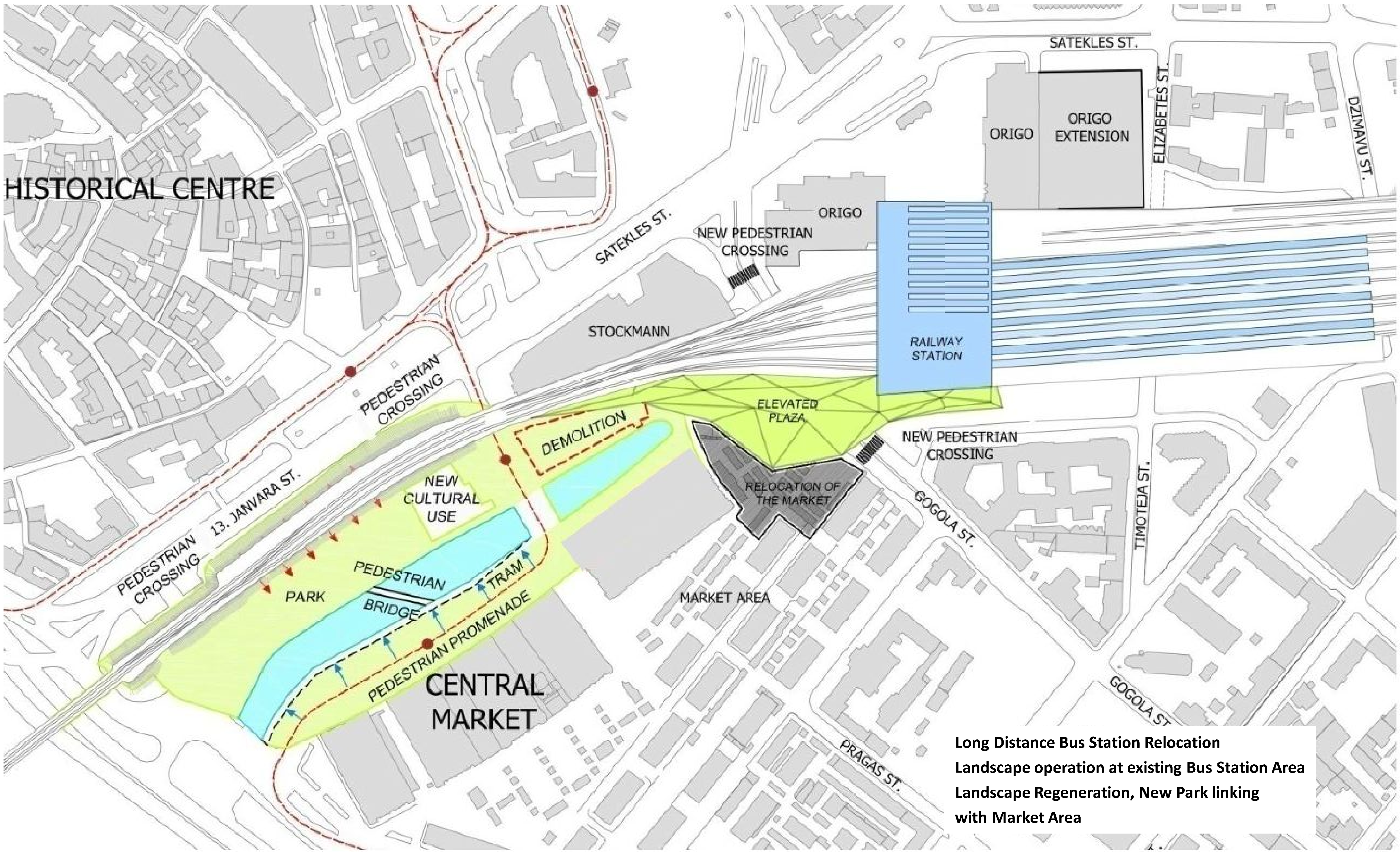
EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.



GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 4 - Elevated Plaza and Station

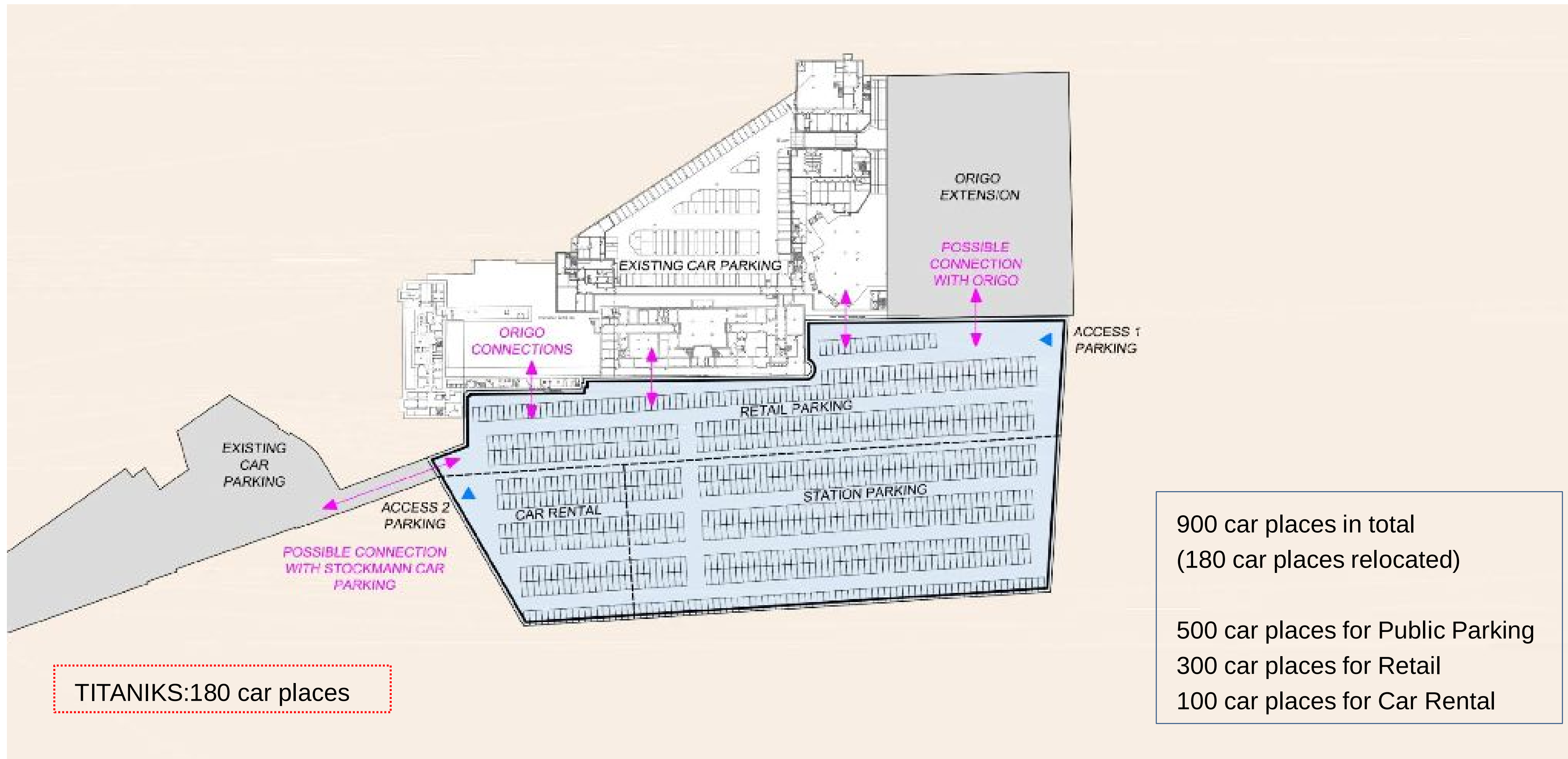
EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.



GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 4 - Elevated Plaza and Station

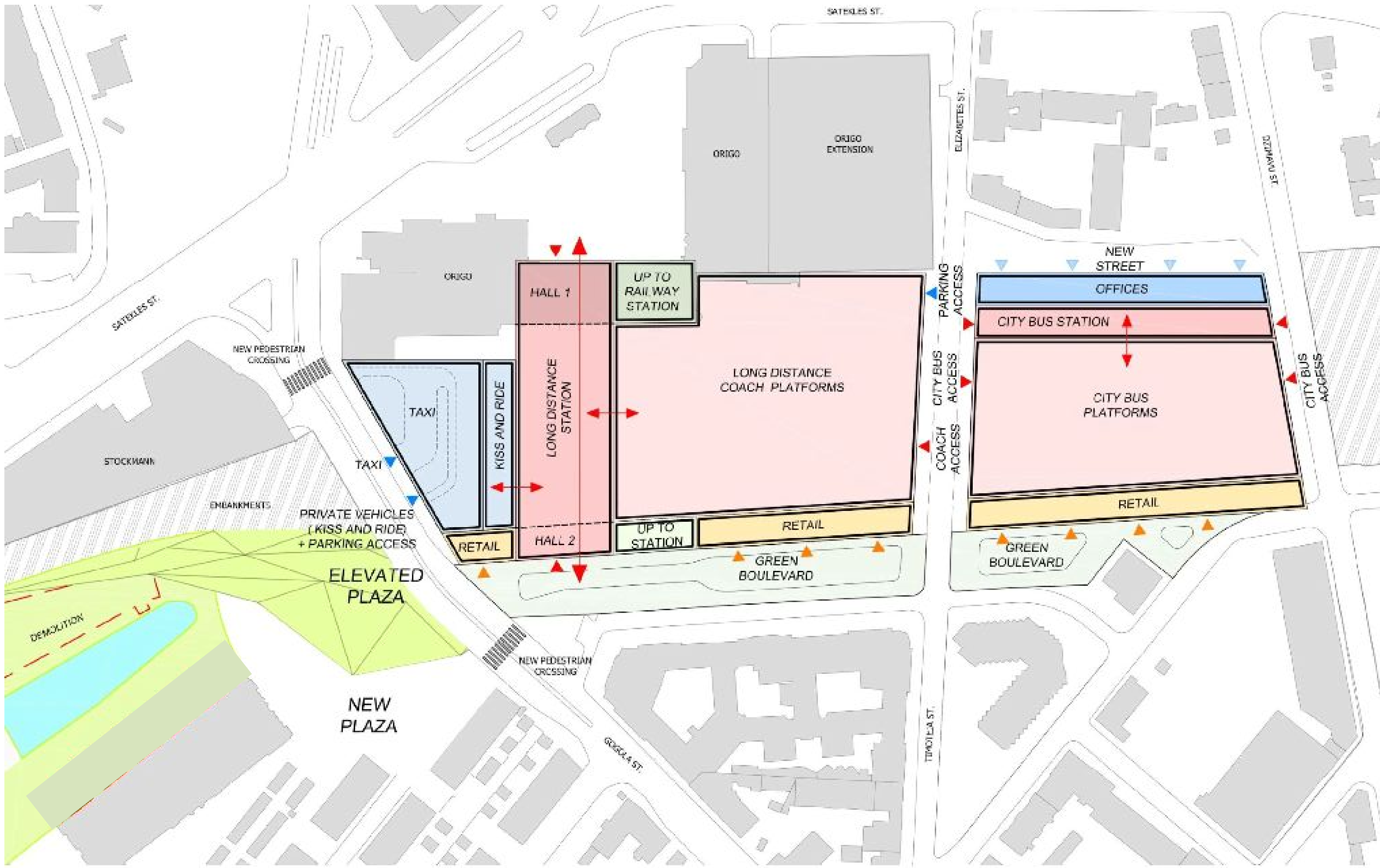
EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.



GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

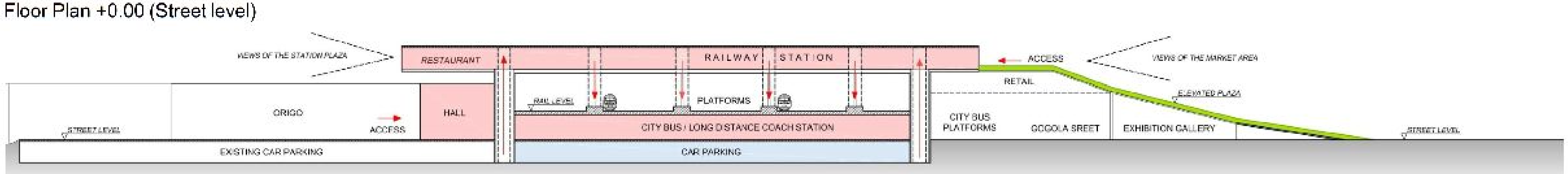
Alternative 4 - Elevated Plaza and Station

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.



Areas	
Current Situation	
Train station +Retail(without offices)	8300
Long Distance Bus Station +Retail	3900
Long Distance Platforms	11700
City Bus Station+Platforms	9500
Parking Janvara Street	17600
Titanik´s Parking	7020
Alternative 4	
Train station +Retail(without offices)	12650
Long Distance Bus Station +Retail	6100
Long Distance Platforms	14700
City Bus Station+Platforms	10400
New Parking	25000
New Offices	5000
New Street level Retail	12300
Cultural Area	5000
Increased area	
Train station +Retail(without offices)	4350
Long Distance Bus Station +Retail	2200
Long Distance Platforms	3000
City Bus Station+Platforms	900
Parking	380
New Offices	5000
New Street level Retail	12300
Cultural Area	5000
TOTAL	33130

Floor Plan +0.00 (Street level)

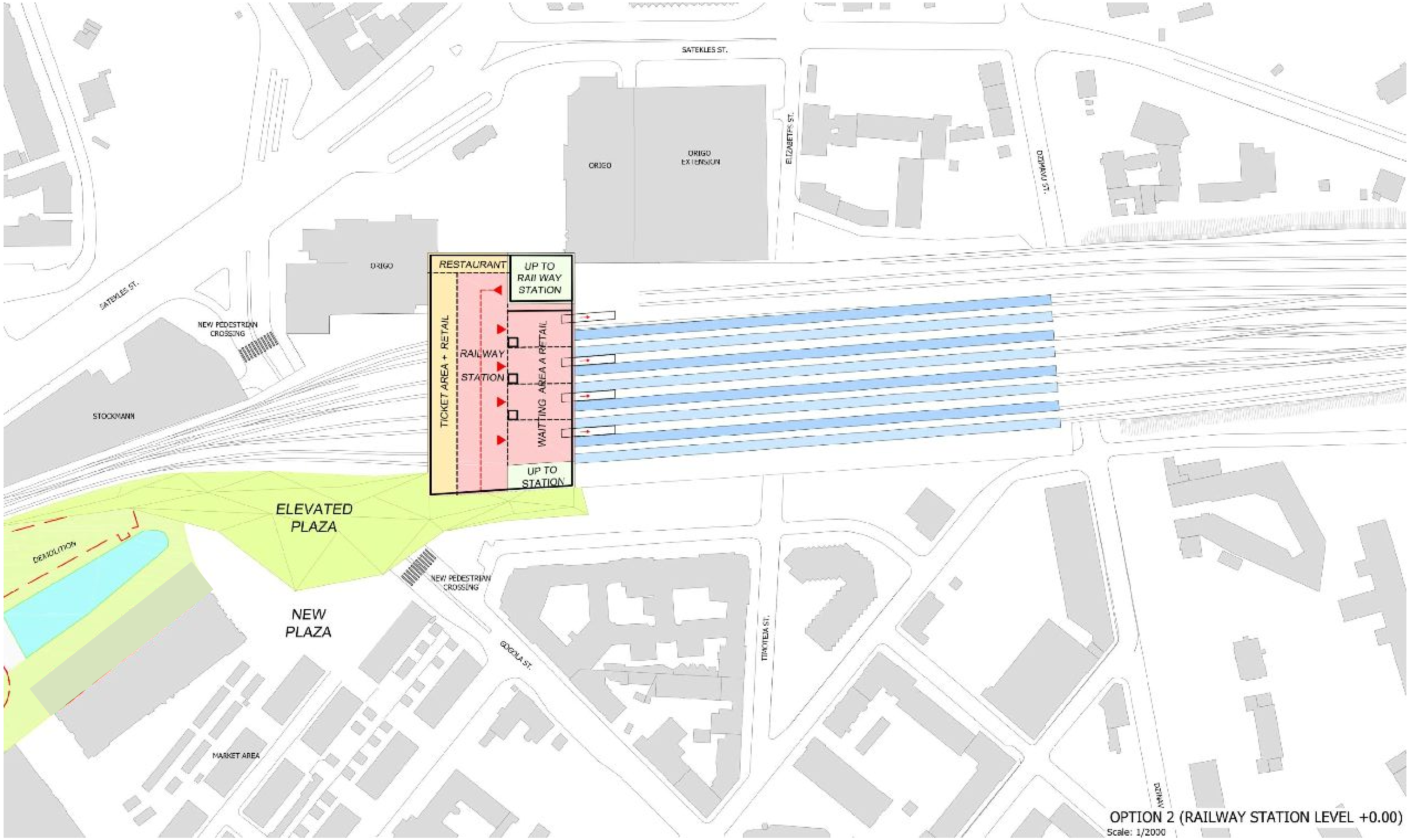


Cross section

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 4 - Elevated Plaza and Station

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.



Railway Station Level

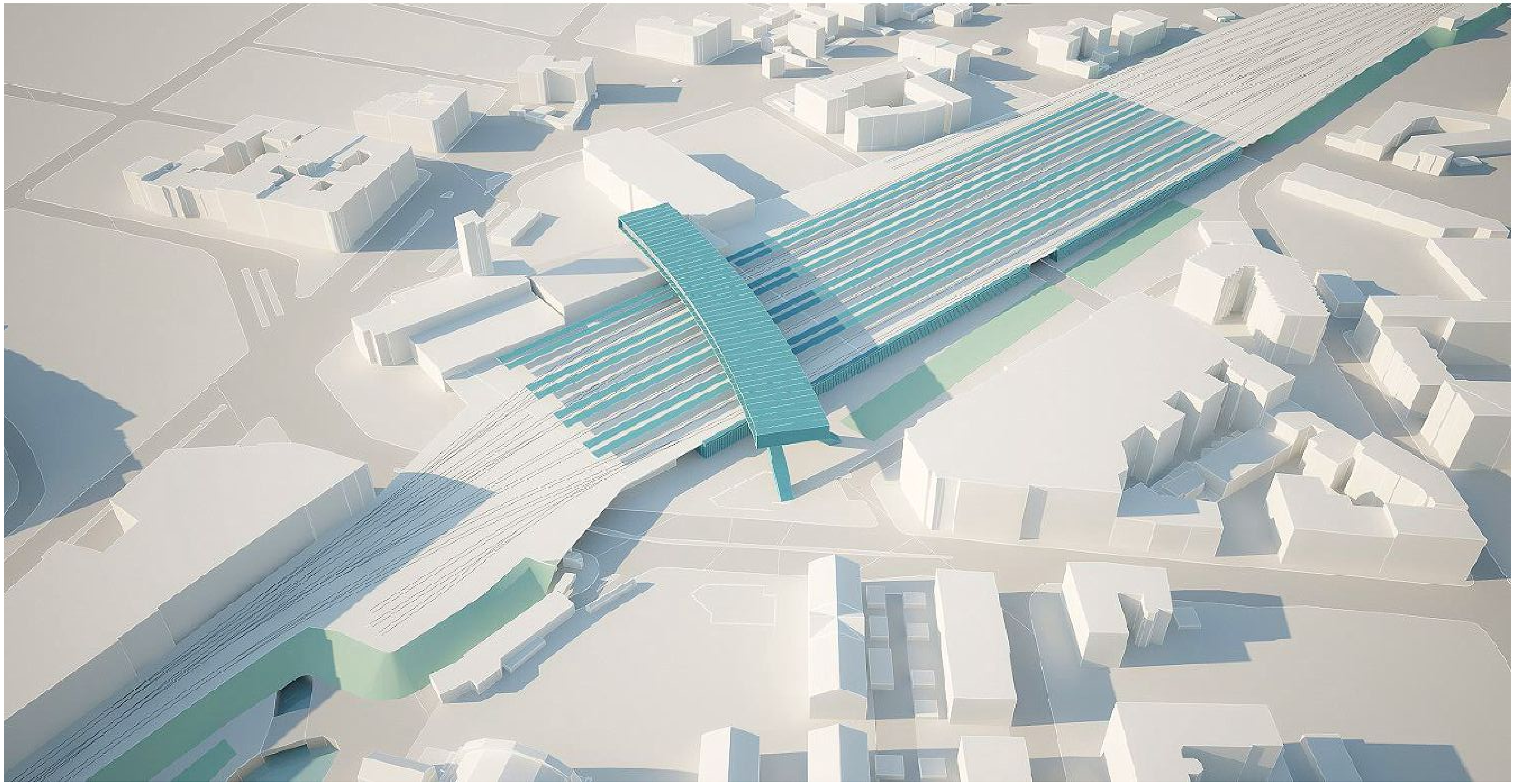
GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 5 Bridge Building Station

Alternative 5.1 – Short bridge: Two connection points

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.

Bridge building over the tracks for Railway Station and other modes of transportation at Street Level



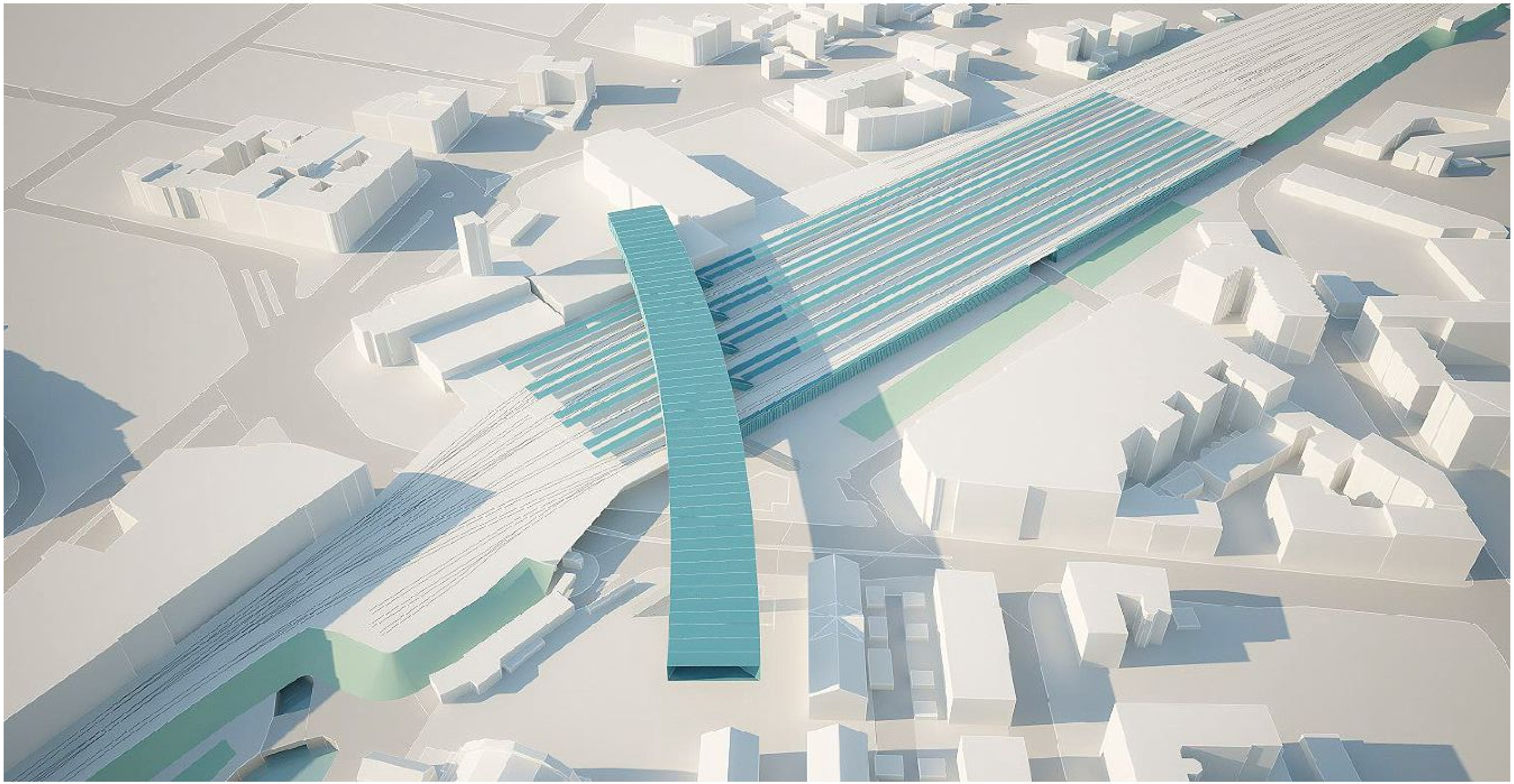
GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 5 Bridge Building Station

Alternative 5.2 – Long bridge: Three connection points. Over Gogola Street

EMBANKMENTS, BASEMENT and construction over the tracks. . City Bus relocated. Car Parking on the basement. New Park at current Coach Station.

Bridge building over the tracks for Railway Station and other modes of transportation at Street Level

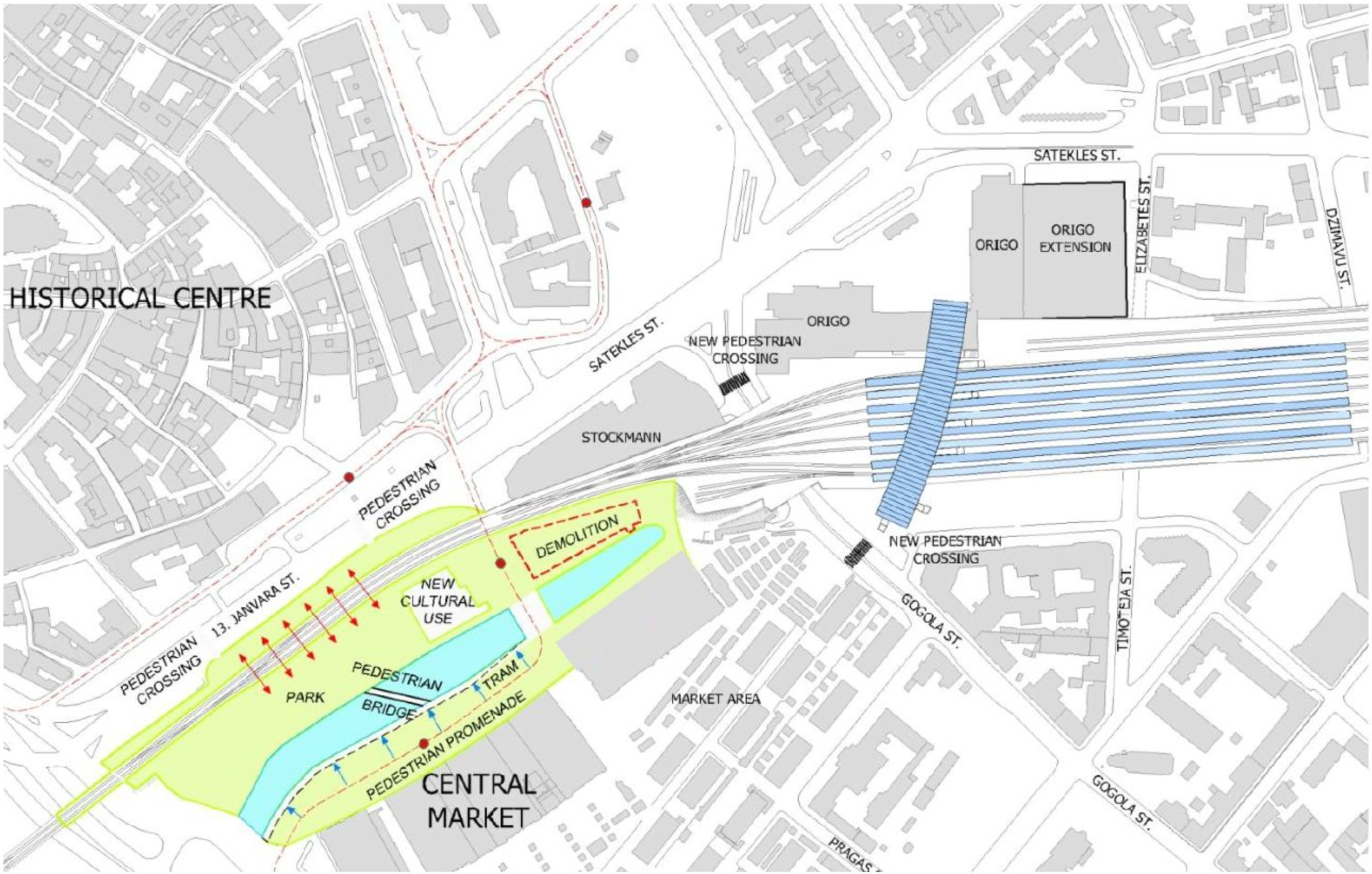


AECOM

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 5 Bridge Building Station

Alternative 5.1 – Short bridge: Three connection points. Over Gogola Street



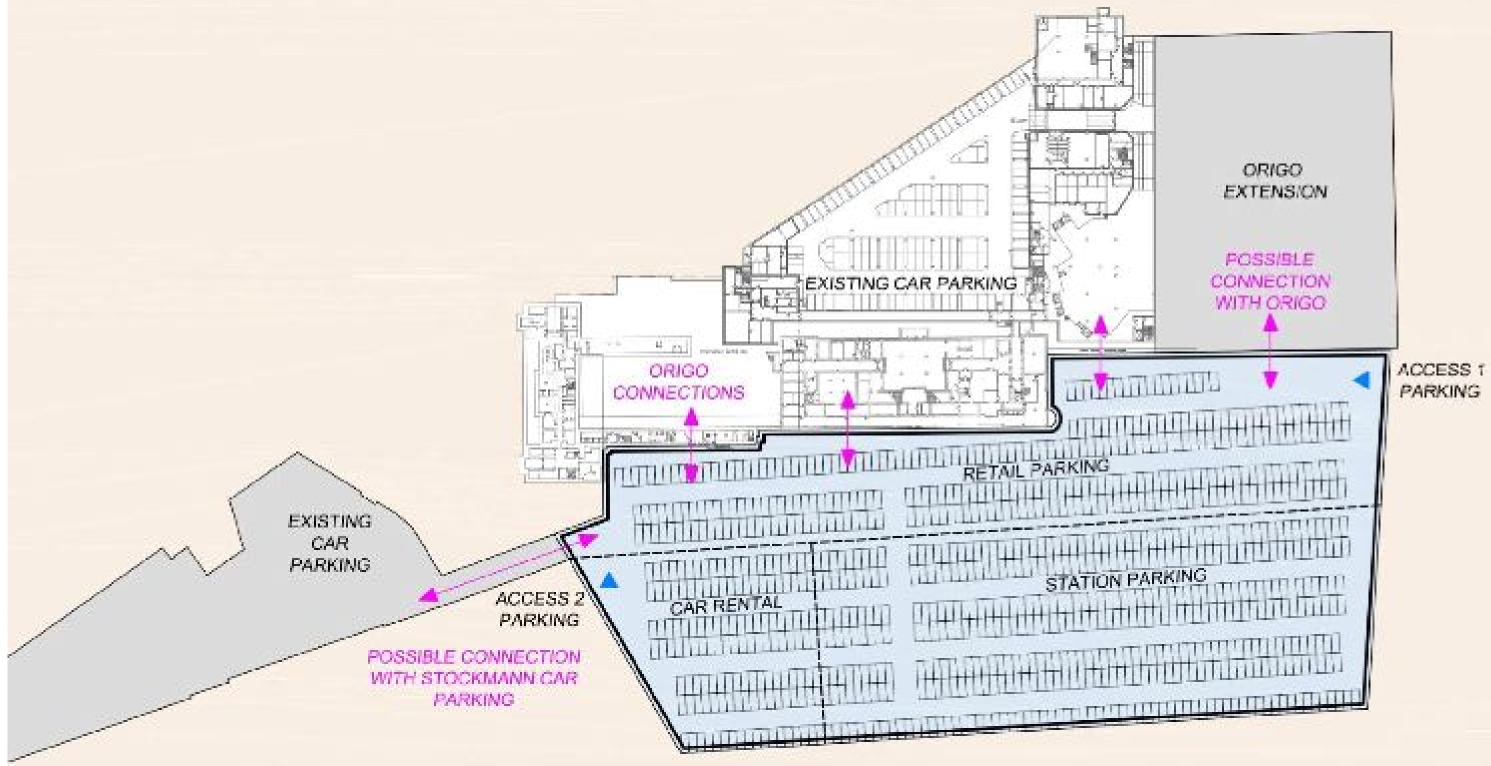
AECOM

WP2.5 – Elaboration of selected alternatives of the transport hub **PROCESS**

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 5 Bridge Building Station

Alternative 5.1 – Short bridge: Three connection points. Over Gogola Street



TITANIKS:180 car places

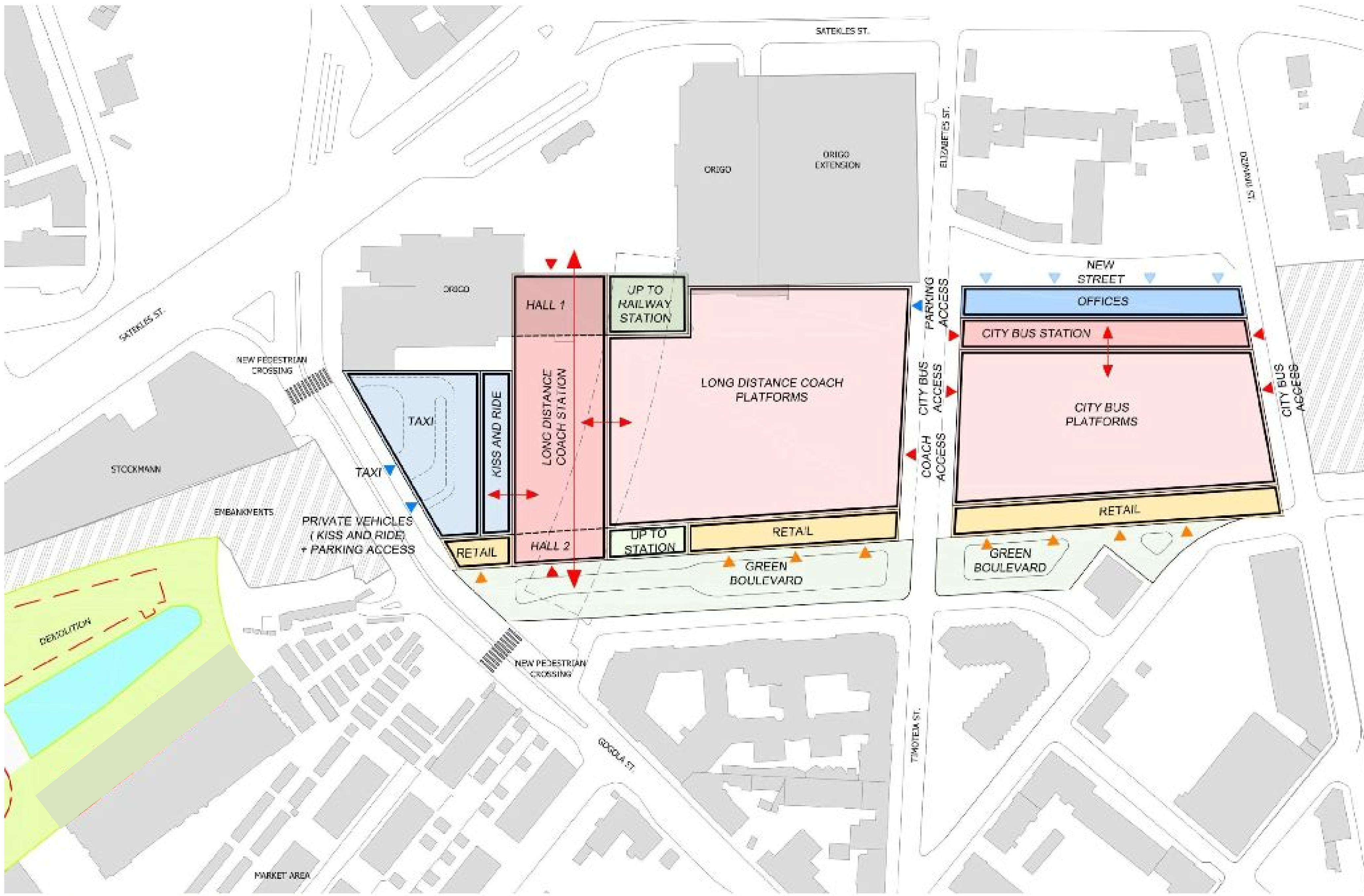
900 car places in total
(180 car places relocated)

500 car places for Public Parking
300 car places for Retail
100 car places for Car Rental

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

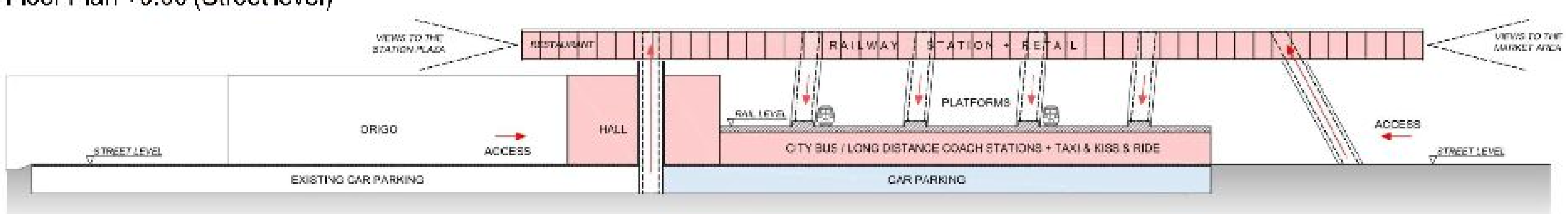
Alternative 5 Bridge Building Station

Alternative 5.1 – Short bridge: Three connection points. Over Gogola Street



Floor Plan +0.00 (Street level)

Areas	
Current Situation	
Train station +Retail(without offices)	8300
Long Distance Bus Station +Retail	3900
Long Distance Platforms	11700
City Bus Station+Platforms	9500
Parking Janvara Street	17600
Titanik´s Parking	7020
Alternative 5.1	
Train station +Retail(without offices)	7200
Long Distance Bus Station +Retail	6100
Long Distance Platforms	14700
City Bus Station+Platforms	10400
New Parking	25000
New Offices	5000
New Street level Retail	12300
Increased area	
Train station +Retail(without offices)	-1100
Long Distance Bus Station +Retail	2200
Long Distance Platforms	3000
City Bus Station+Platforms	900
Parking	380
New Offices	5000
New Street level Retail	12300
TOTAL	22680



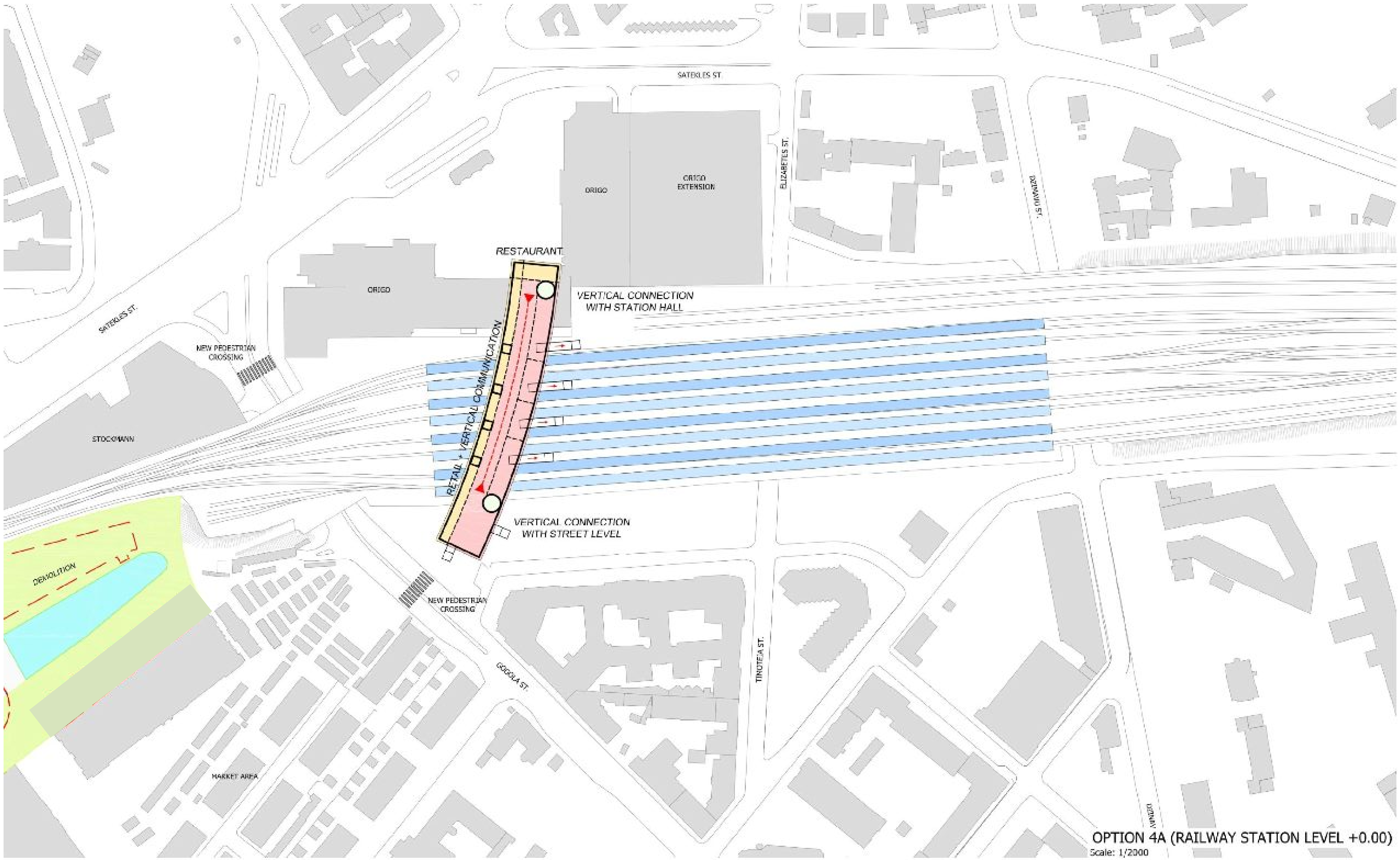
Cross section

AECOM

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 5 Bridge Building Station

Alternative 5.1 – Short bridge: Three connection points. Over Gogola Street

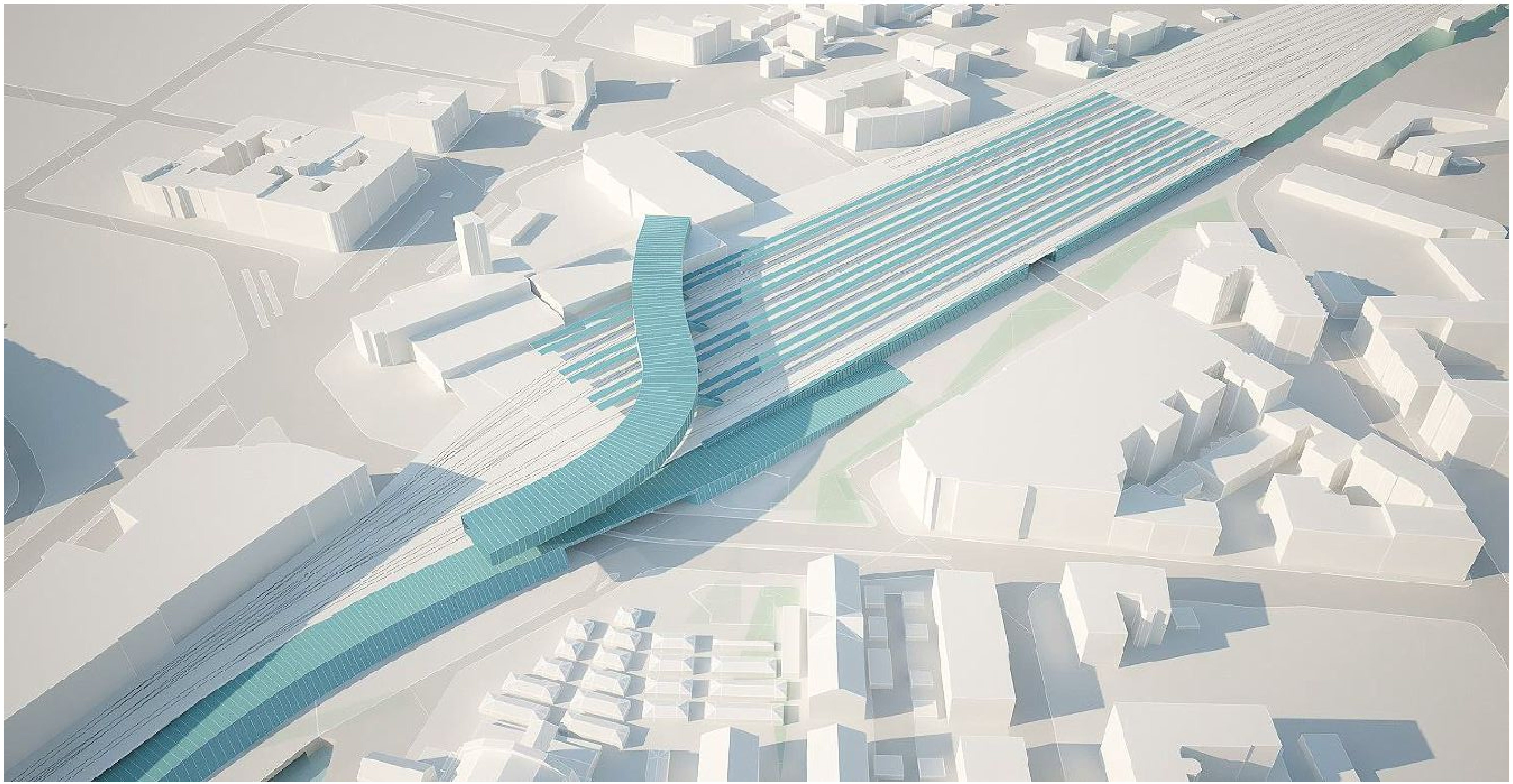


Railway Station Level

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 6 - Elevated Promenade and Station

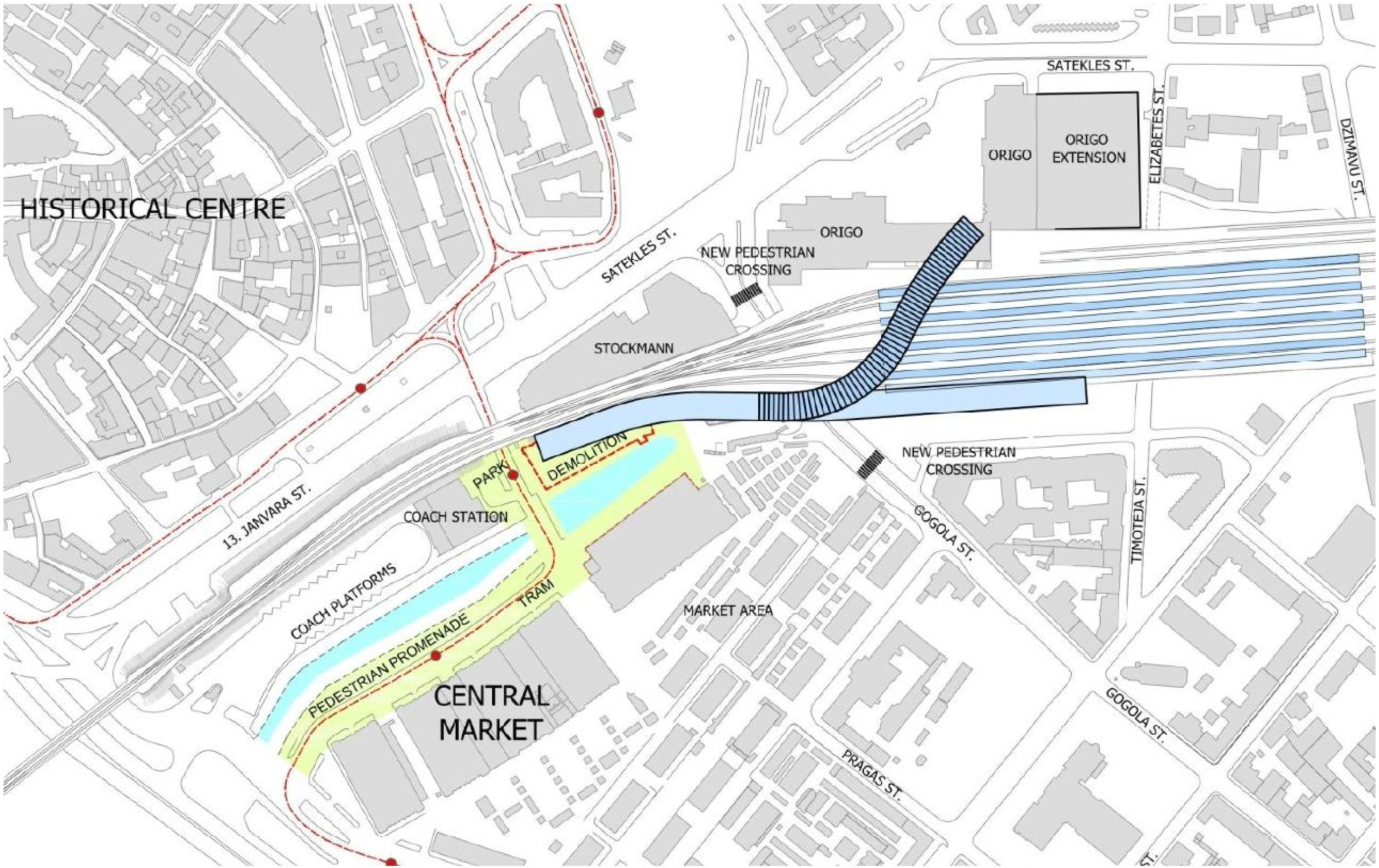
EMBANKMENTS, BASEMENT and construction over the tracks. City Bus relocated in the current Coach Station/Platforms. Car Parking on the basement. Keeping the Long Distance Bus Platforms and Station for the City Bus Area and relocating the Long Distance Buses at Street Level below the tracks. Both stations linked by a green elevated promenade.



GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 6 - Elevated Promenade and Station

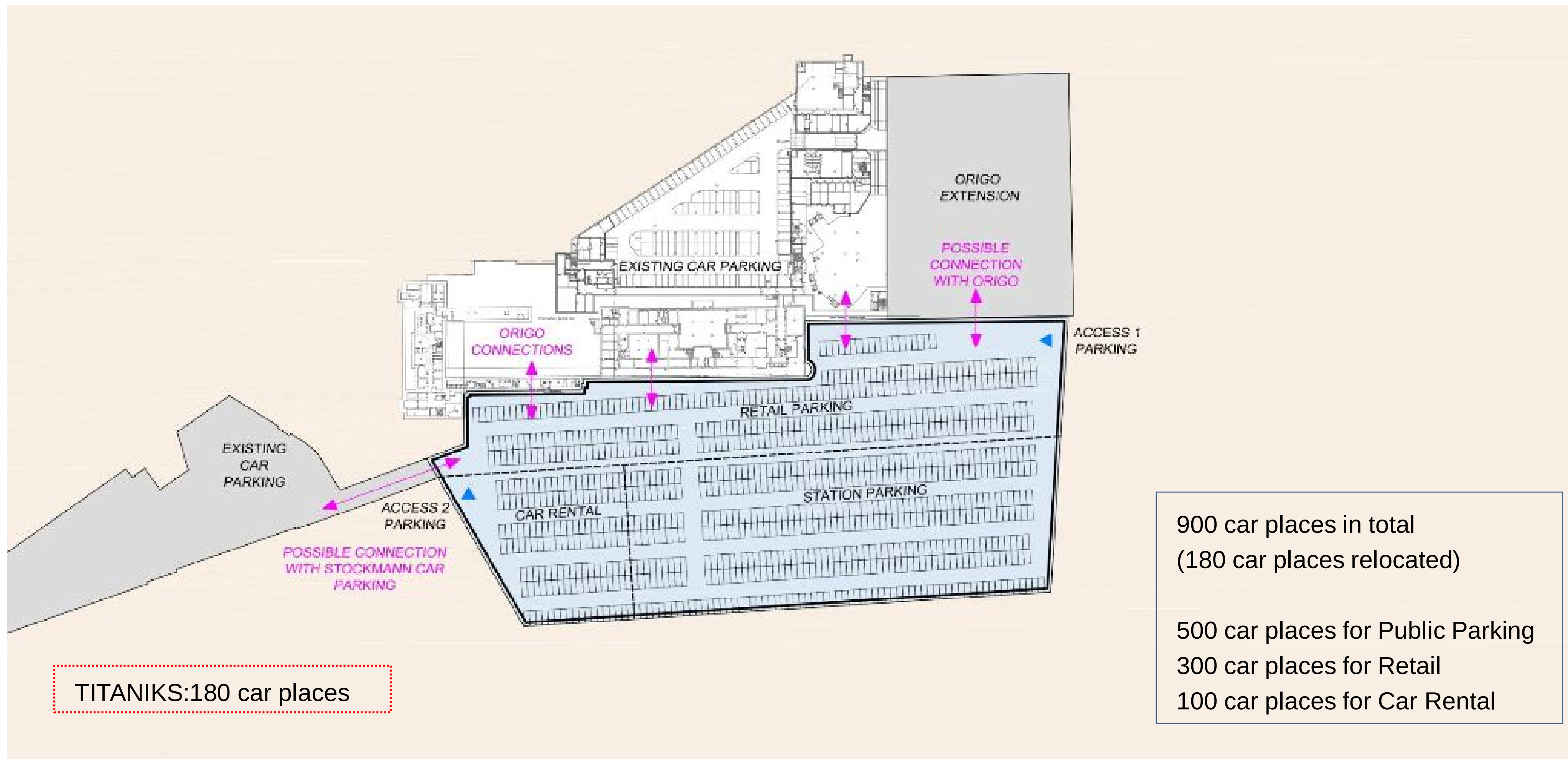
EMBANKMENTS, BASEMENT and construction over the tracks. City Bus relocated in the current Coach Station/Platforms. Car Parking on the basement.



GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 6 - Elevated Promenade and Station

EMBANKMENTS, BASEMENT and construction over the tracks. City Bus relocated in the current Coach Station/Platforms. Car Parking on the basement.

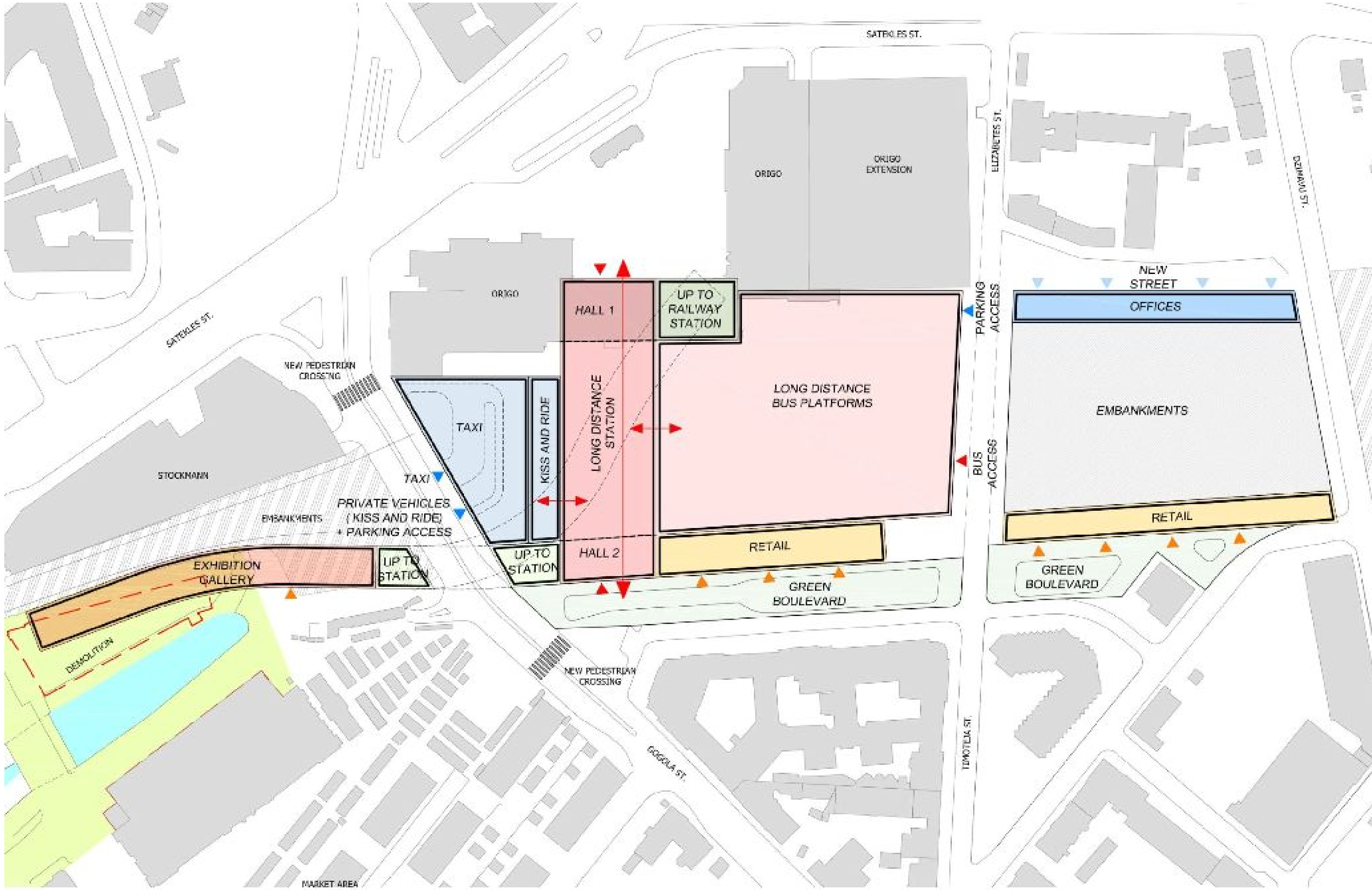


WP2.5 – Elaboration of selected alternatives of the transport hub PROCESS

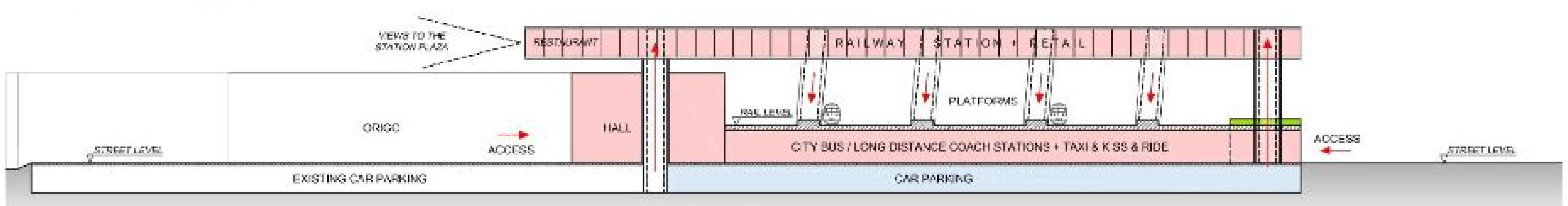
GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

Alternative 6 - Elevated Promenade and Station

EMBANKMENTS, BASEMENT and construction over the tracks. City Bus relocated in the current Coach Station/Platforms. Car Parking on the basement.



Floor Plan +0.00 (Street level)



Cross section

Areas	
Current Situation	
Train station +Retail(without offices)	8300
Long Distance Bus Station +Retail	3900
Long Distance Platforms	11700
City Bus Station+Platforms	9500
Parking Janvara Street	17600
Titanik´s Parking	7020
Alternative 6	
Train station +Retail(without offices)	5900
Long Distance Bus Station +Retail	6100
Long Distance Platforms	14700
City Bus Station+Platforms	-
New Parking	25000
New Offices	5000
New Street level Retail	9100
Cultural Area	3300
Increased area	
Train station +Retail(without offices)	-2400
Long Distance Bus Station +Retail	2200
Long Distance Platforms	3000
City Bus Station+Platforms	-
Parking	380
New Offices	5000
New Street level Retail	9100
Cultural Area	3300
TOTAL	20580

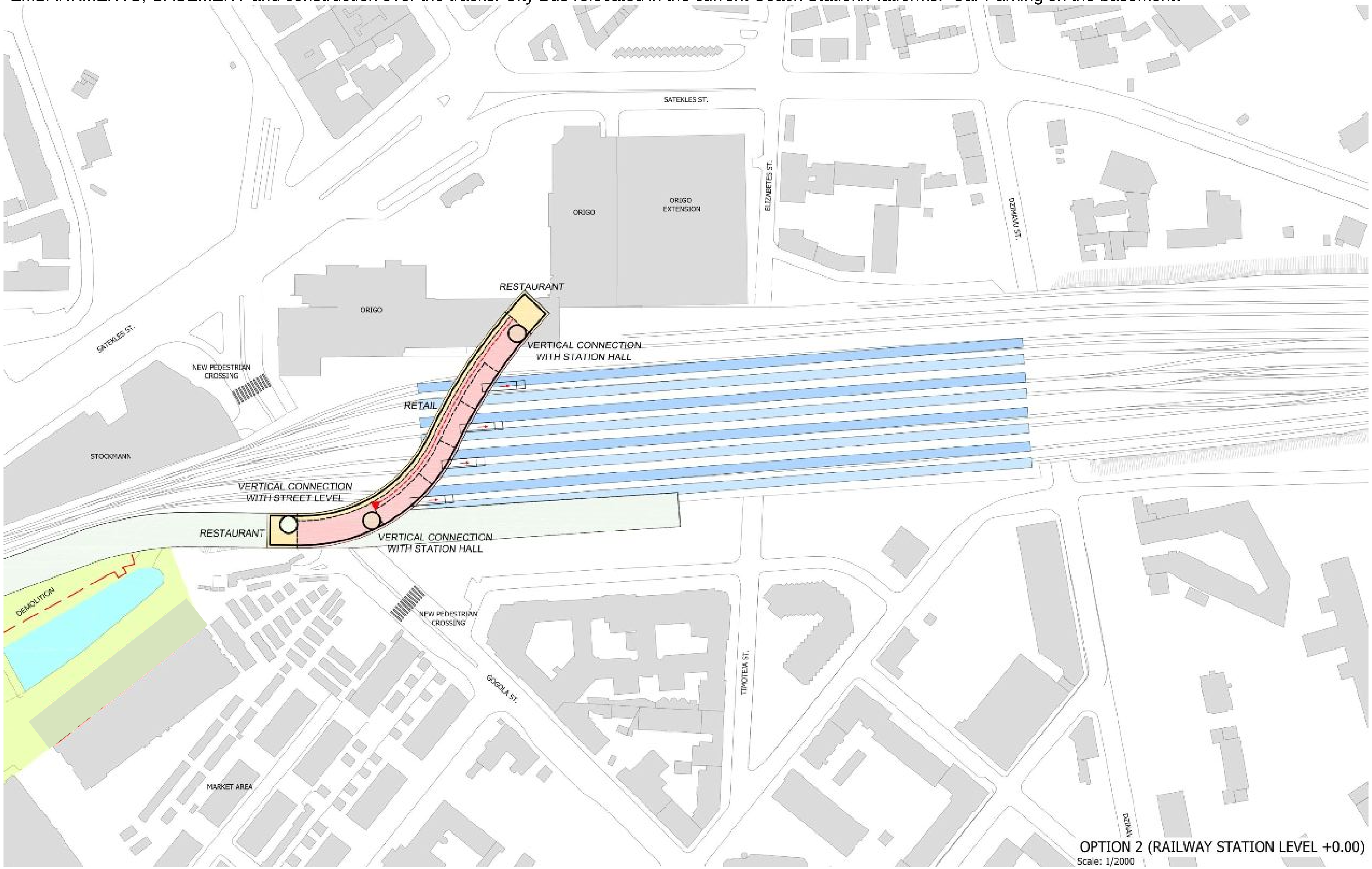
AECOM

WP2.5 – Elaboration of selected alternatives of the transport hub **PROCESS**

GROUP C: COACH STATION RELOCATED. STATION OVER THE TRACKS.

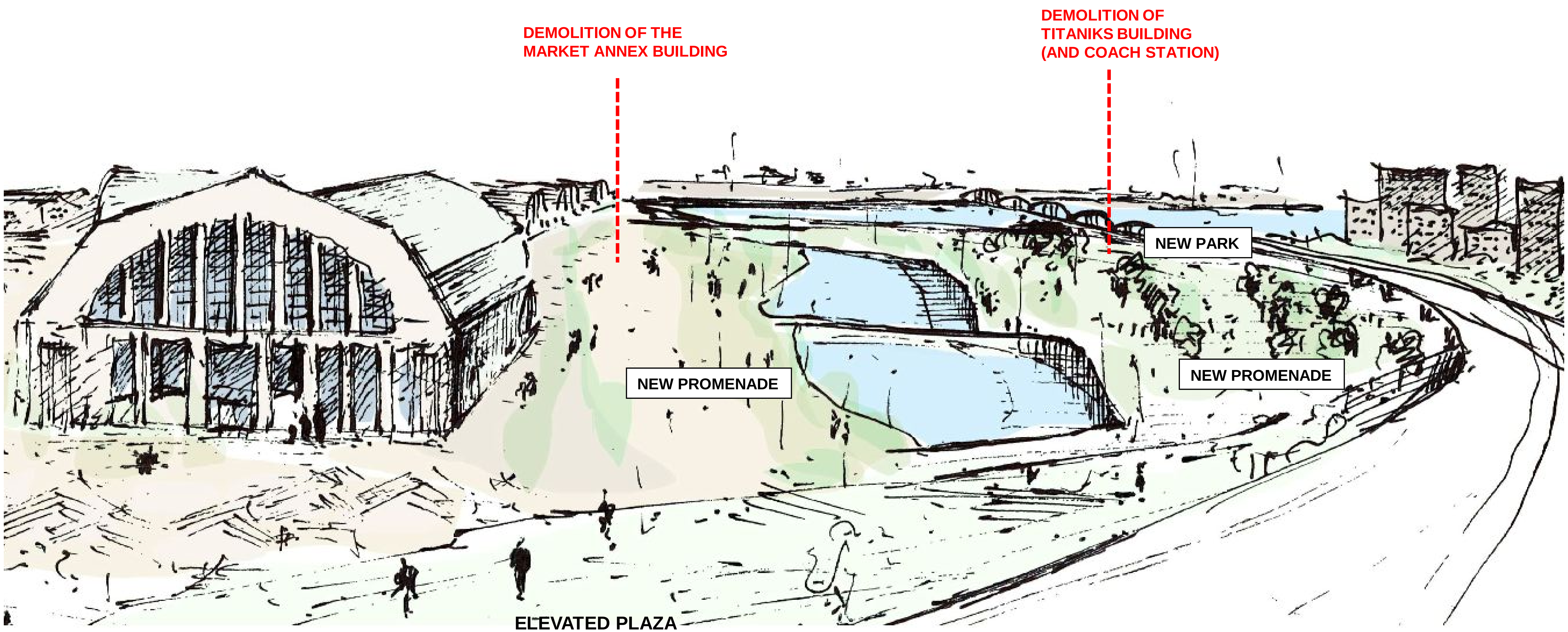
Alternative 6 - Elevated Promenade and Station

EMBANKMENTS, BASEMENT and construction over the tracks. City Bus relocated in the current Coach Station/Platforms. Car Parking on the basement.



Railway Station Level

Views from the Elevated Station



2.3. Options for the front plaza

2.3.1. Cantilevered Canopy over the plaza

AECOM

2.3.2. Cantilevered Canopy over the plaza and welcoming pavilion

2.3.3. New volume over and along the existing station

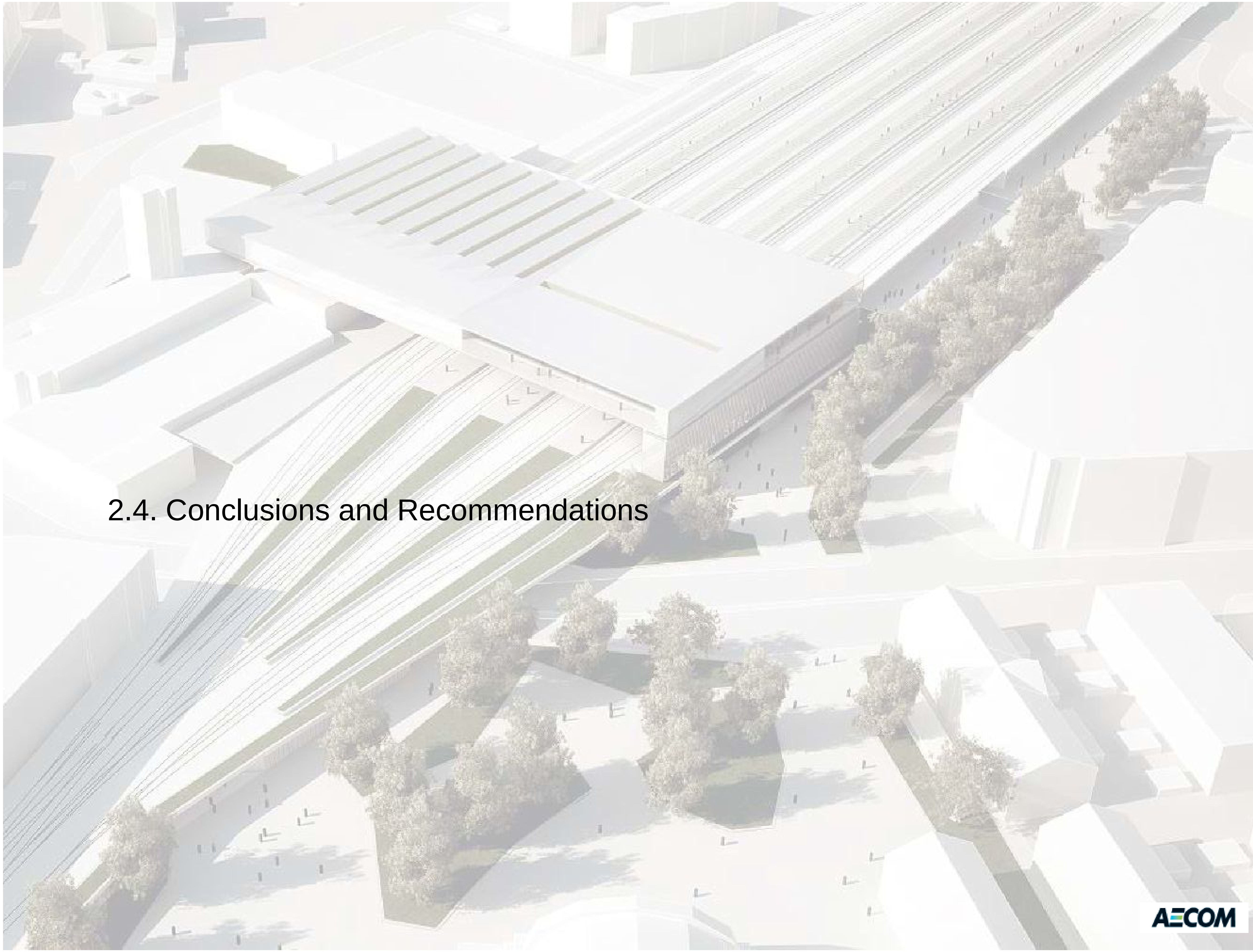
2.3.4. New volume over the existing station

2.3.5. New urban gate – framing the whole façade

2.3.6. New urban gate –framing the glass façade

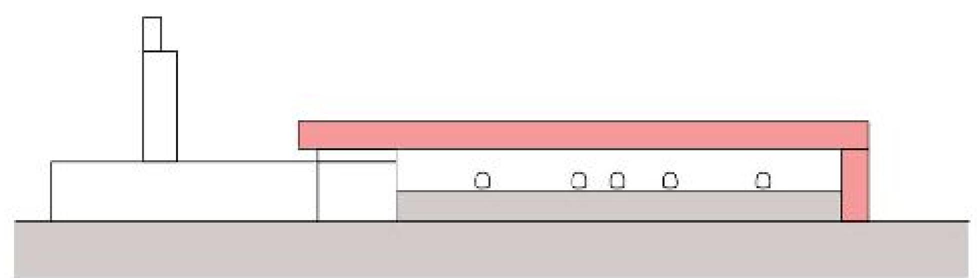
2.3.7. New volume housing new functions

2.3.7. New volume housing new functions – keeping the existing façade untouched – creates a covered atrium at the station entrance



2.4. Conclusions and Recommendations

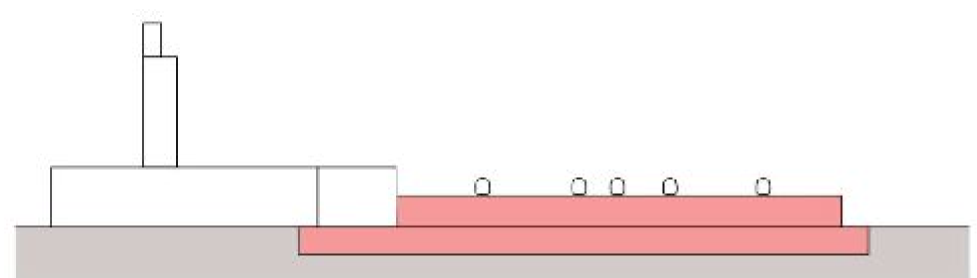
2.4.1. Conclusions for the 3 groups of alternatives



GROUP A
Over the tracks — Alternative 1

PROS
- *No construction at the embankments.*
- *Good views from elevated station*

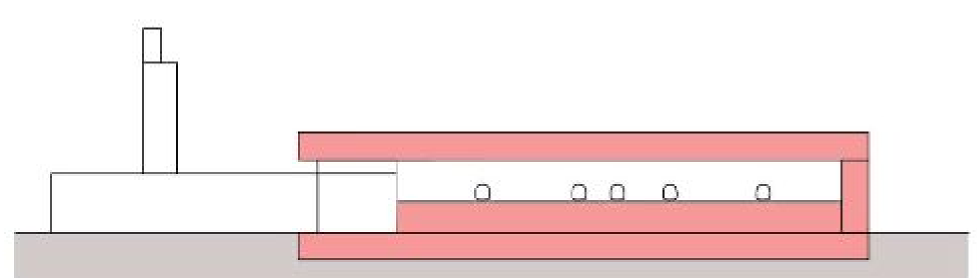
CONS
- *Coach Station kept where it is. Too far still from new Railway station.*
- *Not functional. No space for all modes of transportation.*
- *Car Parking limited.*



GROUP B
Below the tracks — Alternatives 2.1, 2.2

PROS
- *Functional, it can integrate all modes of transportation.*

CONS
- *Construction complexity at the embankment and no visibility.*
- *Not visible from the city, not recognizabe and no views from the station.*



GROUP C
Over and Below the tracks — Alternatives 3, 4, 5 & 6

PROS
- *Efficiency, minimized walking distances between the different modes of transportation.*
- *Possibility of using less area of the embankments than group 1 for the modes of transportation*
- *Urban planning, Landscaping and Relationship with the city,*
- *Architectural solution: Strategically, functionality*

CONS
- *Construction complexity at the embankment*

2.4.2. General Conclusions and Recommendations

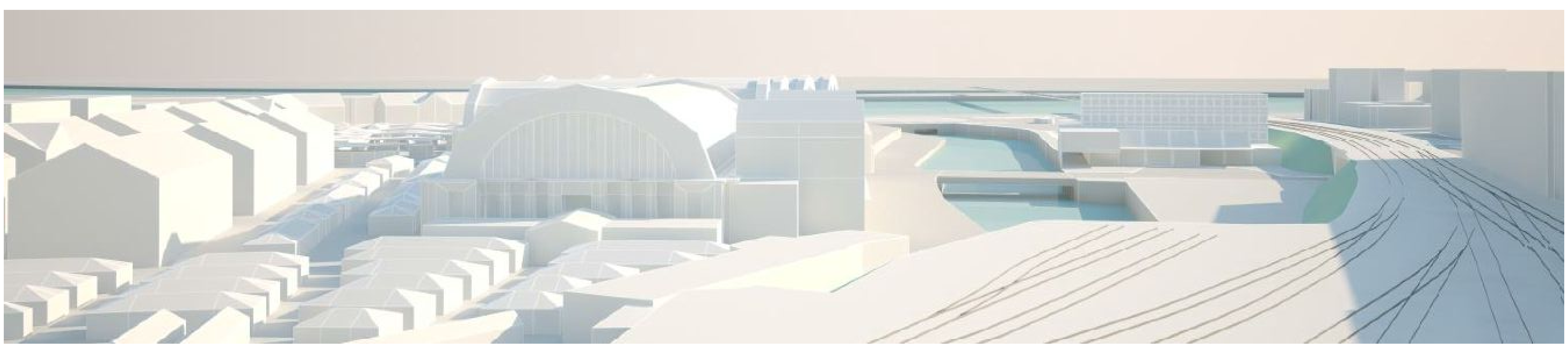
Long Distance Coach Station: Riga Road Transportation Administration notes that the Coach Terminal is **high priority.**
Its integration in the new multimodal hub needs a **Relocation** because the current place is far from the Railway platforms.
This is ONLY possible at street level, below the tracks, due to the lack of space in the surroundings. The touristic buses can remain at the new public space linked to a touristic point of information.

Building over the tracks - State Inspection for Heritage (Height Restrictions):
All alternatives which propose building over the tracks have a maximum height from street level of around 25 m.
Building an elevated station seems the **best solution** for the Railway Station and the access down to the platforms is direct. There are **great views** of the OLD CITY from the elevated station.

Origo-Lingstow Connection: The new station will be linked horizontally and vertically to the **upper levels,** in case the terminal is built over the tracks.
At street level, the embankment below the tracks will be completely opened to the city and directly connected with Origo/ existing Station hall.

Basement and Car Parking: The basement (at the embankment 3) is **highly recommended** for the NEW CAR PARKING at the multimodal hub.
The Car parking at the basement is vertically connected with the Railway Station and the Bus Interchange, as well with the commercial buildings (Stockmann and Origo).

Market Area - Riga City Development Departments: For all alternatives there is a proposal of upgrading both riversides at the market area.
There are many possibilities to recover the canal to the city and improve the promenade along it on both sides.
Landscape intervention based on giving the market area a wider sidewalk for pedestrians and transform the current Coach Station into a **new Park**.



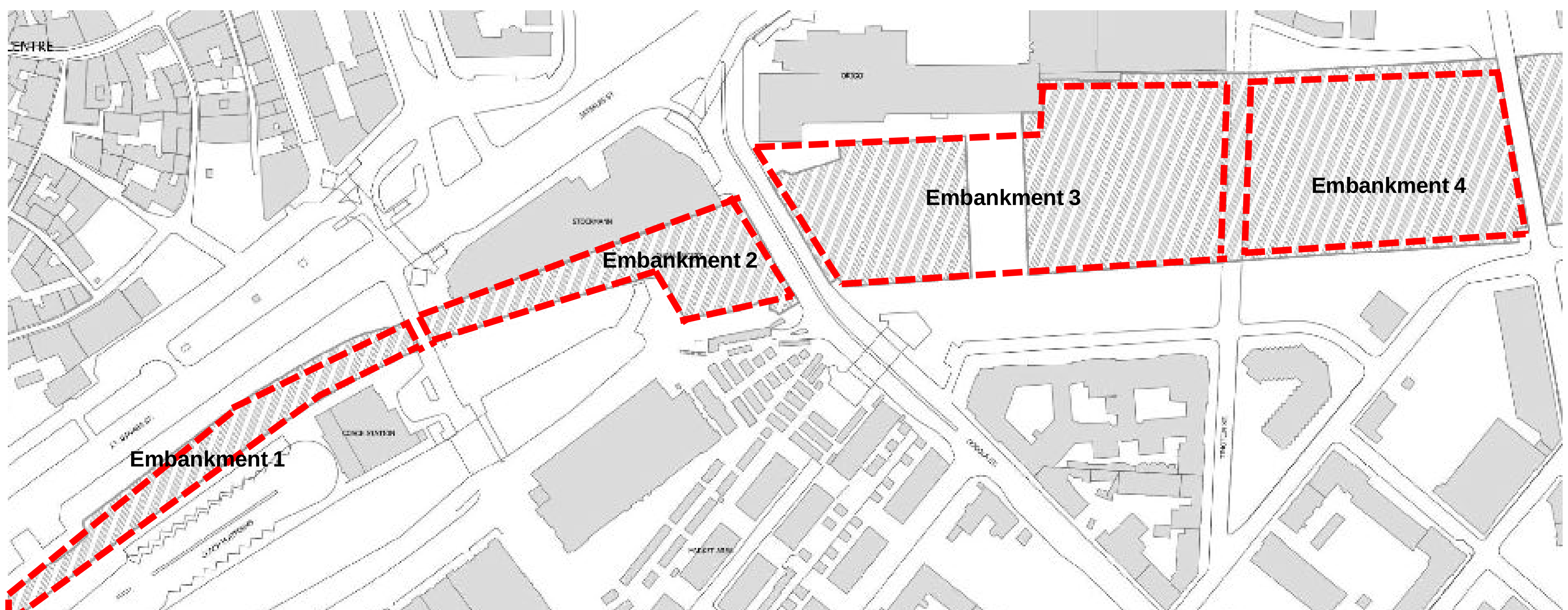
2.4.3. Recommendations for the Embankments

Embankment 1: It is highly recommended to be **partially removed** and let the **connection with the OLD CITY.**

Embankment 2: It is recommended to open a new **ACCESS TO STOCKMANN**. Titanik Car parking to be removed, and its car places relocation at Embankment 1.

Embankment 3: It is highly recommended for an **BUS INTERCHANGE and the Car Parking (basement).**

Embankment 4: The recommendation is **keeping this embankment as it is** and use the Embankment 3 as much as possible.
The proposal is using this embankment in a future stage if neccessary.



Zurich Viaduct Reference

Retail below the railroad

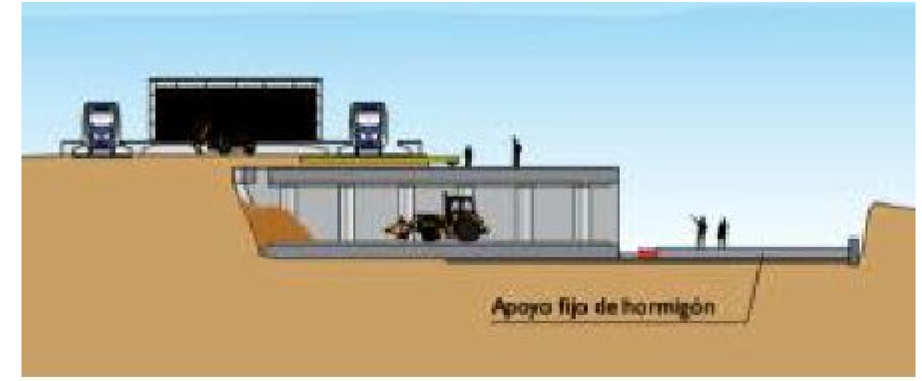
For Embankment 1

3. CONSTRUCTION SYSTEMS AND TRACK CROSS SECTION

STRUCTURE_ Construction Systems

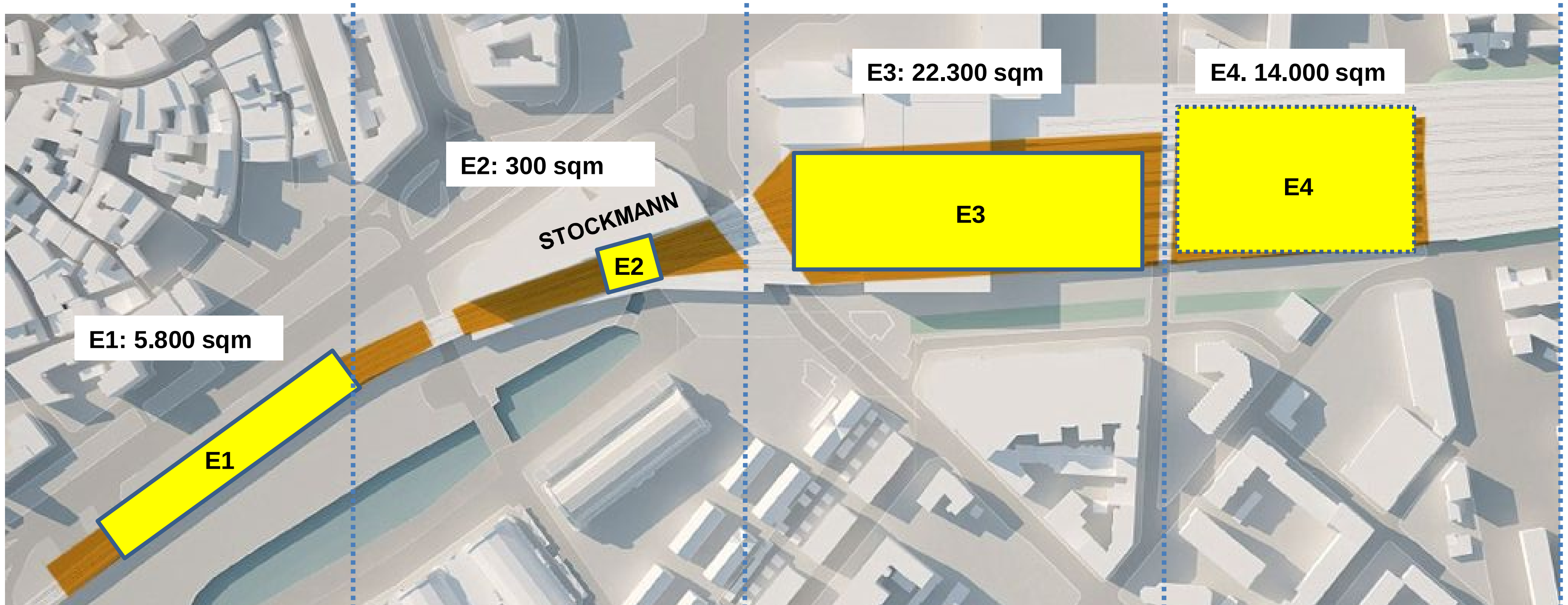
System 1: Construction by Stages with Traffic Divertion
System 2: Construction by Jacked Boxes

VÍDEO WITH JACKED BOX SYSTEM



System 2: Jacked Boxes

Recommended System 1 **By stages** Only at street level	Recommended System 2 **Jacked box** Only at street level	Recommended System 1 **By stages** Two levels: Street Level + Basement	**No Construction** Recommended
5,800.000 €	750.000 €	33,450.000 €	
(1.000 €/sqm)	(2.500 €/sqm)	(1.500 €/sqm)	



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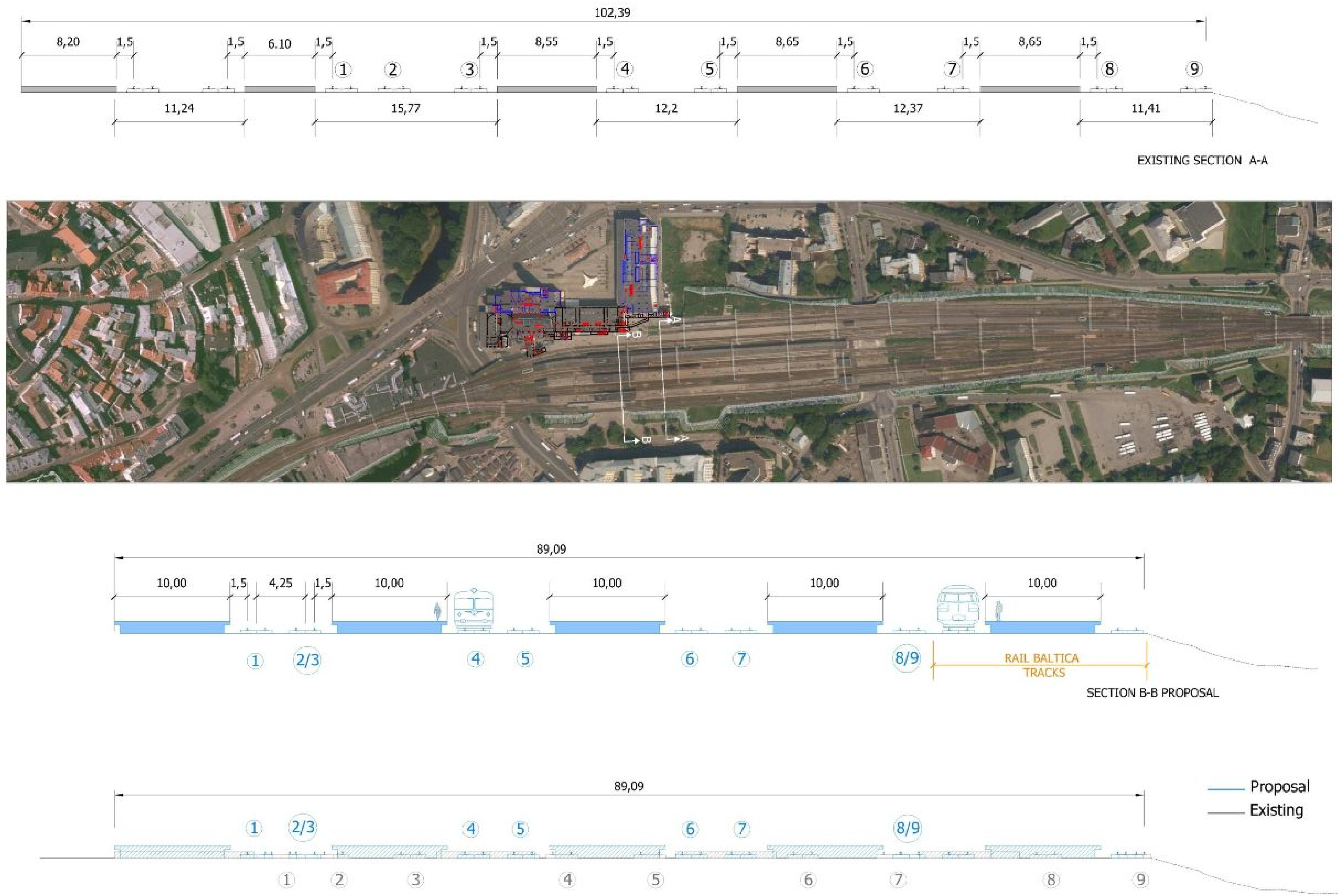
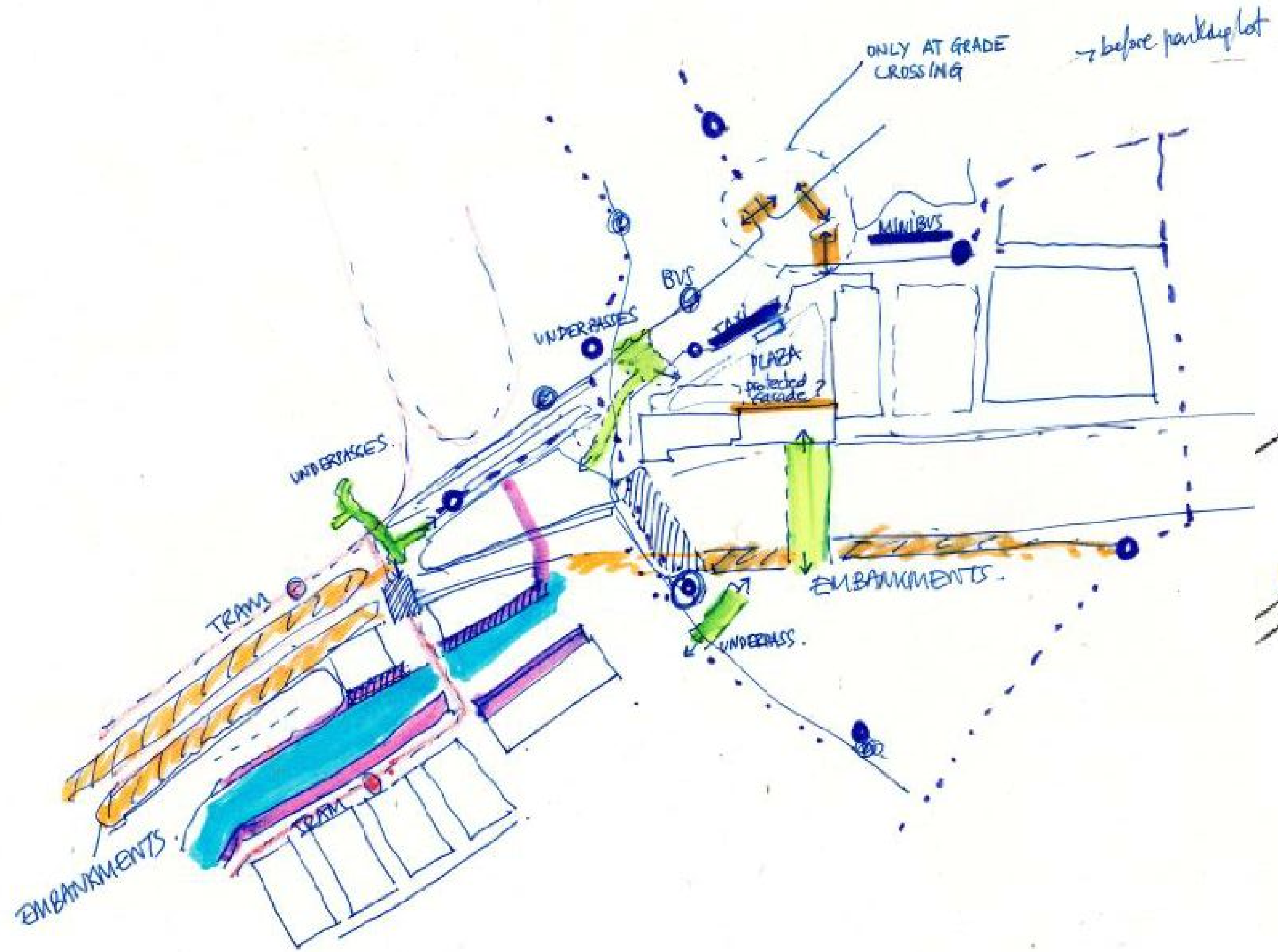
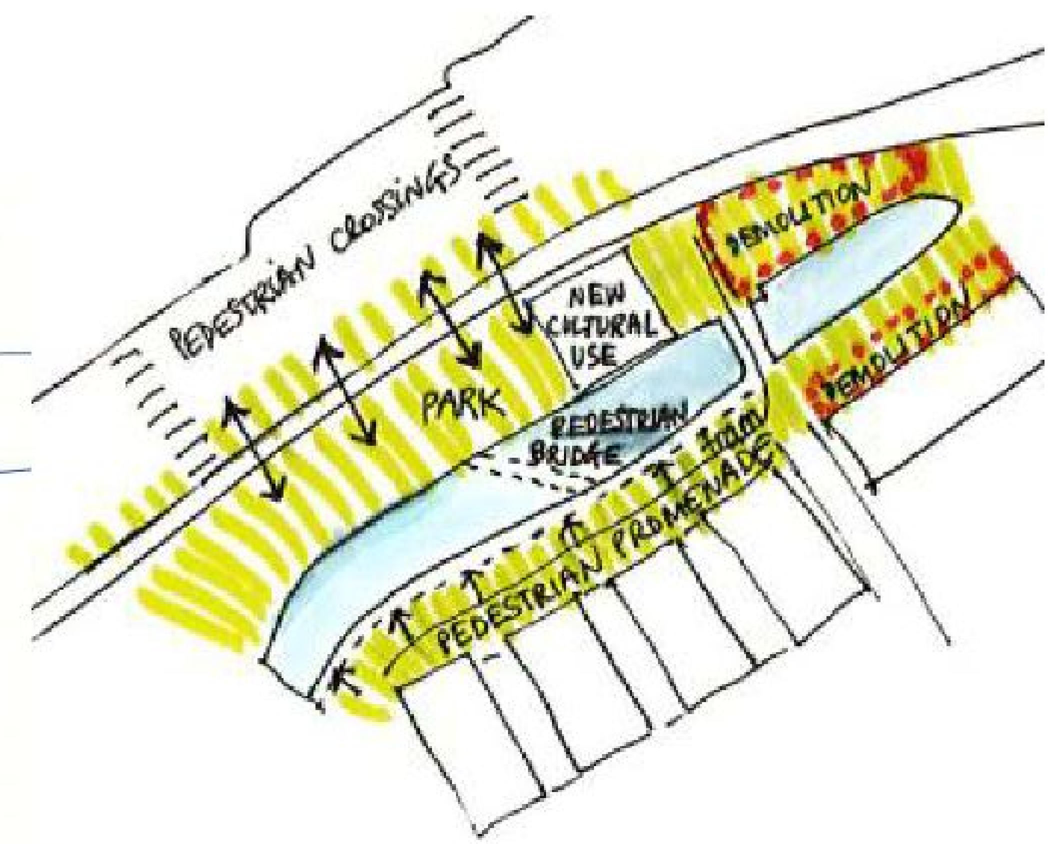
CROSS SECTION



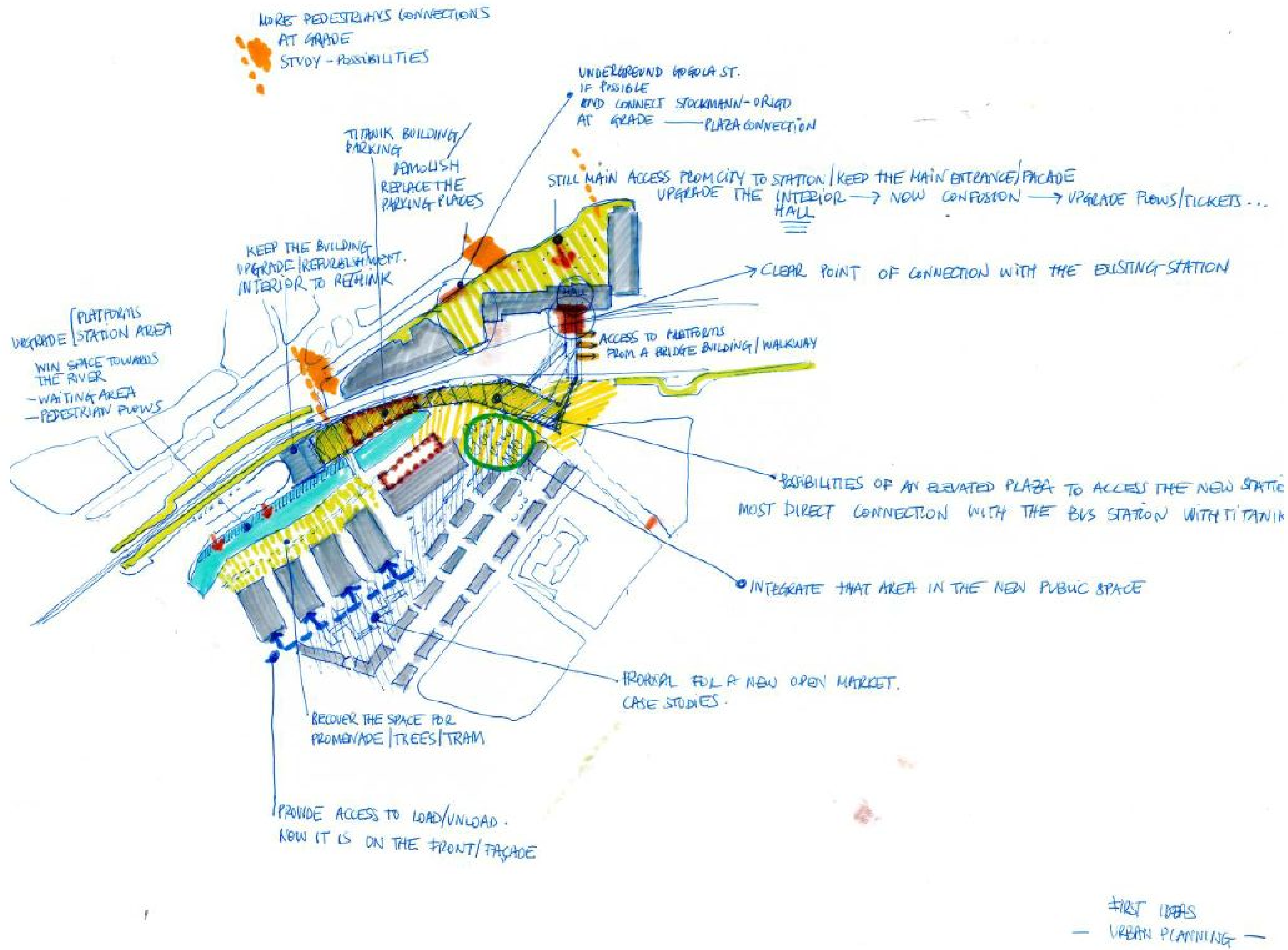
4. DESIGN PROCESS SKETCHES

Design Process Sketches





Design Process Sketches



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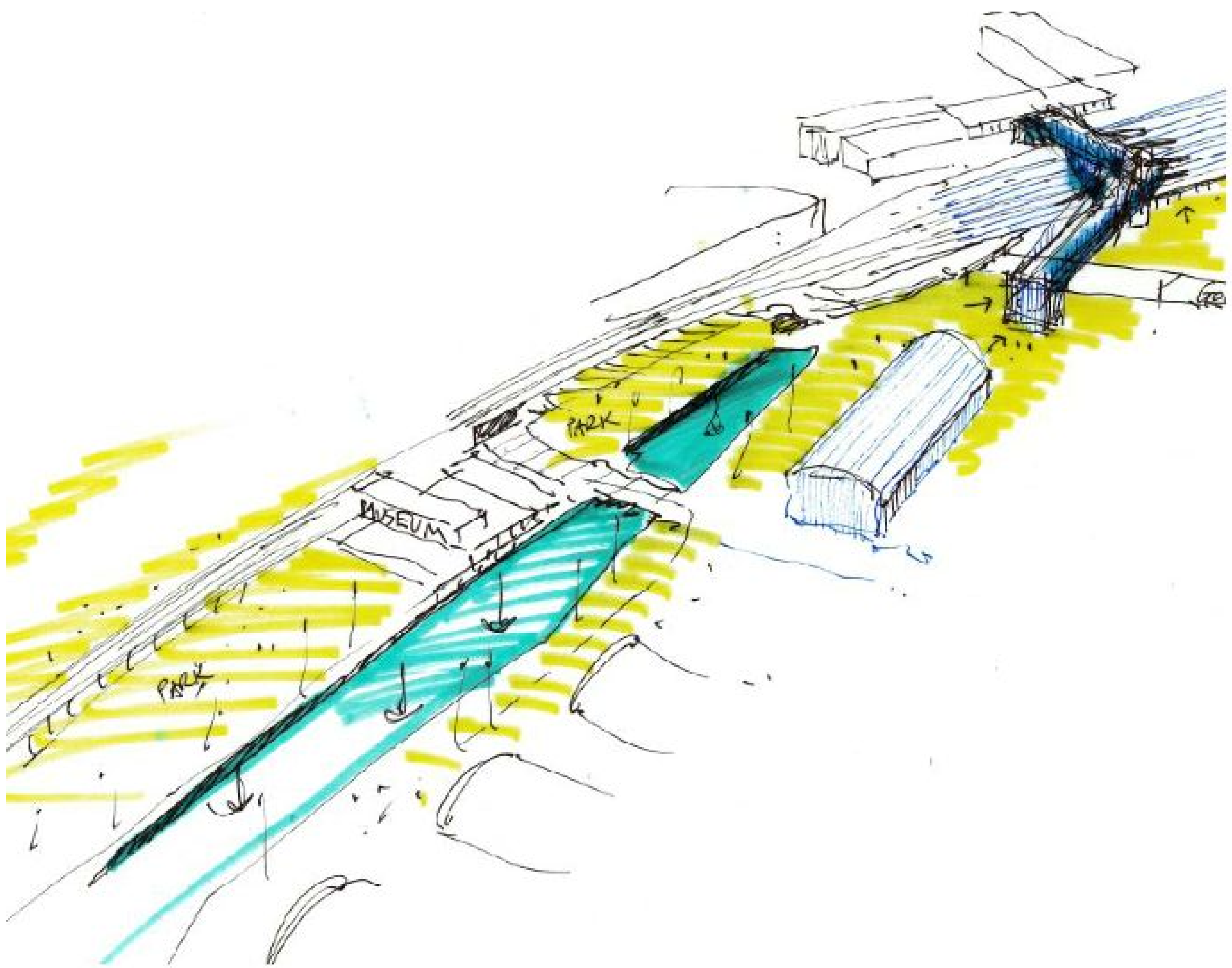
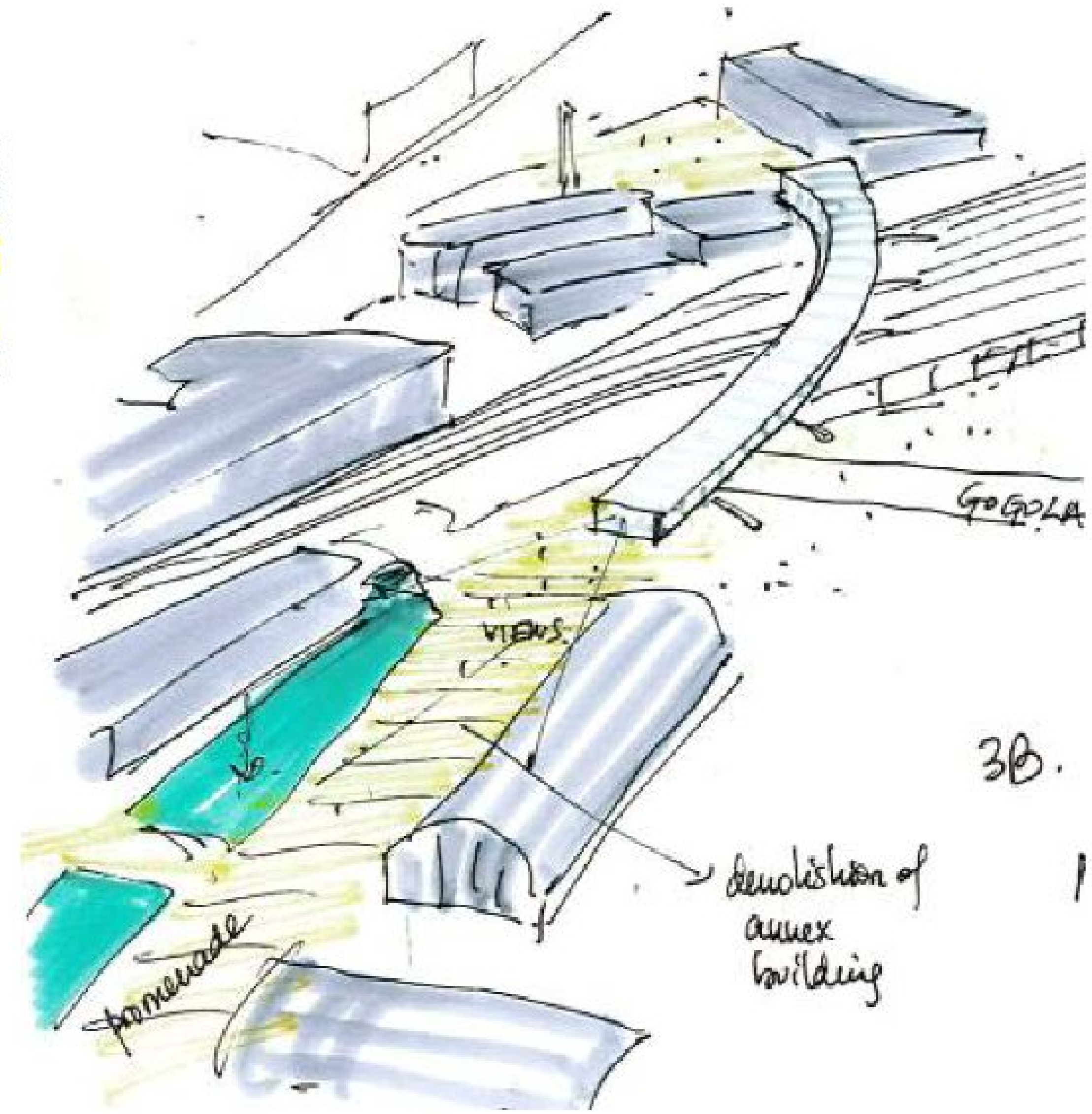
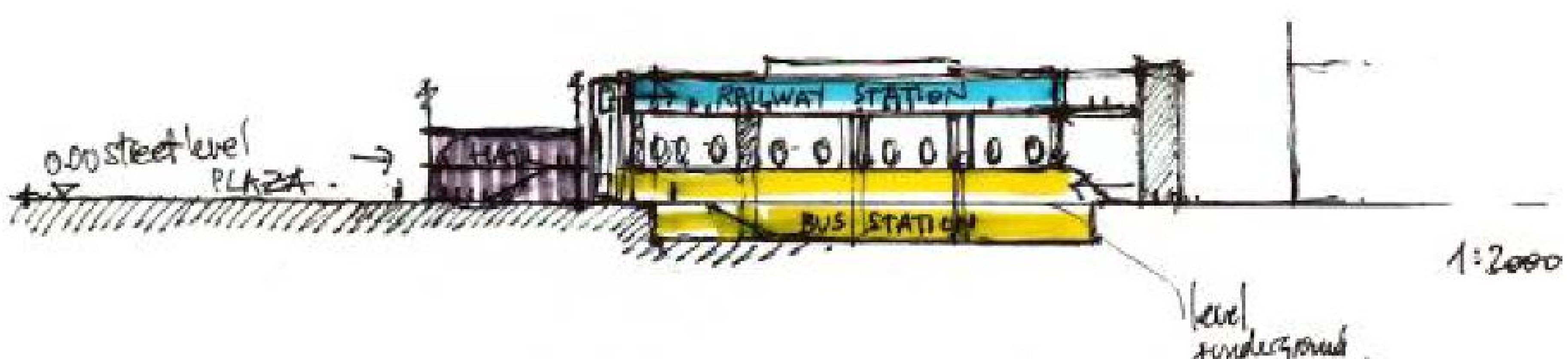
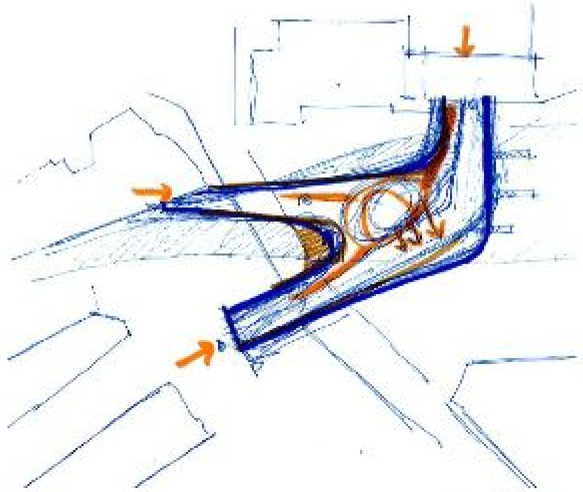
Design Process Sketches

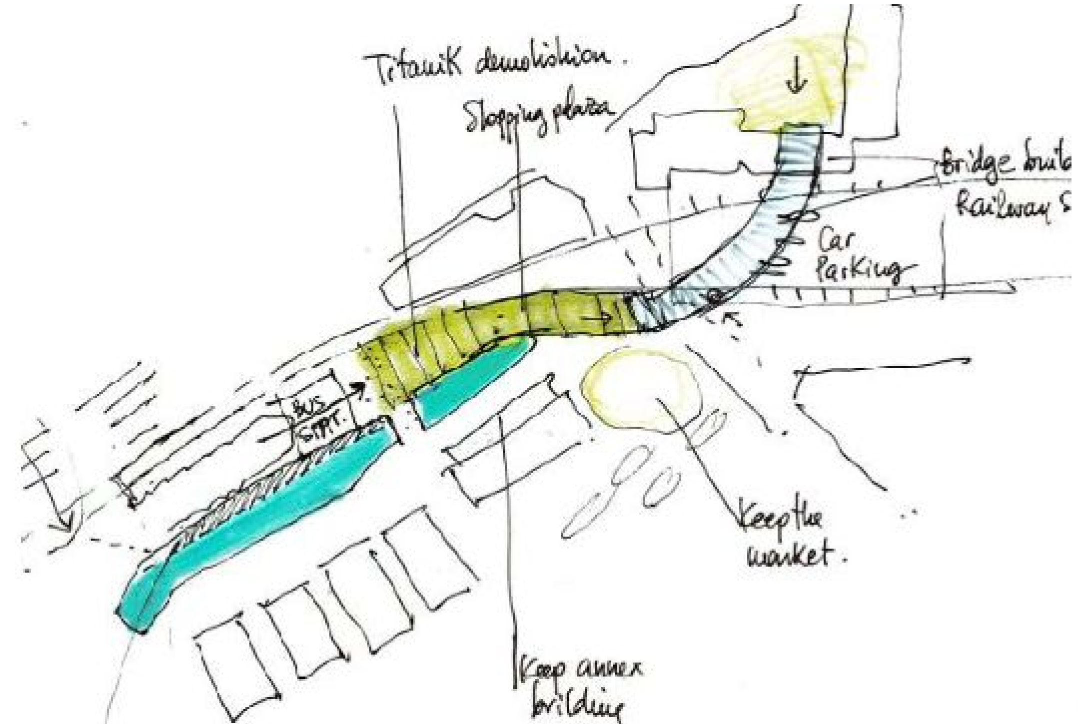


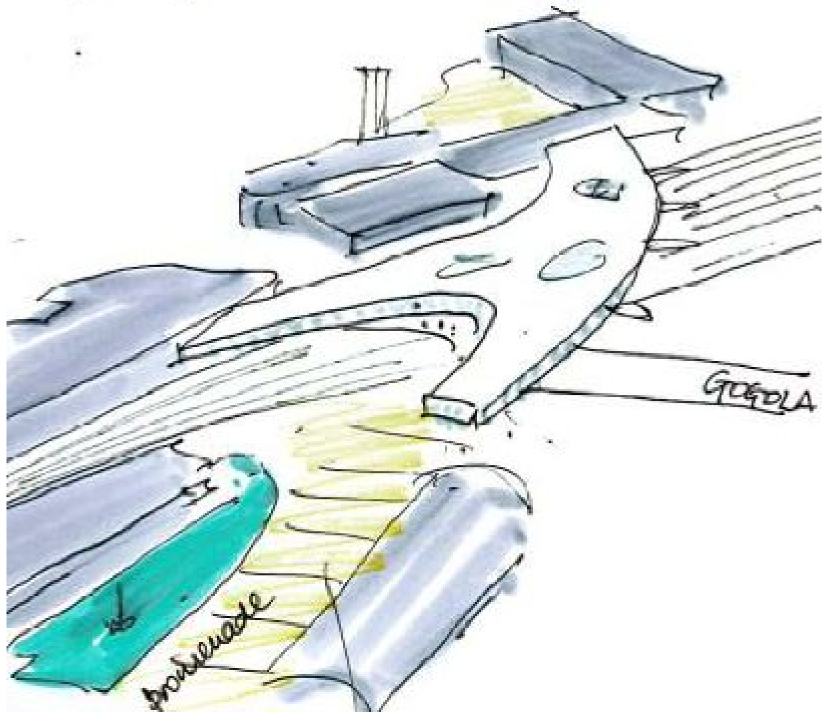


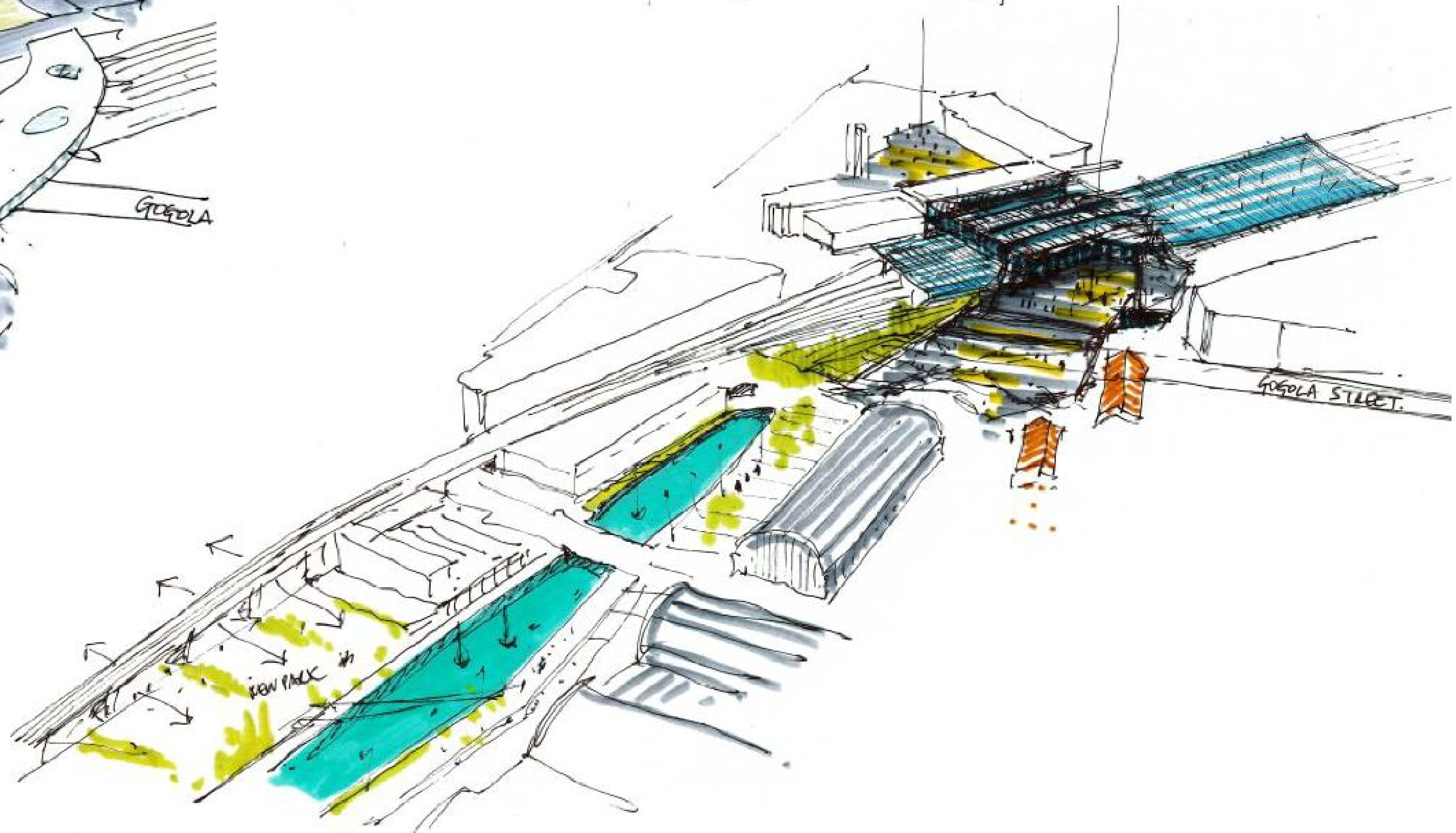


Design Process Sketches





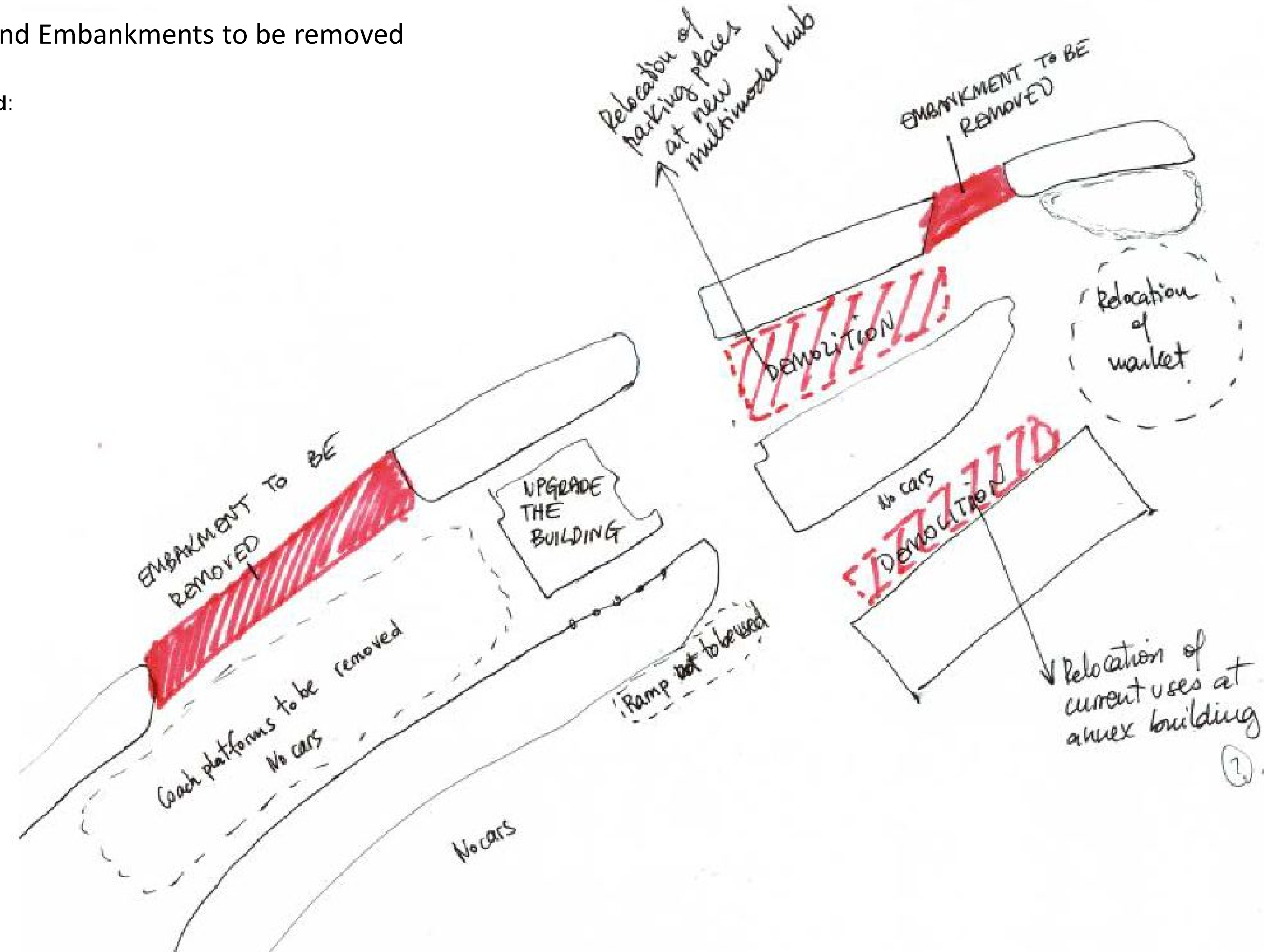


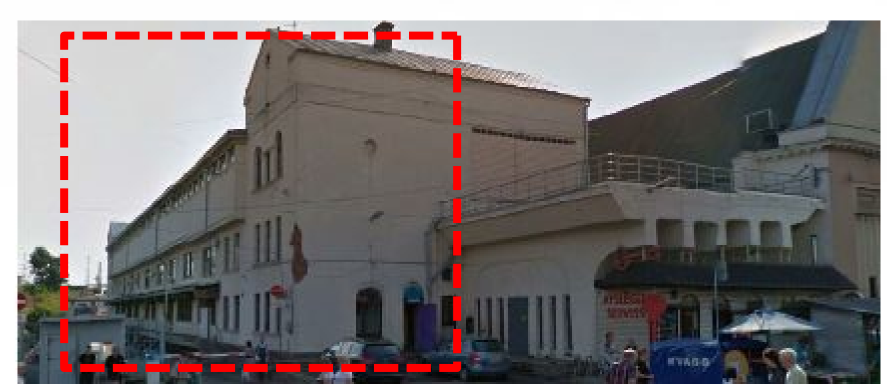


Building Demolitions and Embankments to be removed

Embankments to be removed:
To access from the OLD CITY
To access STOCKMANN

Buildings to be demolished:
Titaniks Car Parking
Annex building to Market

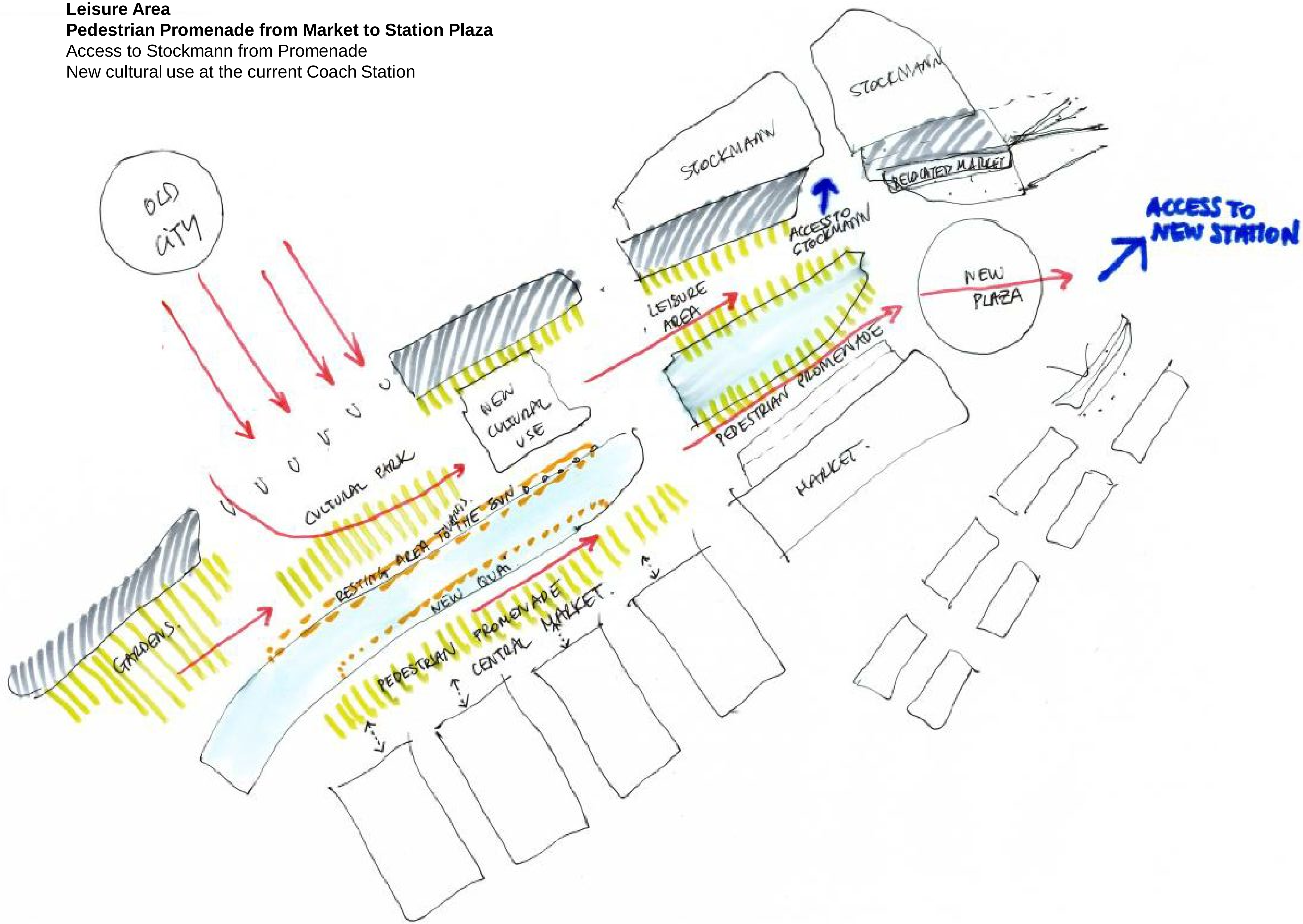




AECOM

Proposals for the Urban regeneration in the Study Area

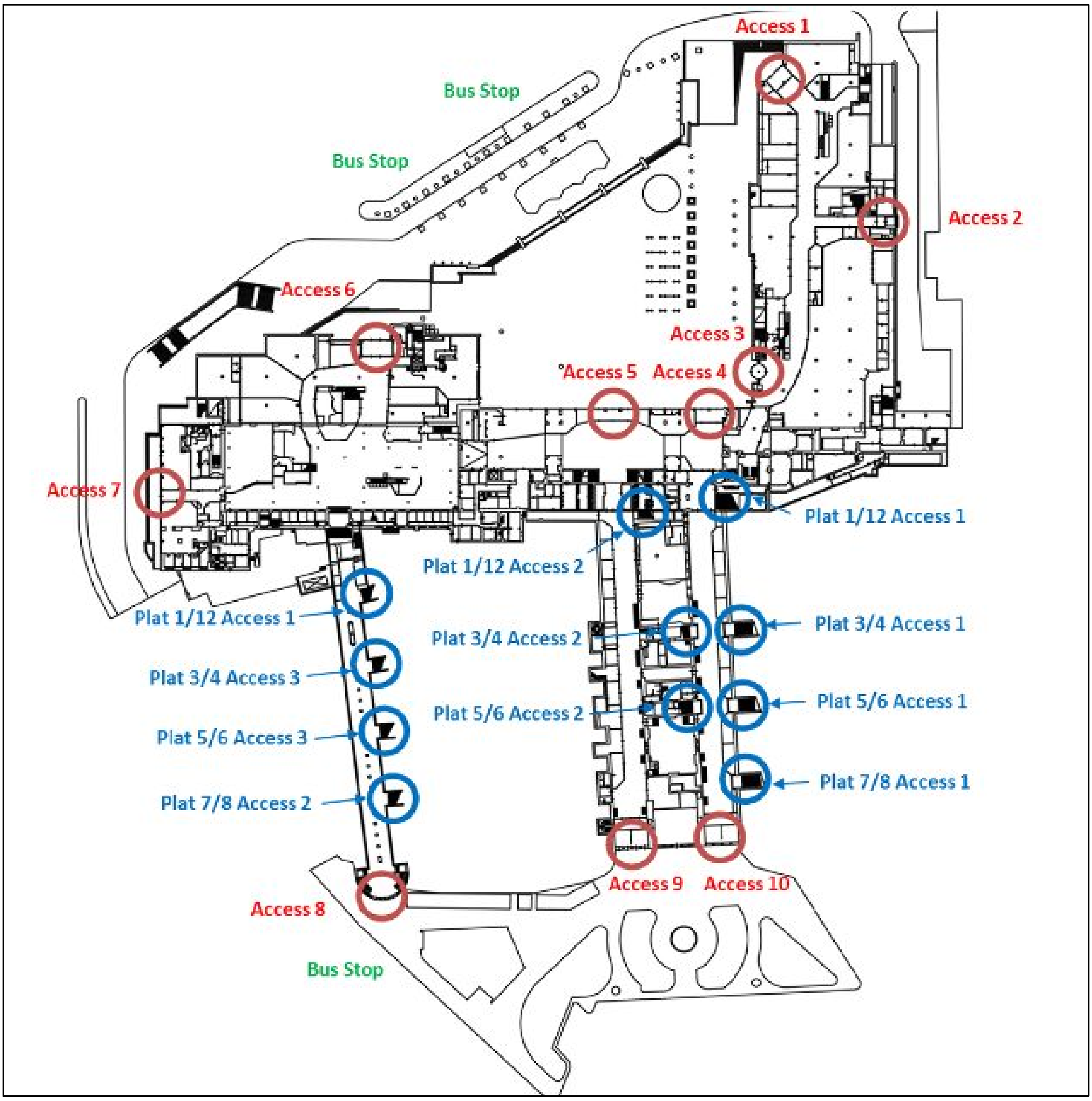
Connection with the OLD CITY through the embankment
Cultural Area
Leisure Area
Pedestrian Promenade from Market to Station Plaza
Access to Stockmann from Promenade
New cultural use at the current Coach Station



Appendix WP 2.3 – Base Model Outputs

Figure 1 below highlights each of the main entry/exit points to the station (red circle) and also the platforms (blue circle).

Figure 1 – Main Entry/Exit Locations (Station Model)



Source: AECOM

Table 2 – Table 6 below provide a comparison between the surveyed and modelled data as part of the model calibration/validation exercise to ensure the models are fit for purpose.

Table 1 –Station Access - AM Peak Hour Flow Comparison

Station Access	Observed Flow		Modelled Flow	
	Entry	Exit	Entry	Exit
Access 1	272	801	319	883
Access 2	7	7	7	8
Access 3	82	216	84	234
Access 4	321	787	325	831
Access 5	201	539	199	534
Access 6	357	579	390	583
Access 7	33	34	39	46
Access 8	262	535	275	474
Access 9	229	239	255	294
Access 10	527	1231	611	1300

Source: AECOM

Table 2 –Platform Access - AM Peak Hour Flow Comparison

Platform Access	Observed Flow		Modelled Flow	
	To Platform	From Platform	To Platform	From Platform
Platform 1/12 Access 1	0	299	10	298
Platform 1/12 Access 2	0	43	0	43
Platform 1/2 Escalator	0	85	0	96
Platform 3/4 Access 1	119	319	111	306
Platform 3/4 Access 2	119	319	106	332
Platform 3/4 Access 3	60	71	84	75
Platform 5/6 Access 1	93	767	90	768
Platform 5/6 Access 2	93	767	83	768
Platform 5/6 Access 3	47	170	64	172
Platform 7/8 Access 1	144	518	149	525
Platform 7/8 Access 2	62	58	58	51

Source: AECOM

Table 3 –Platform Boarding/Alighting Volume - AM Peak Hour Flow Comparison

Platform Demand	Calculated Demand		Modelled Demand	
	Board	Alight	Board	Alight
Platform 3	149	339	147	340
Platform 4	149	370	149	370
Platform 5	122	443	120	443
Platform 6	111	1261	111	1261
Platform 7	91	135	91	135
Platform 8	115	440	115	440
Platform 11	0	296	0	296
Platform 12	0	131	0	131

Source: AECOM

Table 4 –Station Access - PM Peak Hour Flow Comparison

Station Access	Observed Flow		Modelled Flow	
	Entry	Exit	Entry	Exit
Access 1	865	727	922	781
Access 2	12	12	12	13
Access 3	246	209	260	225
Access 4	535	420	541	434
Access 5	433	349	424	356
Access 6	636	581	659	655
Access 7	83	82	94	92
Access 8	403	335	409	317
Access 9	460	458	485	474
Access 10	1078	907	1144	954

Source: AECOM

Table 5 –Platform Access - PM Peak Hour Flow Comparison

Platform Access	Observed Flow		Modelled Flow	
	To Platform	From Platform	To Platform	From Platform
Platform 1/12 Access 1	123	167	129	162
Platform 1/12 Access 2	27	24	28	23
Platform 1/2 Escalator	0	48	0	62
Platform 3/4 Access 1	234	153	243	163
Platform 3/4 Access 2	234	153	224	135
Platform 3/4 Access 3	117	34	112	41
Platform 5/6 Access 1	238	145	253	159
Platform 5/6 Access 2	238	145	222	144
Platform 5/6 Access 3	119	32	116	22
Platform 7/8 Access 1	526	374	526	376
Platform 7/8 Access 2	131	42	124	41

Source: AECOM

Table 6–Platform Boarding/Alighting Volume - PM Peak Hour Flow Comparison

Platform Demand	Calculated Demand		Modelled Demand	
	Board	Alight	Board	Alight
Platform 3	146	114	146	114
Platform 4	439	225	432	224
Platform 5	305	213	302	214
Platform 6	290	110	288	110
Platform 7	512	345	504	345
Platform 8	145	71	145	71
Platform 10	150	114	150	115
Platform 11	0	125	0	125

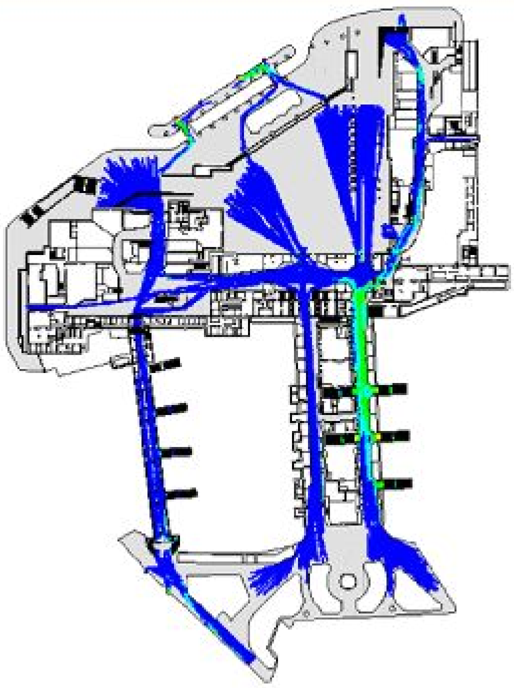
Source: AECOM

It can be seen that both the AM and PM modelled flows compare well with those surveyed therefore, the 2015 'Base' models are considered fit for purpose.

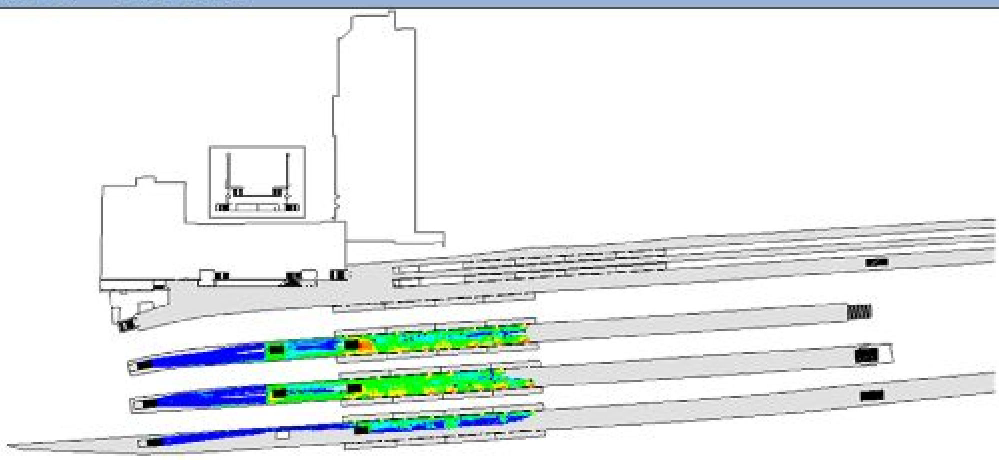
Figure 8 provides the Cumulative Mean Density plot for the AM peak 15 minute period.

Figure 8 – AM Peak 15 Minute Cumulative Mean Density Plot

Ground Floor Level – 'Base' 2015



Platform Level – 'Base' 2015



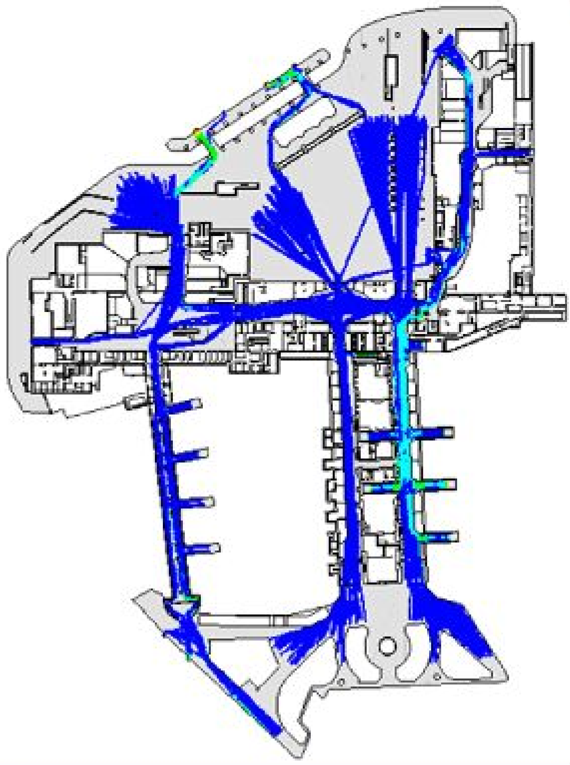
Source: AECOM

During the AM peak approximately 40% of the station demand is associated with through trips connecting the North and South sides of the station. This is non-rail demand which does not originate or destinate at the platforms. In addition, the majority of the rail passenger demand is alighting passengers which equates to approximately 80% of the overall rail demand, this was confirmed during the AECOM site visit.

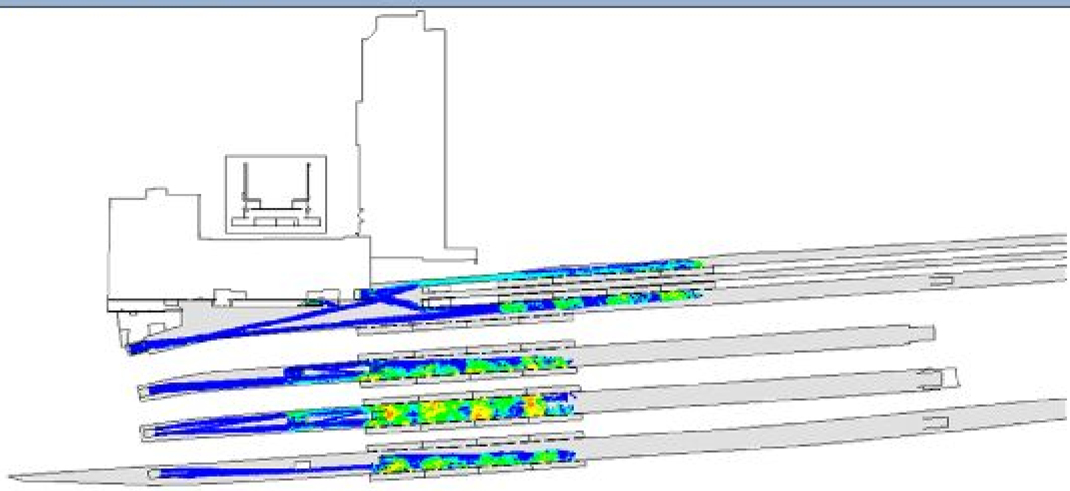
Figure 9 provides the Cumulative Mean Density plot for the PM peak 15 minute period.

Figure 9 – PM Peak 15 Minute Cumulative Mean Density Plot

Ground Floor Level – 'Base' 2015



Platform Level – 'Base' 2015



Source: AECOM

During the PM peak approximately 60% of the station demand is associated with through trips. There is a notable increase in through trips when compared to the AM given that all retail units are open during the PM period which attracts additional non-rail demand.

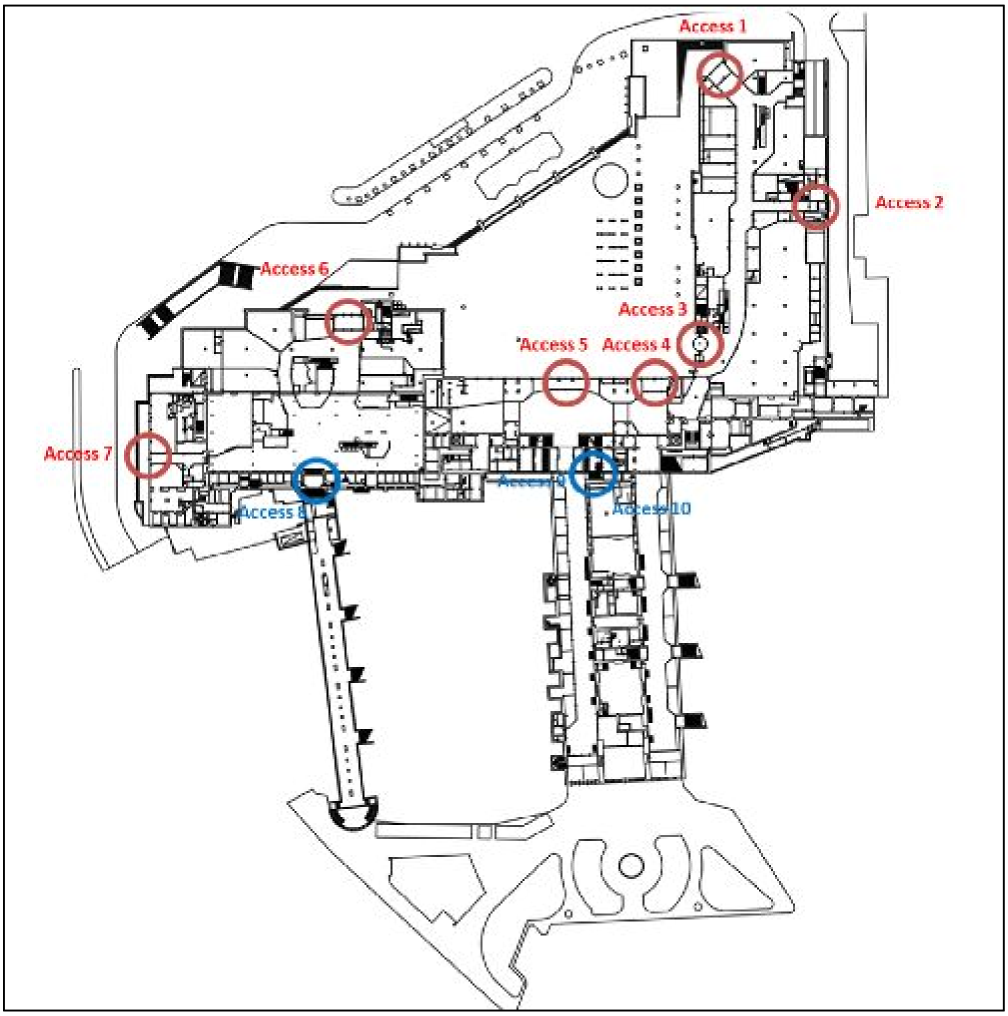
In terms of rail demand there is approximately a 60/40 split between boarding and alighting passengers, this split was confirmed on site during the AECOM modelling team visit.

1.1.1 'Base' 2015 Origo Model Outputs

The 'Base' 2015 Origo model was developed using the same data sources as the 'Base' 2015 Station model.

Figure 10 below highlights each of the main entry/exit points to the station (red circle) and also the platforms (blue circle). The platforms and the tunnels leading to them were not modelled as part of the Origo Shopping Centre Model. The shopping centre model is for the PM Peak from 17:00 – 18:00.

Figure 10 – Main Entry/Exit Locations (Shopping Centre Model)



Source: AECOM

Table 11 below provides a comparison between the surveyed and modelled data as part of the model calibration/validation exercise to ensure the model is fit for purpose.

Table 11 – Station Access- PM Peak Hour Flow Comparison

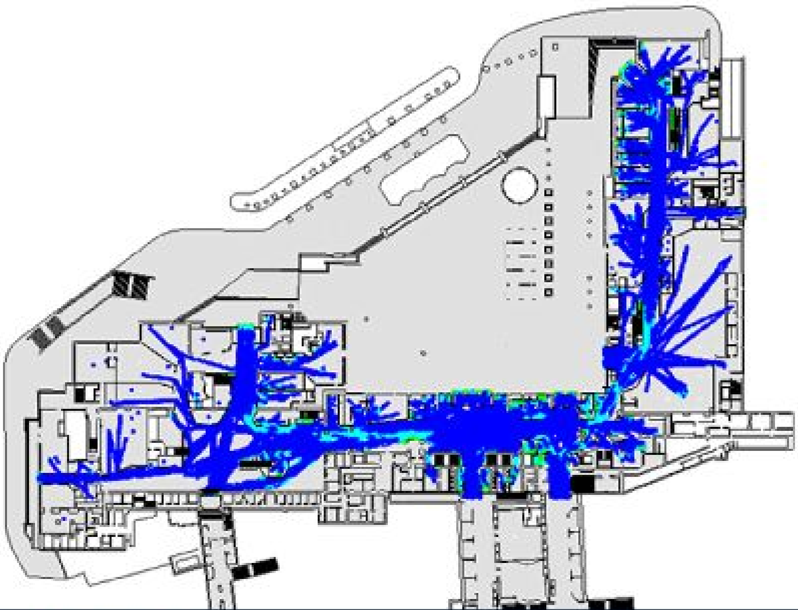
Station Access	Observed Flow		Modelled Flow	
	Entry	Exit	Entry	Exit
Access 1	864	743	876	784
Access 2	11	11	12	8
Access 3	247	212	240	205
Access 4	527	441	532	474
Access 5	412	364	413	326
Access 6	628	575	640	593
Access 7	83	82	85	75
Access 8	196	459	201	475
Access 9	521	945	537	937
Access 10	1403	1060	1421	1080

Source: AECOM

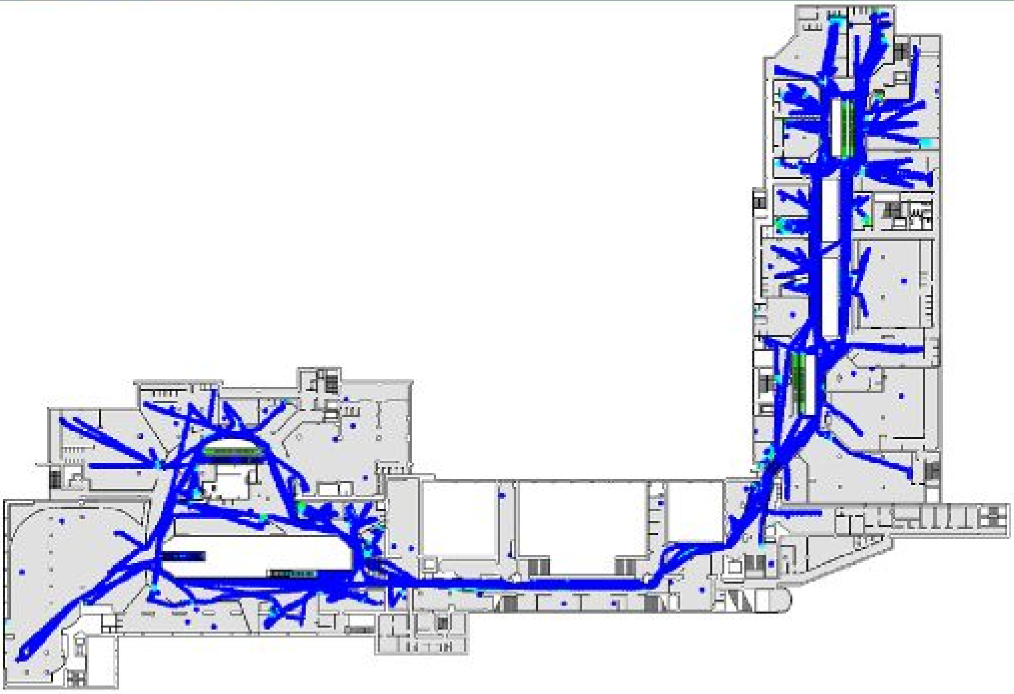
Figure 12 provides the Cumulative Mean Density plot for the PM peak 15 minute period.

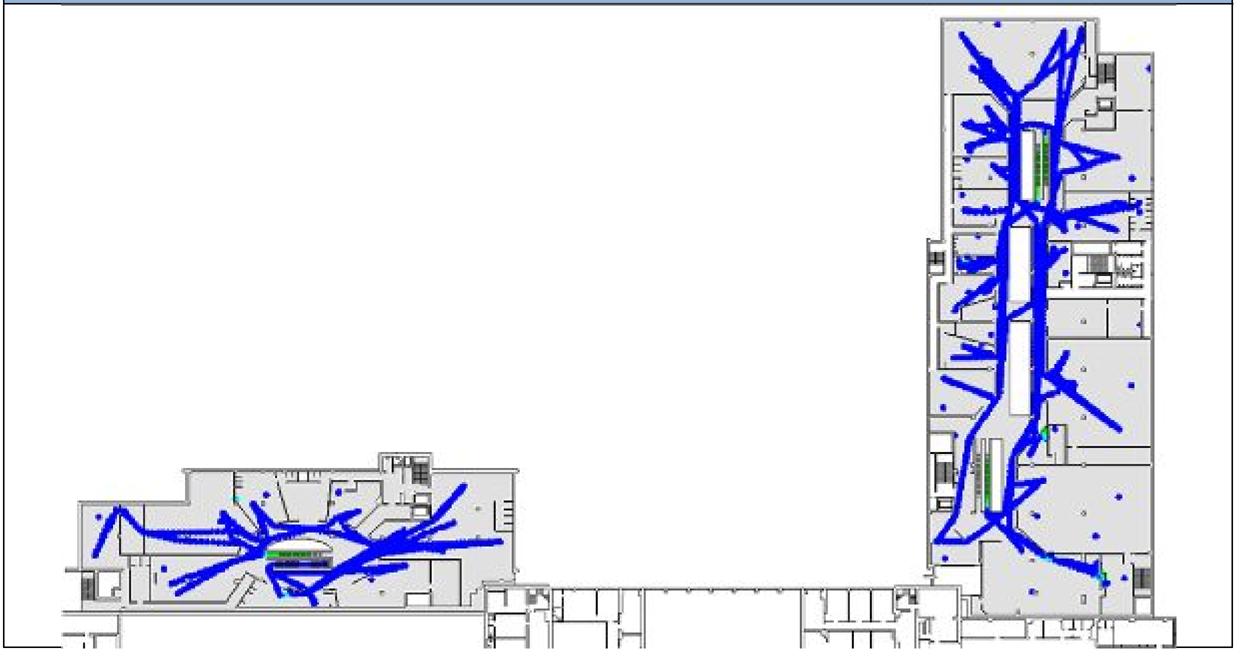
Figure 12 – PM Peak 15 Minute Cumulative Mean Density Plot (Origo Shopping Centre)

Ground Floor Level – 'Base' 2015



First Floor Level – 'Base' 2015



Second Floor Level – 'Base' 2015


Source: AECOM

As can be seen from the above CMD maps, the shopping centre mainly experiences LoS A with generally low levels of crowding throughout the evening peak hour.

Appendix WP 2.4 – AIMSUN Development Report

Technical Note

Project:	**RPTH**	**Job No:**	**60437212**
Subject:	**Aimsun Model Development and Forecasting Report**		
Prepared by:	**Ronnie Paulus**	**Date:**	**11 December 2015**
Checked/Approved by:	**Antony Kivistik**	**Date:**	**11 December 2015**

1 Introduction

The first stage of the microsimulation modelling process was to build and validate a 'Base' (existing scenario) model of the study area.
The second stage of the modelling process was to update the model to for a future year (ie 2050) 'Do Minimum' model, and to test 'Do Something' options.

This technical note outlines:

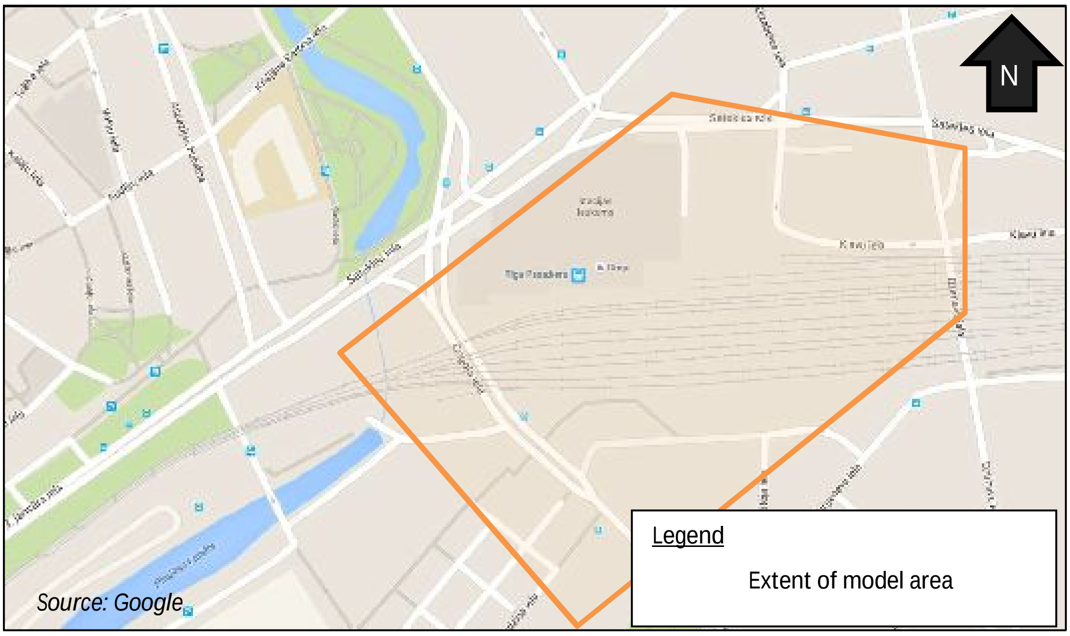
- the input data and methodology used to build and validate the 'Base' model;
- presents the 'Base' model validation statistics;
- the input data for the 2050 'Do Minimum' model;
- the input data for the 2050 'Do Something' model; and
- a comparison of results of the 2050 'Do Minimum' and 'Do Something' models

2 'Base' Model

2.1.1 Extent of Base Model Area

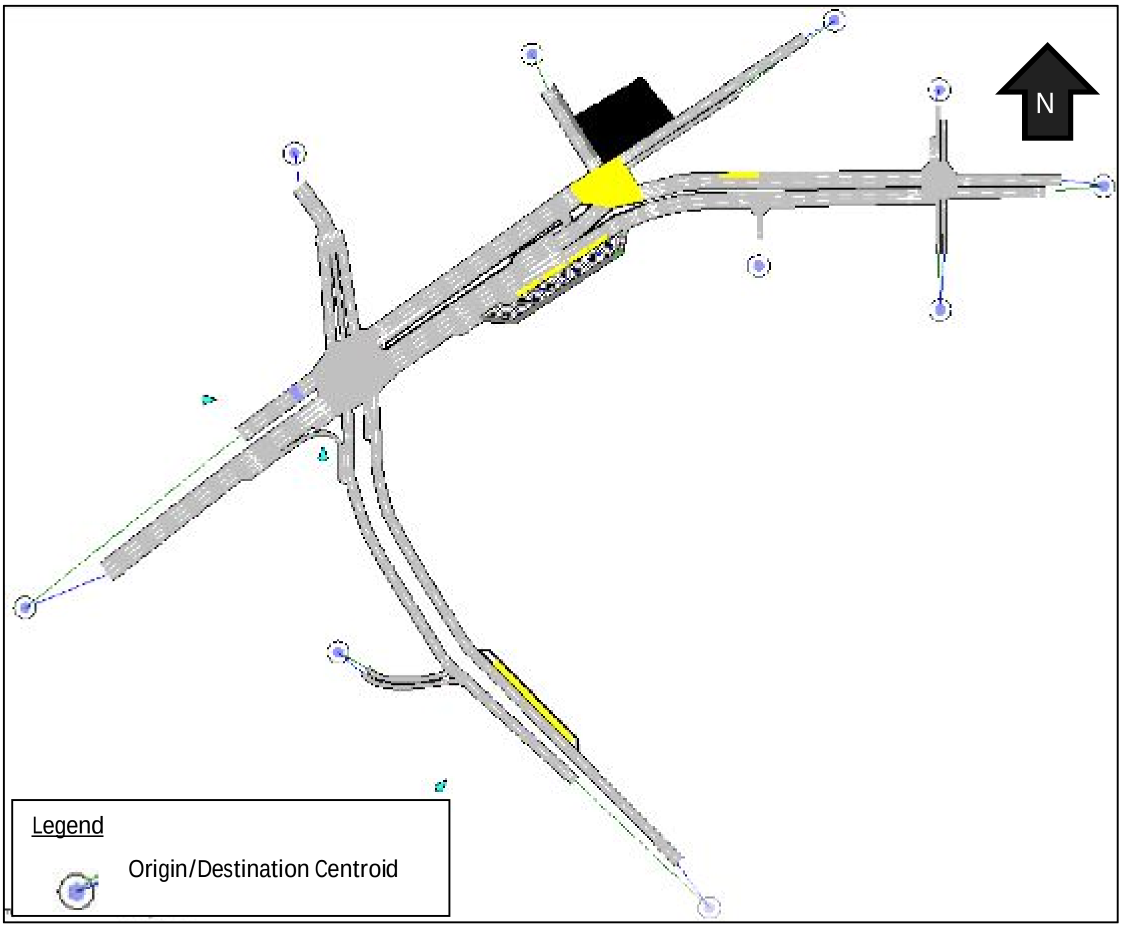
The extent of the model area is 'adjacent to the Station/Origo' and is indicated in Figure 2-1.

Figure 2-1: Site Locality



This network representation of the Base Model is shown in Figure 2-2.

Figure 2-2: Modelled Network Representation



The network representation in Figure 2-2 demonstrates the origin and destination centroids of all vehicle trips used in the model.

2.1.2 Data

Traffic count surveys were undertaken in September 2015 by Solvers SIA using video recording technology. Traffic count data was extracted from the recorded video footage and was classified in terms of cars, buses and heavy vehicles. The traffic count data for the following intersection data was used in this model:

- Gogola iela / Satekles iela / Raina bulvaris
- Satekles iela / Marijas iela / Merkeja iela
- Satekles iela / Elizabetes iela

The recorded video footage also provided anecdotal maximum queue lengths on some of the intersection legs.

2.1.3 Model Period

The peak periods have been determined from the traffic count data. These were determined to be:

- **Weekday AM: 07:00 - 08:00**
- **Weekday PM: 17:00 – 18:00**

As a result, the 2015 'Base' model has been developed for these time periods.

2.1.4 Network Coding

A number of data sources were used to enable the building of the model network. These sources included:

- **Orthophotos of the network (Google Earth);**
- **CAD drawings of the site layout; and**
- **On site observations of traffic behaviour and speeds.**

2.1.5 Road Links

The primary data source used to build the base road network was the CAD site layout drawings, supplemented by Google Earth orthophotos. This provided intersection and road geometry and locations.

2.1.6 Link Speeds

Link speed limits were coded as per the actual speed limits surrounding the site in km/h.

2.1.7 Intersections

Two intersections were modelled as signalised intersections. The cycle time and phasing's for these intersections were modelled as per those operating during the traffic count surveys. The remainder of the intersections were modelled as priority intersections, with priority applied as per on-site observed operations.

2.1.8 Demand Profiles

The model comprises three user class traffic states, as per the data obtained from the traffic count surveys. These are:

- **Car traffic state (passenger cars)**
- **Heavy vehicle traffic state (heavy vehicles)**

An additional traffic state was developed for taxi's which specifically uses the taxi rank proximate to the entrance of Origo on Satekles.
Public transport routes were coded into the network based on their timetabled frequency.

2.1.9 'Base' Model Settings

Version and Seed

The model was built using Aimsun version 8.0.5. It is essential that the model is run using this version to maintain consistency in output.

The model has been set to simulate on a random seed. This essentially means that each run of the modelled time period is unique to effectively represent the random nature of journey start time (i.e. each seed releases vehicles into the network at random intervals – but always within the matrix profile settings).

Duration

The model runs for a simulation of one hour in the AM (0800-0900) and one hour in the PM (1700-1800). A 15 minute model warm up period was used to populate the model prior to the scenario commencing.

3 'Base' Model Calibration and Validation

The calibration exercise involved running the Aimsun model simulation, examining the modelled vehicle travel behaviour throughout the network and making small adjustments until the simulated behaviour closely matched the actual observed.
Key indicators used for calibration included:

- **vehicle behaviour at the study junctions;**
- **junction turning counts;**
- **stopline positioning; and**
- **observed queue lengths versus observed.**

Modelled junctions have been validated consistent with the UK Design Manual for Roads and Bridges (DMRB) criteria which requires that at least 85% of turning count/link flow differences, between observed and modelled, should have a GEH of less than 5.
The model was run for ten replications for both the AM and PM scenarios. Each replication used a different random seed numbers. The average of these replications was extracted to calculate the GEH statistics.
The average model results successfully satisfy the above criteria for all modelled periods. A detailed breakdown of the comparison is demonstrated in Figures 3-1 and 3-2 for the AM and PM peak periods respectively.

Figure 3-1: AM Model Volumes and GEH

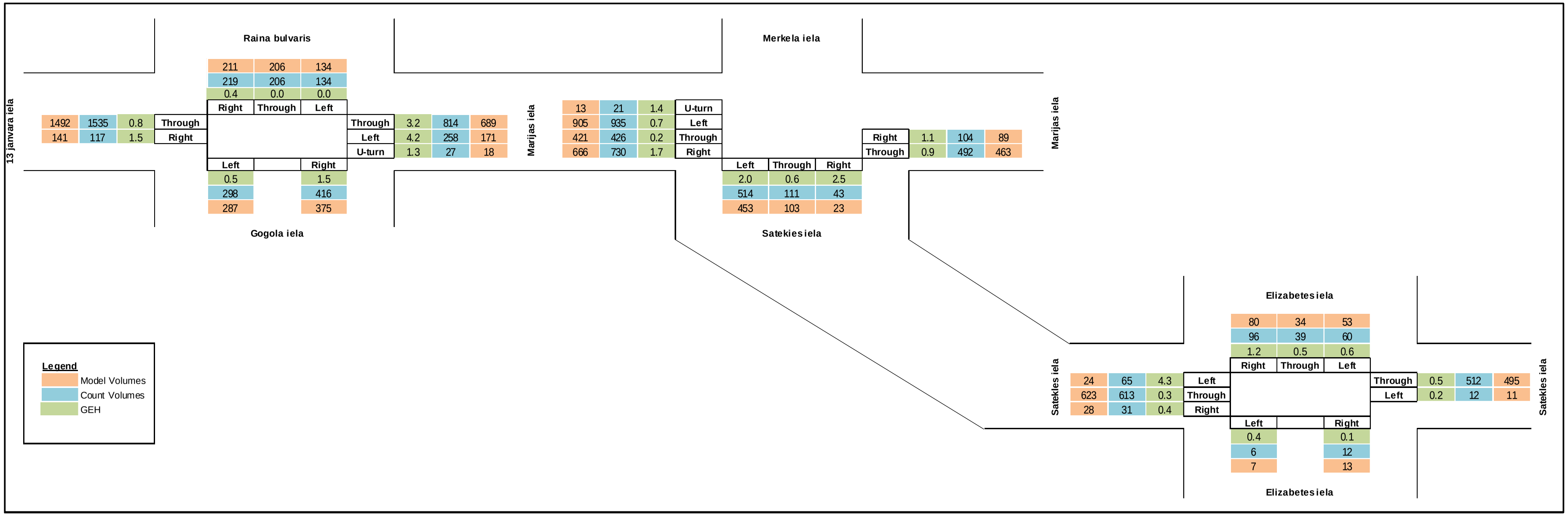
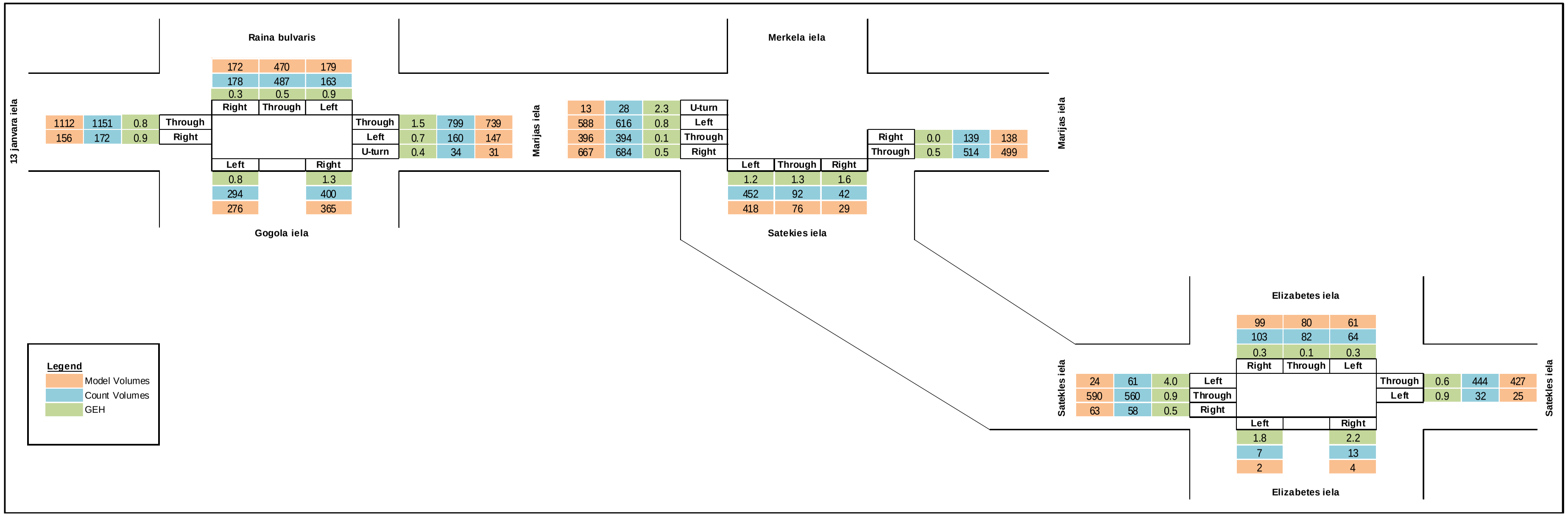


Figure 3-2: PM Model Volumes and GEH



4 'Do Minimum' Model

4.1.1 Extent of 'Do Minimum' Model Area

The extent of the model area is identical to the base mode, and is shown in Figure 2.1. Signal timings have remained constant with the 'Base' model.

4.1.2 Model Period

Consistent with the 'Base' model, the 'Do Minimum' peak periods have been determined from the traffic count data. These were determined to be:

- **Weekday AM: 07:00 - 08:00**
- **Weekday PM: 17:00 – 18:00**

As a result, the 2050 'Do Minimum' model has been developed for these time periods.

4.1.3 Demand Profiles

The model comprises of the traffic demand states used in the 'Base' model, to which a 42.65% growth rate has been applied to account for the growth in background traffic volumes between 2015 and 2050. These are consistent with the traffic flow volumes with Chapter 7 Appendix WP 1.5 & 1.6 2.

HGV proportions have been assumed constant with those present in 2015 base year traffic count data, and bus frequency is assumed to remain unchanged between 2015 and 2050.

4.1.4 Intersections

Two intersections were modelled as signalised intersections. The cycle time and phasing's for these intersections were modelled as per those operating during the traffic count surveys. The remainder of the intersections were modelled as priority intersections, with priority applied as per on-site observed operations.

4.1.5 Duration

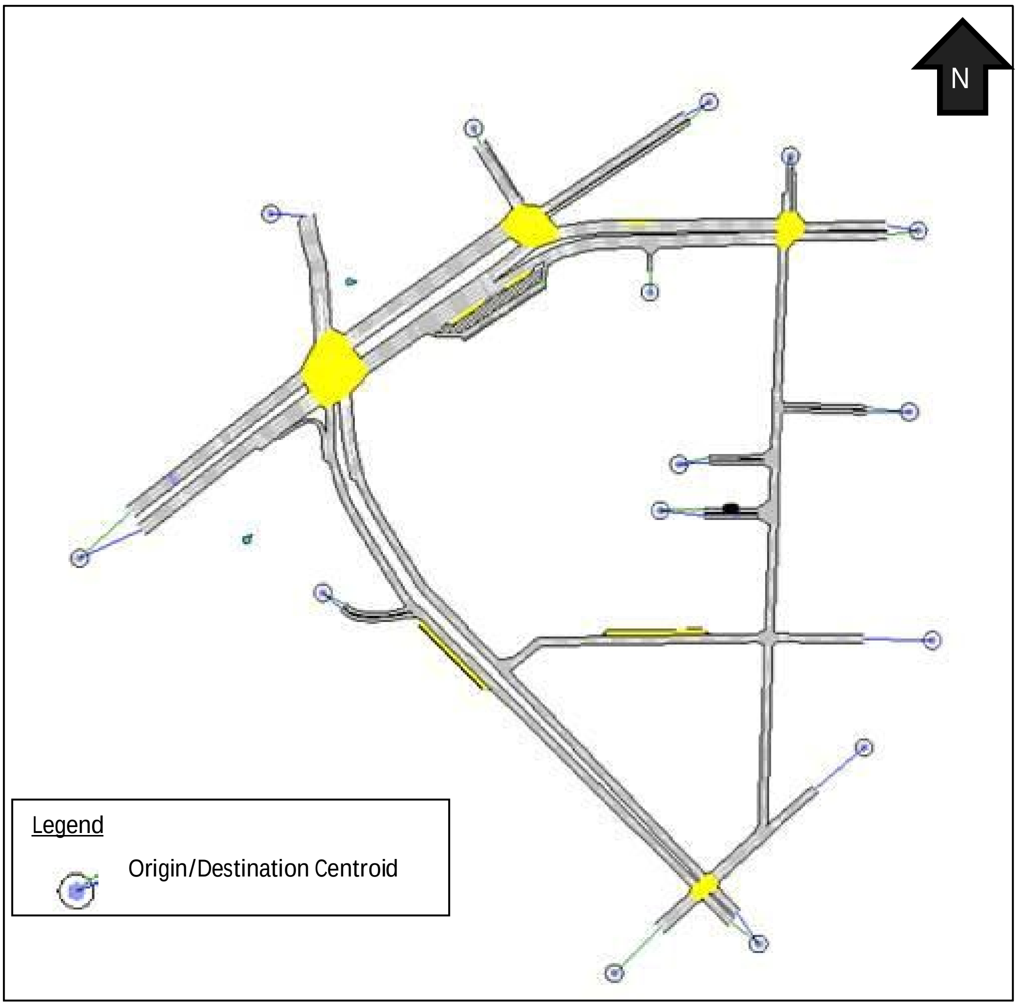
The model runs for a simulation of one hour in the AM (0800-0900) and one hour in the PM (1700-1800). A 15 minute model warm up period was used to populate the model prior to the scenario commencing.

5 'Do Something' Model

5.1.1 Extent of 'Do Something' Model Area

The 'Do Something' model has expanded on the 'Base' model to take into account changes in traffic flow surrounding the development. The model has been built to help determine the feasibility of the proposed roads network in 2050. This corresponds with the layout proposed as part of the 'preferred option' design. The extent of the network representation of the 'Do Something' Model is shown in Figure 5-1.

Figure 5-1: Modelled Network Representation



5.1.2 Model Period

Consistent with the 'Do Minimum' model, the 'Do Something' peak periods have been determined from the traffic count data. These were determined to be:

- **Weekday AM: 07:00 - 08:00**
- **Weekday PM: 17:00 – 18:00**

As a result, the 2050 'Do Something' model has been developed for these time periods.

5.1.3 Demand Profiles

The model comprises of the traffic demand states used in the 'Base' model, to which a growth rate have been applied to account for the growth in background traffic volumes, development and development related traffic between 2015 and 2050. Additionally, traffic flows were adjusted to account for the changes in the network, including redistribution of traffic due to the implementation of one way systems. These are consistent with the traffic flow volumes with Chapter 7 Appendix WP 1.5 & 1.6 2.

HGV proportions have been assumed constant with those present in 2015 base year traffic count data, and bus frequency is assumed consistent with the 'Do Something' development proposal.

5.1.4 Intersections

Three intersections were modelled as signalised intersections. LINSIG modelling has essentially been undertaken to optimise the fixed time signal plans in the 2050 'do something' scenario. Alterations to the existing signal timings are required due to the layout changes proposed as part of the RPTH design. The model assumed the following fixed cycle times during the AM and PM peak scenarios:

Table 5-1: 'Do Something' Modelled Cycle Times

Intersection	Cycle Time
Gogola / Raina / Satekeles	120 seconds
Satekeles / Marijas / Merkela	120 seconds
Elizabetes / Satekeles	90 seconds
Gogola / Turgeneva	105 seconds

The assumed staging for these intersections is shown in Figures 5-2 to 5-5 below.

Figure 5-2: Gogola / Raina / Satekeles

Stage 1 Stage 2 Stage 3 Stage 4 Stage 5

Figure 5-3: Satekeles / Marijas / Merkela

Stage 1 Stage 2 Stage 3

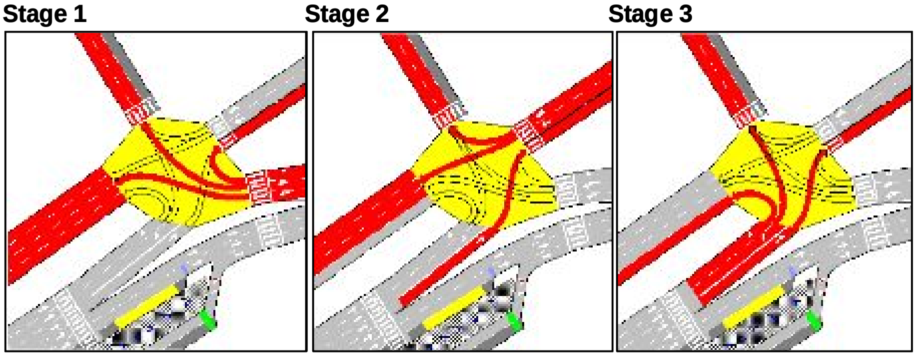


Figure 5-4: Elizabetes / Satekeles

Stage 1 **Stage 2** **Stage 3**

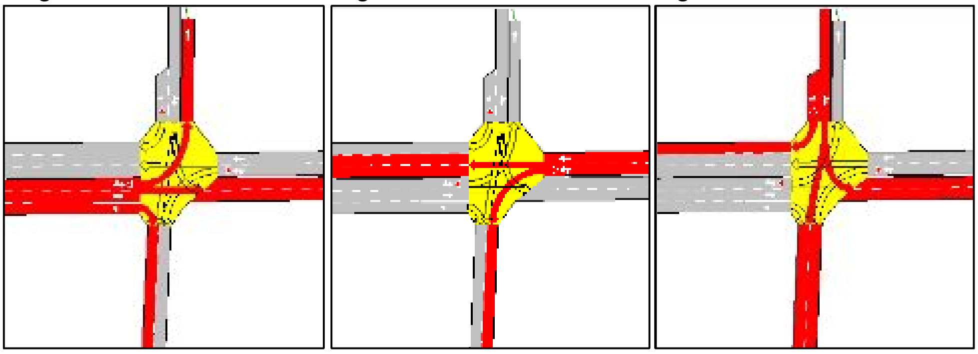
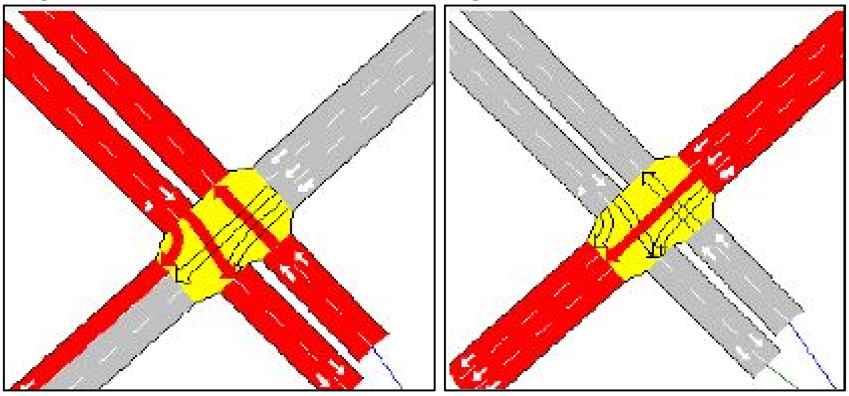


Figure 5-5: Gogola / Turgeneva

Stage 1 **Stage 2**



The remainder of the intersections were modelled as priority intersections, with priority applied as per existing on site conditions and expected future operations.

5.1.5 Duration

The model runs for a simulation of one hour in the AM (0800-0900) and one hour in the PM (1700-1800). A 15 minute model warm up period was used to populate the model prior to the scenario commencing.

6 'Do Minimum' vs 'Do Something' Model Comparison

Travel time results were extracted from Aimsun to determine the differences in the 'Do Minimum' And 'Do Something' options. The routes for which journey time were collected are shown in Figures 6-1 to 6-6.

Figure 6-1: West to East Route

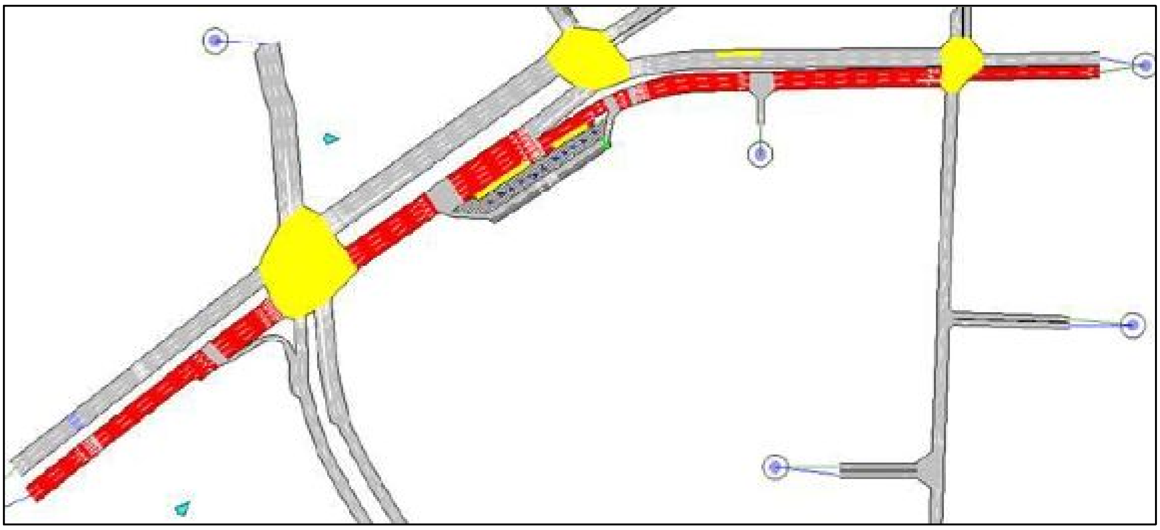


Figure 6-2: East to West Route

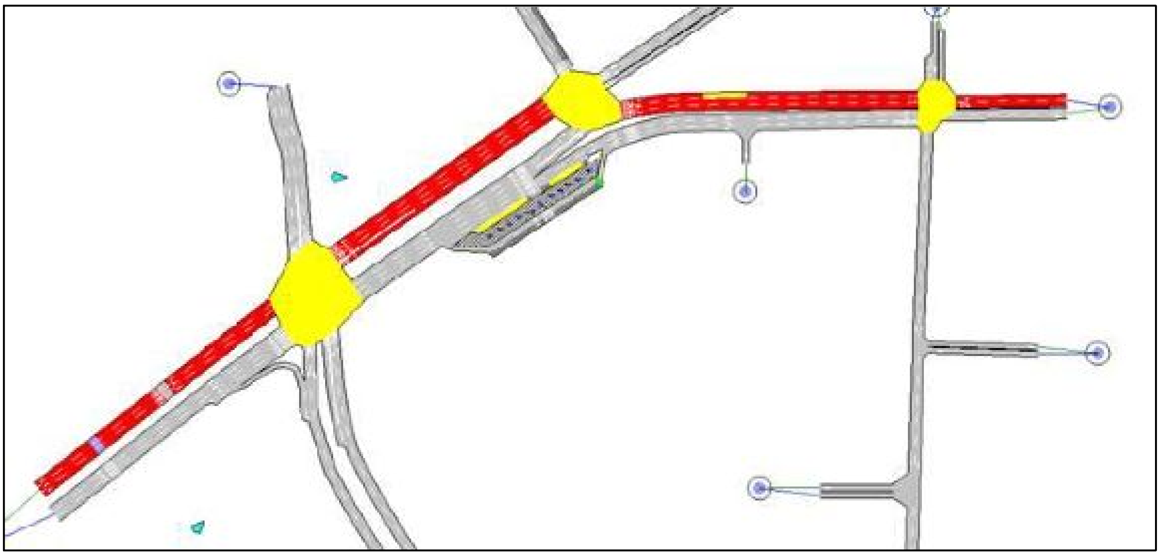


Figure 6-3: North to South Route

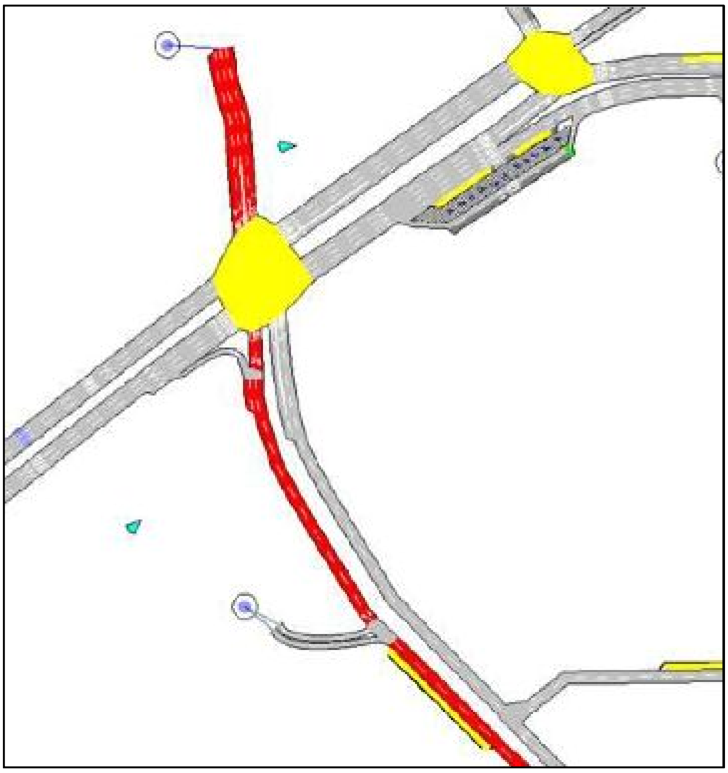


Figure 6-4: South to North Route

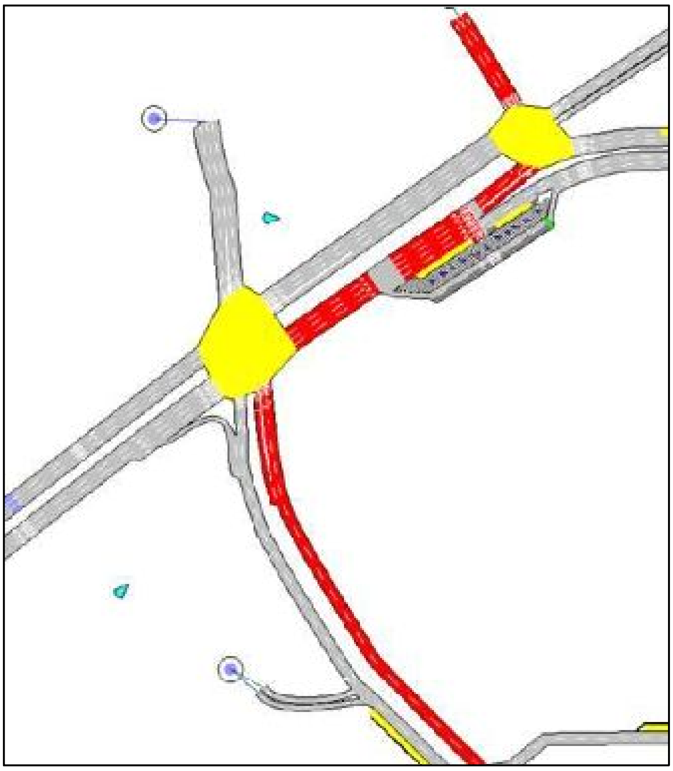


Figure 6-5: **South to North-East Route**

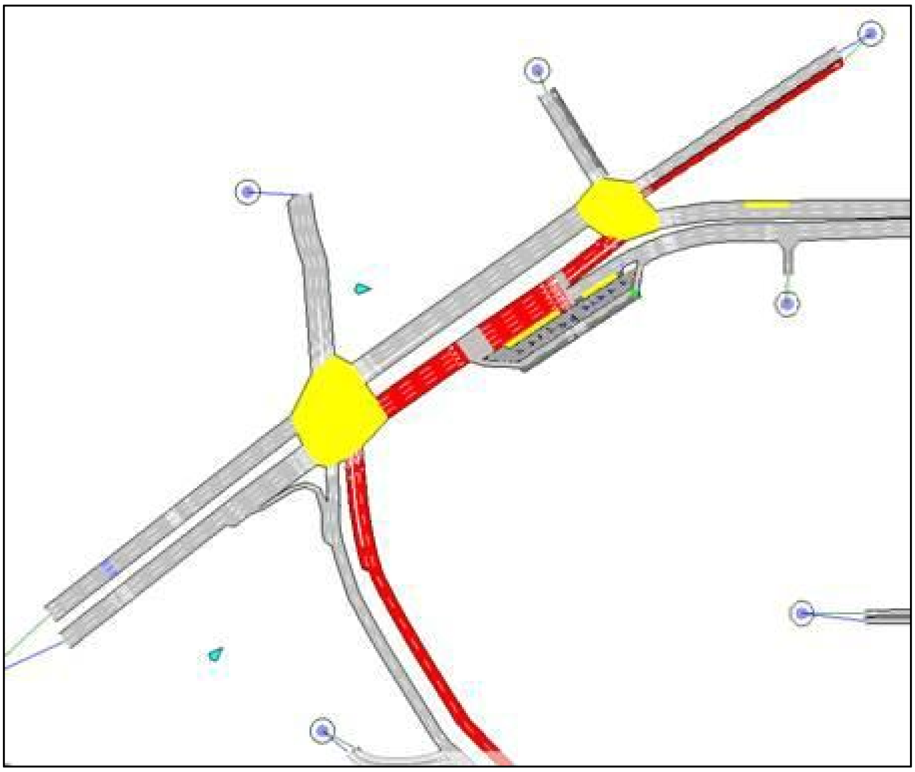
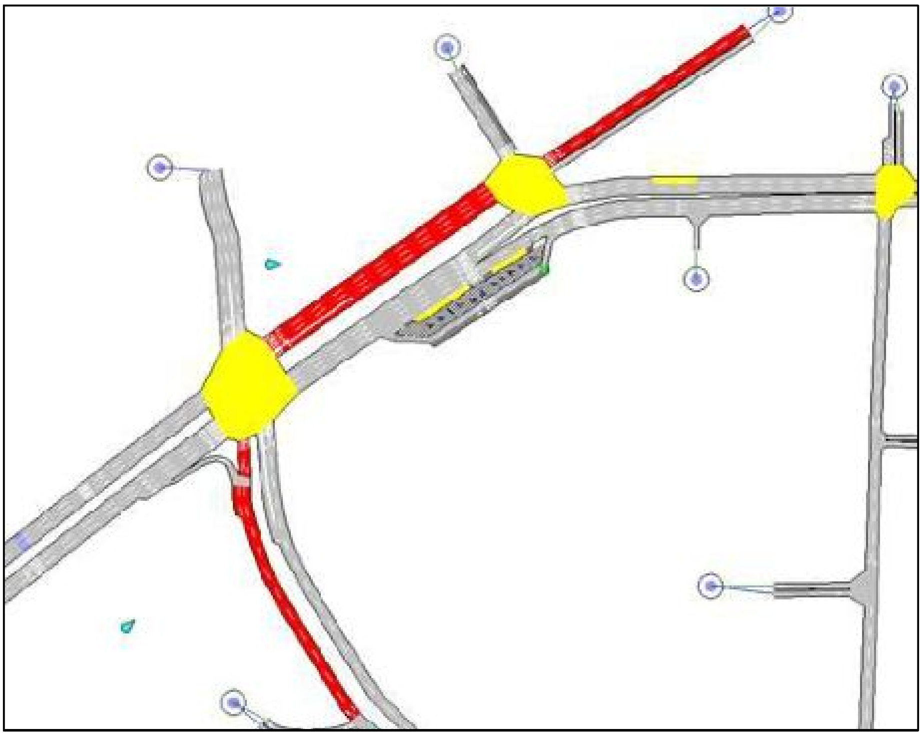


Figure 6-6: **North-East to South**



Tables 6-1 and 6-2 demonstrate the journey time results for each modelled scenario for the AM Peak and PM Peak hours, respectively. Each Journey Time stated is an average of 10 model runs of that specific scenario.

Table 6-1: AM Journey Times

Journey/Route	Scenario		
	2015 AM Base/Existing	2050 AM Do Minimum	2050 AM Do Something
West to East	91	179	243
North to South	55	56	217
East to West	115	207	162
South to North	161	411	284
South to North-east	171	488	259
North-east to South	329	684	300

Table 6-2 PM Journey Times

Journey/Route	Scenario		
	2015 PM Base/Existing	2050 PM Do Minimum	2050 PM Do Something
West to East	87	133	238
North to South	61	92	202
East to West	110	184	151
South to North	151	400	147
South to North-east	110	355	132
North-east to South	112	429	247

The tables show that journey times increase significantly from the 2015 'Base scenario' to the 2050 'Do Minimum'. This is, however, to be expected due to the calculated increase in flow due predominantly to background growth. The 2050 'Do Something' scenario journey times are significantly lower overall than those of the 2050 'Do Minimum' scenario and crucially, from a feasibility perspective, the observed modelled queue lengths are not extensive in the 'Do Something'.

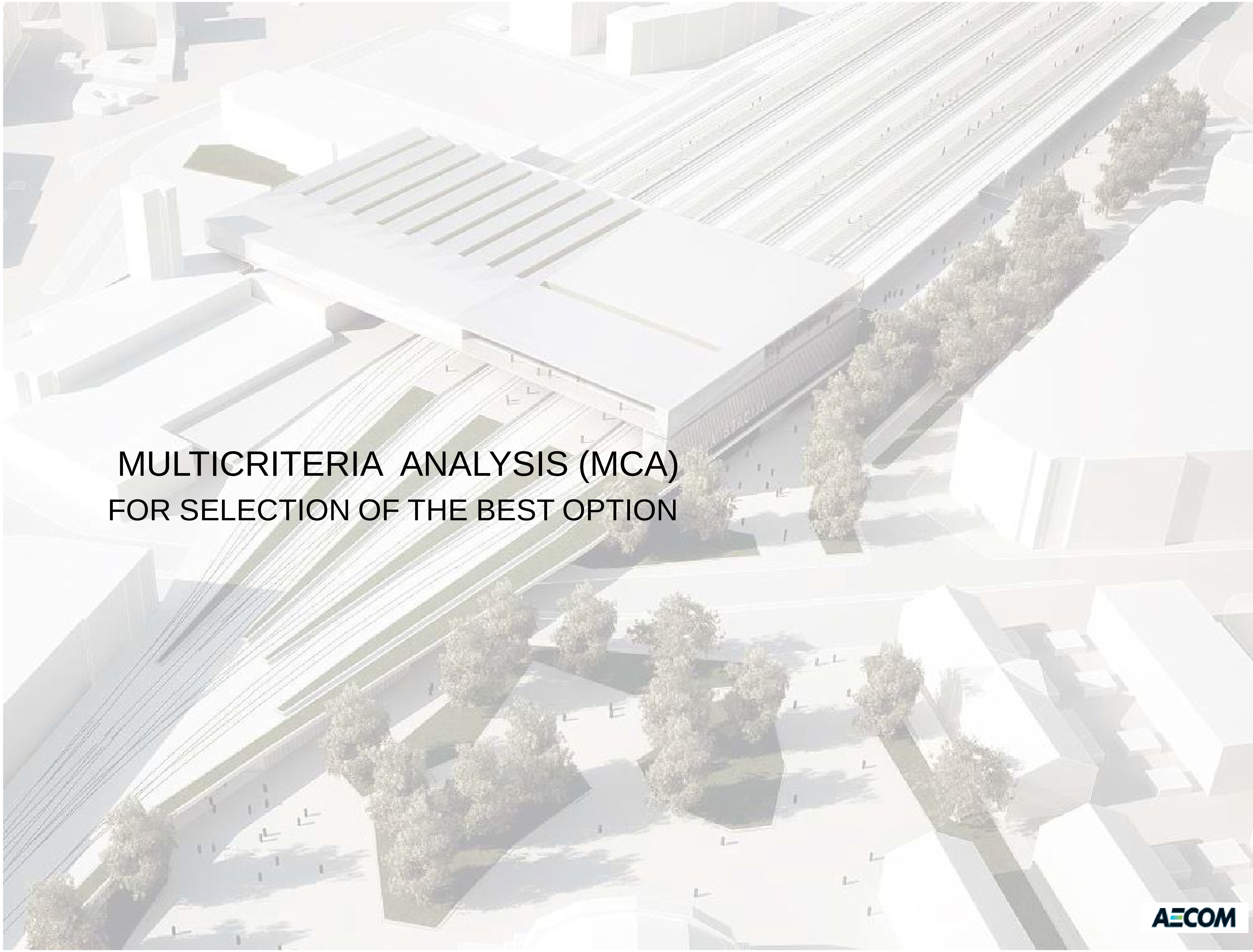
There is scope for further reduction to the 'Do Something' journey times and queue lengths through the implementation of vehicle actuated signal staging which will ensure that green time is distributed efficiently between the stages.

Appendix WP 2.6 – MCA Analysis

RPTH RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

Multicriteria analysis

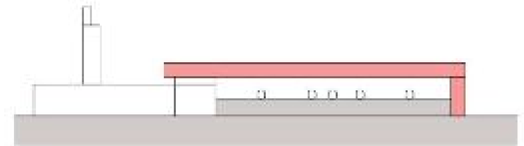
AECOM



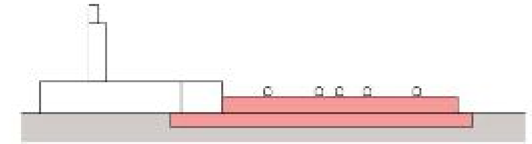
MULTICRITERIA ANALYSIS (MCA)

FOR SELECTION OF THE BEST OPTION

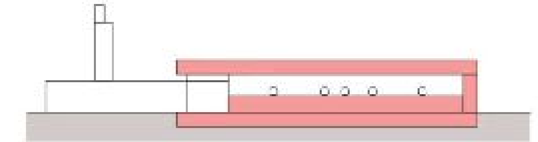
ALTERNATIVES_ List



GROUP A



GROUP B



GROUP C

GROUP A

Minimum intervention proposal

GROUP B

Multimodal Hub Below the tracks

2.1 Box type canopies

Multimodal Hub Below the tracks

2.2 Longitudinal canopies

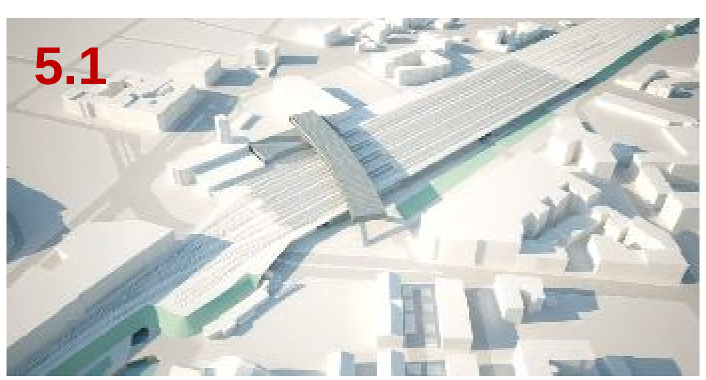
GROUP C

Box type Station

Box type Station (Variation)

Elevated Plaza and Station

Bridge Building Station - Short

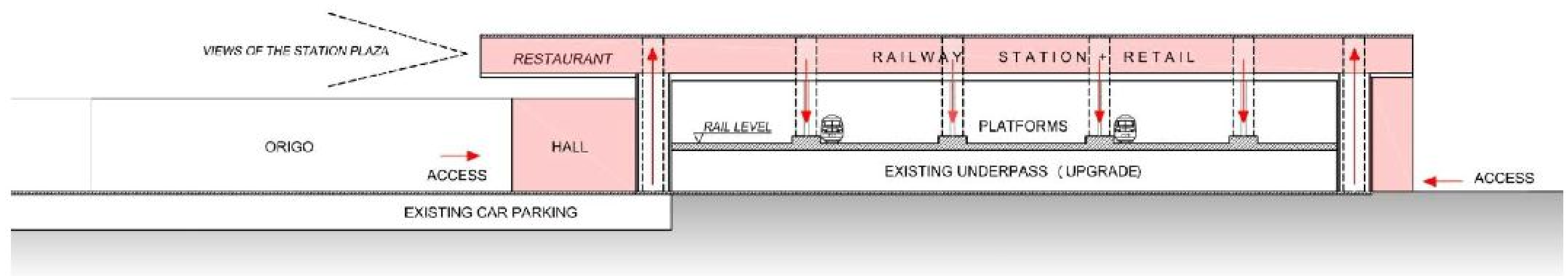


Bridge Building Station – Long variation

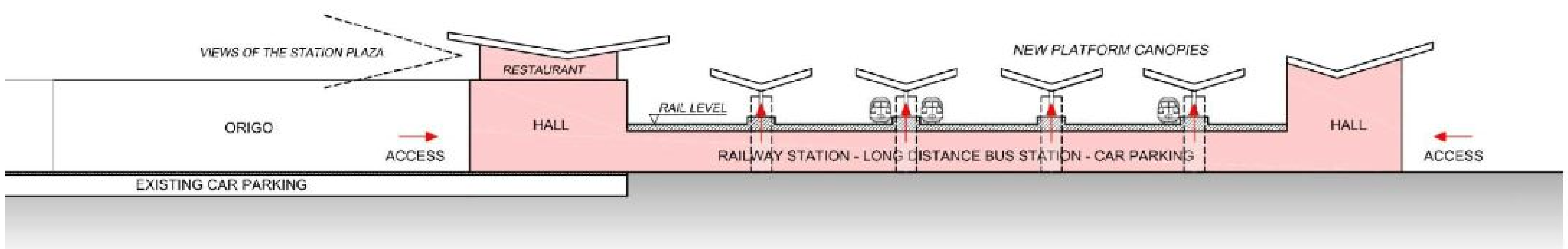
Elevated Promenade and Station

AECOM

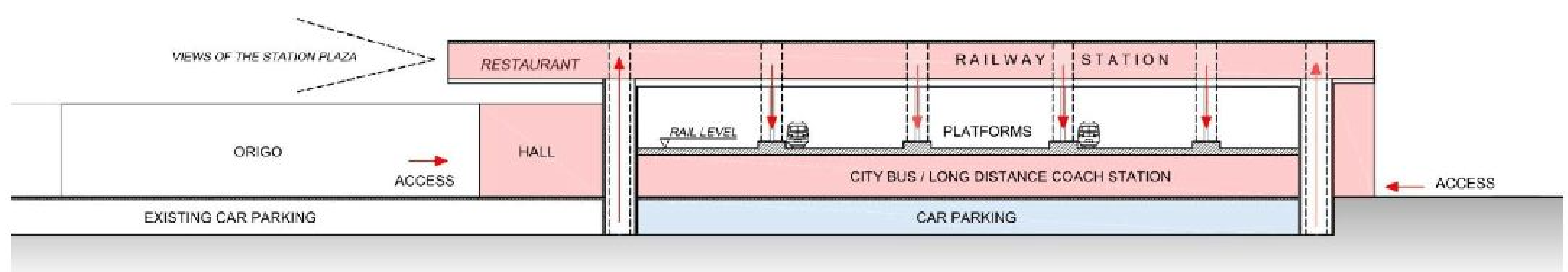
CROSS SECTIONS
GROUPS A, B & C



GROUP A

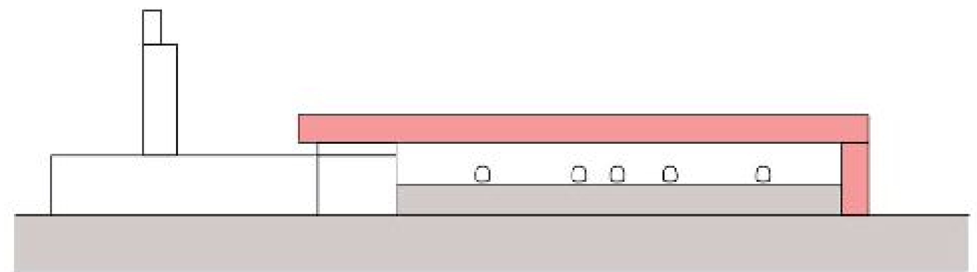


GROUP B



GROUP C

Conclusions for the 3 groups of alternatives



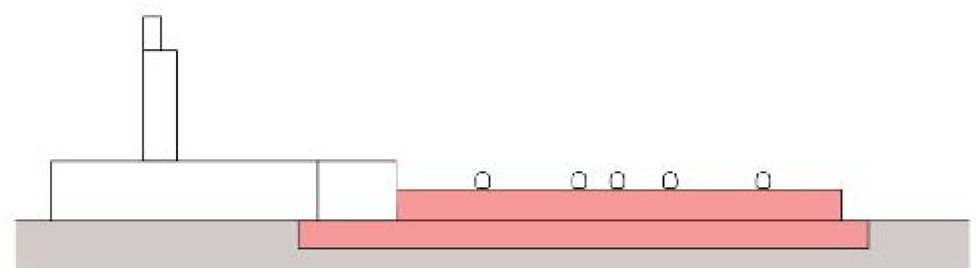
GROUP A
Over the tracks — Alternative 1

PROS

- *No construction at the embankments.*
- *Good views from elevated station*

CONS

- *Coach Station kept where it is. Too far still from new Railway station.*
- *Not functional. No space for all modes of transportation.*
- *Car Parking limited.*



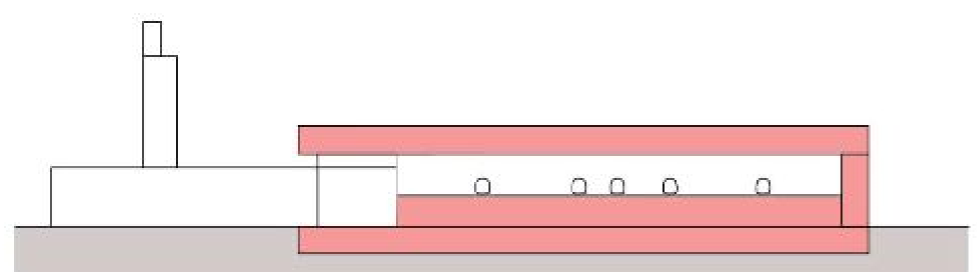
GROUP B
Below the tracks — Alternatives 2.1, 2.2

PROS

- *Functional, it can integrate all modes of transportation.*

CONS

- *Construction complexity at the embankment and no visibility.*
- *Not visible from the city, not recognizabe and no views from the station.*



GROUP C
Over and Below the tracks — Alternatives 3, 4, 5 & 6

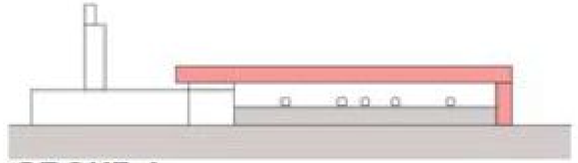
PROS

- *Efficiency, minimized walking distances between the different modes of transportation.*
- *Possibility of using less area of the embankments than group 1 for the modes of transportation*
- *Urban planning, Landscaping and Relationship with the city,*
- *Architectural solution: Strategically, functionality*

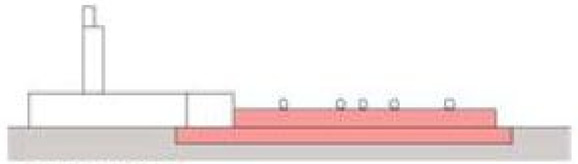
CONS

- *Construction complexity at the embankment*

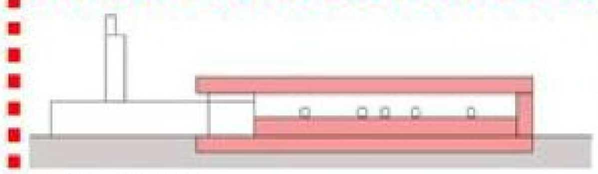
Multicriteria analysis



GROUP A



GROUP B



GROUP C

MCA Assessment - Project Outcomes

Headline Criteria/Assessment Criteria	Weighting	Option							
		Group A - Option 1		Group A - Option 2		Group B		Group C	
		Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Economy (transport user benefits)		1,0	1,0	1,0	1,0	1,5	1,5	1,0	1,0
Pedestrian walk times	1,00	1	1	1	1	1,5	1,5	1	1
Regeneration/Wider Economy		1,0	1,0	0,0	0,0	3,0	3,0	3,0	3,0
Facilitating future development around the station	1,00	1	1	0	0	3	3	3	3
Urban Environment		2,0	1,0	2,0	1,5	2,0	1,0	4,0	2,0
Public urban space (Quantity)	0,50	1	0,5	1	0,5	1	0,5	2	1
Public urban space (Quality)	0,50	1	0,5	1	1	1	0,5	2	1
Architectural features		6,0	2,0	-1,0	-0,3	4,0	1,3	8,0	2,7
Natural light and ventilation	0,33	3	1,0	0	0,0	1	0,3	3	1,0
Views from the station/Iconic image	0,33	3	1,0	0	0,0	1	0,3	3	1,0
Functionality	0,33	0	0,0	-1	-0,3	2	0,7	2	0,7
Integration		1,0	0,3	1,0	0,3	5,0	1,7	3,0	1,0
Interchange with bus and coach services	0,33	0	0,0	0	0,0	2	0,7	1	0,3
Connections to taxis and Kiss and ride	0,33	0	0,0	0	0,0	2	0,7	1	0,3
Private vehicle access and parking	0,33	1	0,3	1	0,3	1	0,3	1	0,3
Pedestrian Accessibility/Connectivity		1,0	0,3	1,0	0,3	4,0	1,3	5,0	1,7
Internal (Station)	0,33	0	0,0	0	0,0	2	0,7	1	0,3
External (to/from station)	0,33	1	0,3	1	0,3	1	0,3	2	0,7
External (between land-use areas)	0,33	0	0,0	0	0,0	1	0,3	2	0,7
Future Suitability		-1,0	-0,5	-2,0	-1,0	3,0	1,5	6,0	3,0
Capacity	0,50	-1	-0,5	-1	-0,5	2	1,0	3	1,5
Flexibility to accommodate future changes	0,50	0	0,0	-1	-0,5	1	0,5	3	1,5
Total		11,0	5,2	2,0	1,8	22,5	11,3	30,0	14,3

Headline Criteria	Group A - Option 1	Group A - Option 2	Group B	Group C
Economy (transport user benefits)	1.0	1.0	1.5	1.0
Regeneration/Wider Economy	1.0	0.0	3.0	3.0
Urban Environment	1.0	1.5	0.8	2.0
Architectural features	2.0	-0.3	1.3	2.7
Integration	0.3	0.3	1.7	1.0
Pedestrian Accessibility/Connectivity	0.3	0.3	1.3	1.7
Future Suitability	-0.5	-1.0	1.5	3.0
Total	5.2	1.8	11.1	14.3

AECOM

Arguments for the MCA results

Economy

Pedestrian Walk Times – Walk times are likely improved from the existing in all design scenarios due to the following:

-Group A: Additional capacity and routing option to/from platforms provided by the bridge.
-Group B: Due to the co-location of bus and rail services, journey times between those modes would be substantially reduced from that of the existing. This would likely more than offset any increase in through station (i.e. people routing through the station as a shortcut) journey times caused by the reduction in the number of tunnels.
-Group C: Due to the co-location of bus and rail services, journey times between those modes would be substantially reduced from that of the existing. The routing to/from platform level via the bridge would likely increase journey times for passengers routing to/from street. Overall, however, due to the co-location of transport modes, segregation of through trips and passengers and consequential reduction in congestion, the Group C options would reduce walk times overall from the existing.

Regeneration/ Wider Economy

Facilitating future development around the station:

-Group A :It doesn't allow the development of the water promenades, since this option keeps the existing bus platforms and station.
-Group B: By relocating the bus station and the parking, the proposal allows to introduce new commercial and cultural buildings that can regenerate the surrounding and may attract people from other parts of the city.
-Group C: As the solution B, a big public area is freed by relocating the bus stations and the parking. In this case, even more retail can be accommodated on the "bridge building" which results more business activities. The area may turn to into a representative urban space that can join the market area into a tourist spot

The public space potentialities that offer Group B and C is considerably higher.

Urban development

Public Urban Space (Quantity & Quality**)** – Public urban space quantity and quality improvements, from the existing, would likely be realised in all design scenarios due to the following:

-Group A: Additional pedestrian crossing provision at-grade adjacent to the station.
-Group B: The additional pedestrian crossing provision at-grade to/from the city centre and landscaping upgrades to the South and Southwest of the station would improve the quantity and quality of the urban space within the study area.
-Group C: The additional pedestrian crossing provision at-grade to/from the city centre and landscaping upgrades to the South and Southwest of the station would improve the quantity and quality of the urban space within the study area. The proposed 'green Boulevard' to the North of the site, and its reallocation of roadspace to facilitate more pedestrian and cyclist space, would further improve the urban space quantity and quality.

Architectural features

Natural light and ventilation: The elevated stations proposed in Group A and C offer better conditions for the confort for the passengers as they are at a high position.

Views from the station/ Iconic image: The elevated stations proposed in Group A and C have very good views towards the market area. The elevated station is visible from many points of the city and is recognizable and can become an iconic image and new gate to the capital of Latvia.

Functionality: Group A is the worse as it presents a lack of space as the minimum intervention. Group B and C act as a New Multimodal Building, gathering more functions.

Arguments for the MCA results

Architectural features

Natural light and ventilation:

-Group A. The elevated station, offer better conditions for the comfort for the passengers as they are at a high position. This area can be easily ventilated and its well illuminated

-Group B. As the station remains under the tracks, the space would have more or less the same conditions as it has now. No natural light and bad ventilation at the train station

-Group C. As the group A, the elevated station a allows good ventilation and very good lighting conditions

Views from the station/ Iconic image:.

-Group A. The elevated stations proposed in Group A has very good views towards the market area. The station is visible from many points of the city and is recognizable and can become an iconic image and new gate to the capital of Latvia

-Group B. The station volume doesn´t show much. The canopy is the only element which can be recognizable from the market area.

-Group C. As option C, the station becomes an icon and a new gate to Riga

Functionality:

-Group A. This option is the worse as it presents a lack of space as the minimum intervention.

-Group B. This option acts as a New Multimodal Building, gathering more functions, and allowing different connections between them.

-Group C. As Option B, it gathers many functions in one building. If we compare both, Option C, by separating the train and bus station in different levels, has a clearer zoning

Integration

Interchange with bus and coach services, Connections to taxis and Kiss and ride and Private vehicle access and parking

-Group A: Attending to the interchange with bus and coach services:, Group A remains the worst in terms of connectivity with the Bus Station, because there is no space for a new terminal in the plot. Connections with taxis and Kiss and ride remain he same as they are in the current station. Regarding the private car access, all groups solve the integration of the private car parking.

-Group B. In terms of interchange with bus and coach services, Group B is better connected because the Railway station is at the same level as the Bus Interchange. The kiss and ride And the car parking are well integrated

-Group C. Despite they are in different levels, the train station is very well connected to the new Bus Interchange. Same as Group B in terms of taxi/kiss and ride and private car integration

Pedestrian accesibility/connectivity

Pedestrian Walk Times – Walk times are likely improved from the existing in all design scenarios due to the following:

-Group A: Additional capacity and routing option to/from platforms provided by the bridge.

-Group B: Due to the co-location of bus and rail services, journey times between those modes would be substantially reduced from that of the existing. This would likely more than offset any increase in through station (i.e. people routing through the station as a shortcut) journey times caused by the reduction in the number of tunnels.

-Group C: Due to the co-location of bus and rail services, journey times between those modes would be substantially reduced from that of the existing. The routing to/from platform level via the bridge would likely increase journey times for passengers routing to/from street. Overall, however, due to the co-location of transport modes, segregation of through trips and passengers and consequential reduction in congestion, the Group C options would reduce walk times overall from the existing.

Arguments for the MCA results

Pedestrian Accessibility/Connectivity (to/from station) – To/from station pedestrian accessibility/connectivity would likely be improved from the existing in all design scenarios due to the following:

-Group A: Connectivity externally to/from the station is improved due to the segregation of pedestrian through flows and platform flows. Due to the introduction of the bridge concourse area, passengers routing from South of the station would no longer need to route through the tunnels to purchase a ticket and then double back to access platforms. Instead routing is simpler and less congested. External accessibility is also improved upon due to the proposed additional at-grade crossing facilities adjacent to the station.
-Group B: External accessibility is improved upon due to the proposed additional at-grade crossing facilities adjacent to the station and extensive improved connectivity between the Old Town and new Promenade area which then connects with the station access/egress (South).
-Group C: Connectivity externally to/from the station is improved due to the segregation of pedestrian through flows and platform flows. Due to the introduction of the bridge concourse area, passengers routing from South of the station would no longer need to route through the tunnels to purchase a ticket and then double back to access platforms. Instead routing is simpler and less congested. External accessibility is also improved upon due to the proposed additional at-grade crossing facilities adjacent to the station and extensive improved connectivity between the Old Town and new Promenade area which then connects with the station access/egress (South).

Pedestrian Accessibility/Connectivity (between land-use areas) – Between land use area accessibility/connectivity would likely be improved from the existing in design Groups B and C due to the following:

-Group A: Minor changes proposed which would improve accessibility/connectivity between land uses.
-Group B: External accessibility is improved upon due to the proposed additional at-grade crossing facilities adjacent to the station and extensive improved connectivity between the Old Town and new Promenade area which then connects with the station access/egress (South).
-Group C: External accessibility is improved upon due to the proposed additional at-grade crossing facilities adjacent to the station and extensive improved connectivity between the Old Town and new Promenade area which then connects with the station access/egress (South).

Future suitability

Capacity and Flexibility to accommodate future changes:

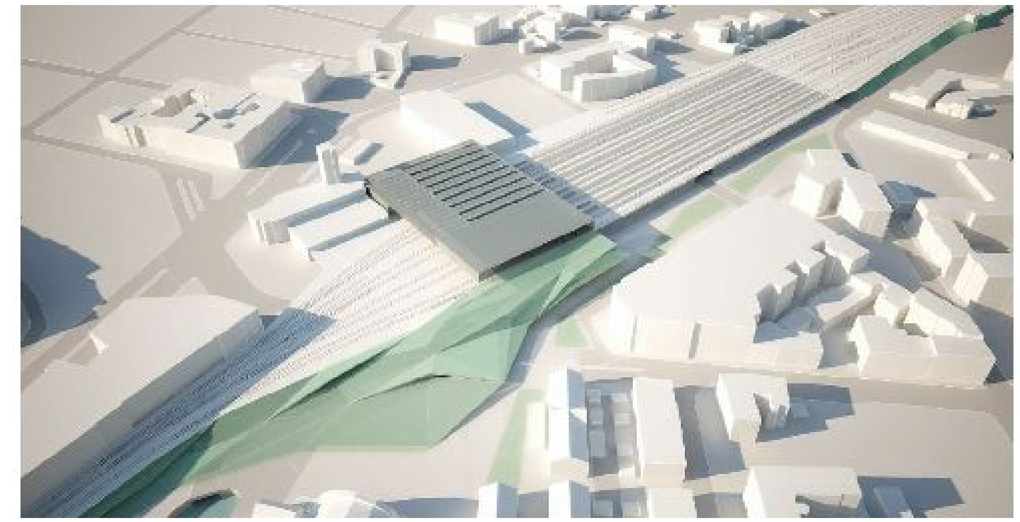
-Group A. Group A limits its development to the tracks influence area, which is not enough for all modes of transport It can solve the problem of adding the Rail Baltica tracks, but definitely it ignores the urban problems of the area, so consequently, future improvements will be difficult to achieve. This is not a valid option for 2050
-Group B: It can provide a higher level of development, but is less flexible than group C to accommodate the future actions at the station
-Group C: This is the best option as it provides a bigger area that can accommodate future demand increases

AECOM

Best option from group C: Selection of the alternative 3.1 Box type

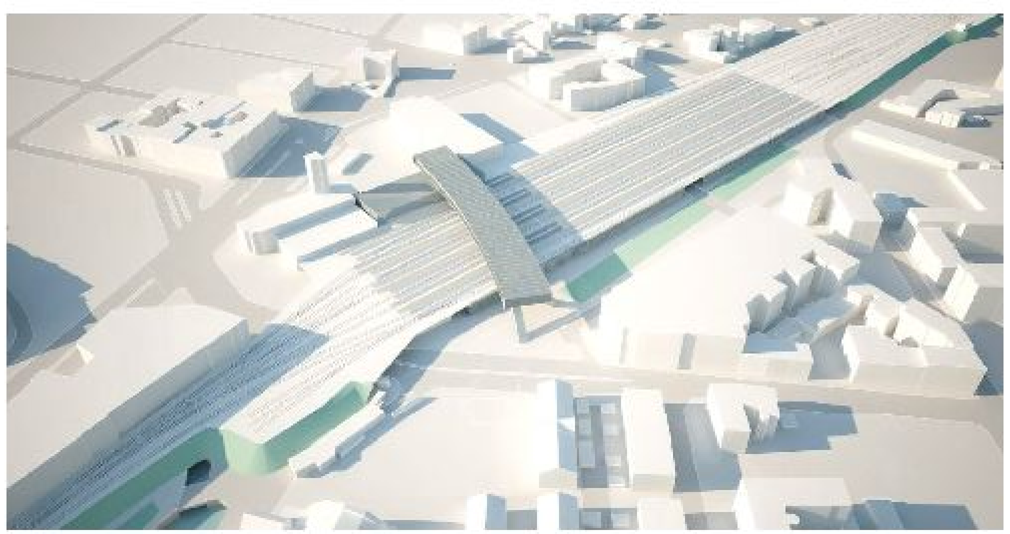
3.1 Box type

RETAIL OPPORTUNITIES WITH VIEWS
BEST CENTERED IN THE TRACKS



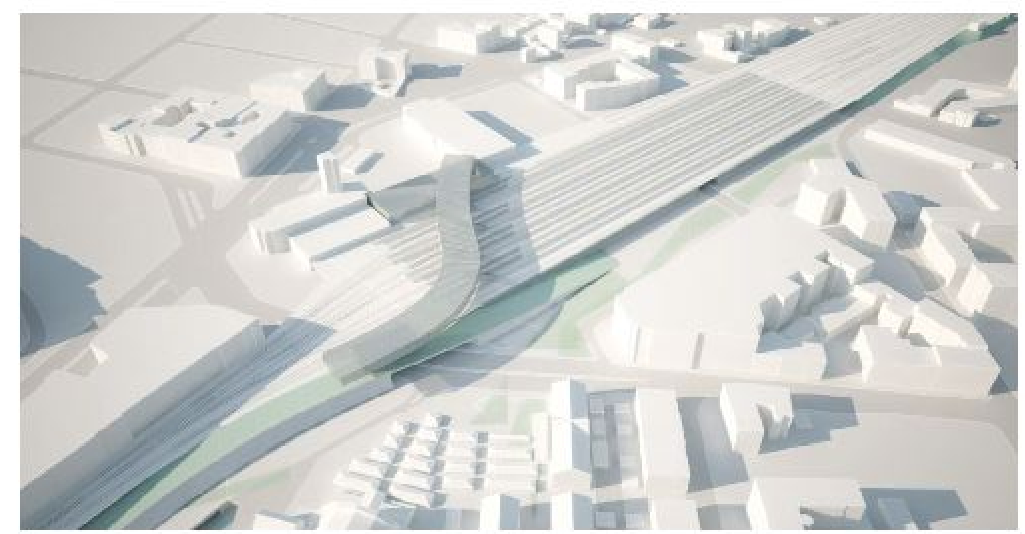
3.2 Box type + Elevated plaza

POSSIBILITY FOR A FUTURE STAGE
COMPLEX



4 Bridge building station

LONGER WALKING DISTANCES TO ACCESS THE TRACKS
NO SPACE FOR RETAIL
TOO NARROW – ONLY CONNECTION



5 Bridge solution + landscape connection

BETTER CONNECTED WITH LANDSCAPE
But same limitations as alternative 4

AECOM

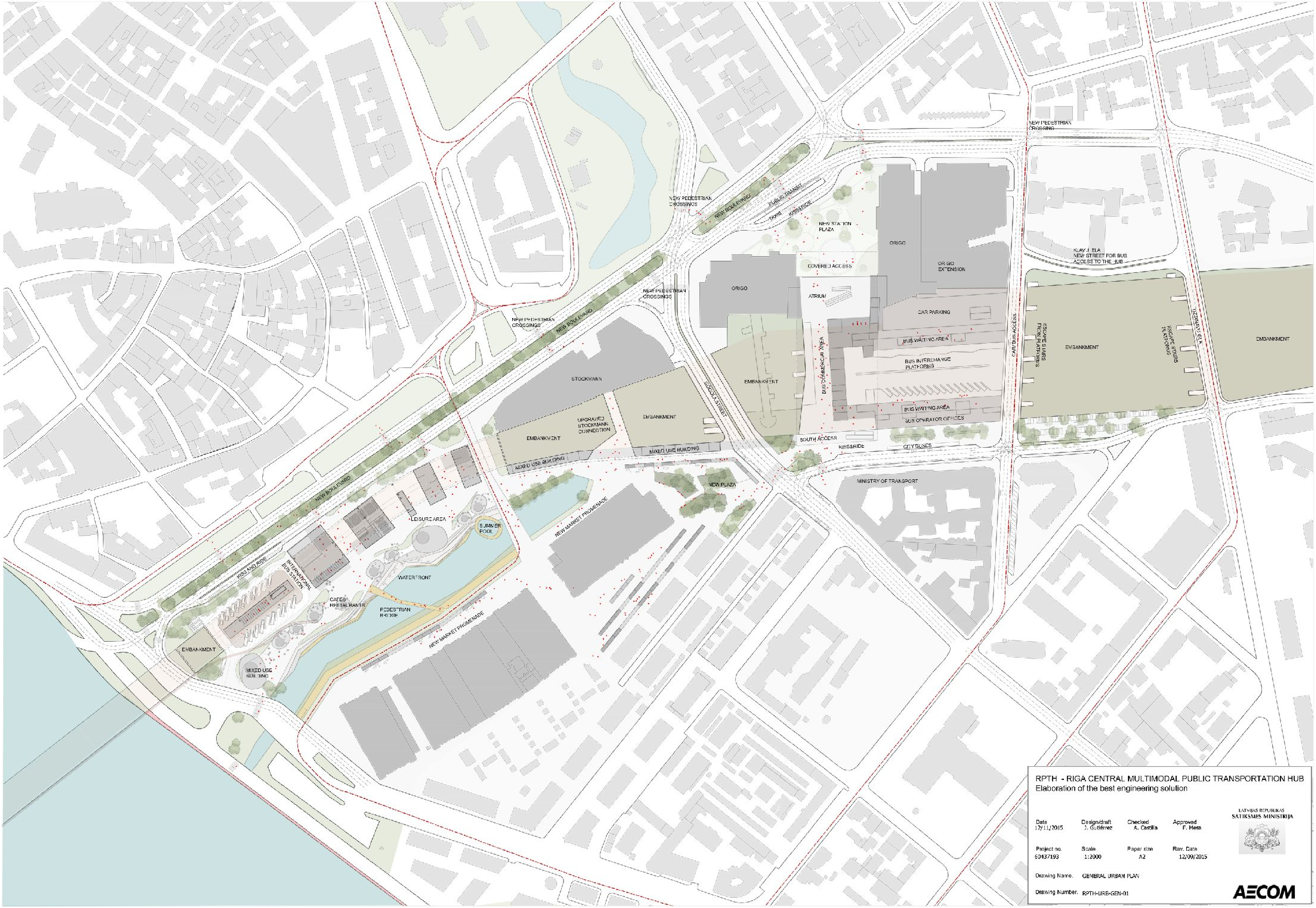
Appendix WP 2.7.1 – List of Appendix Drawings

RIGA RPTH LIST OF DRAWINGS

Discipline	CONCEPT DESIGN	Document Number	Scale	Sheet	Appendix
		URBAN PROPOSAL			
Urb	General Urban Plan	RPTH-URB-GEN-01	1:2000	A2	**APPENDIX WP 2.7.2. Urban Planning and 3D views**
Urb	Urban Area Plan+ Area Schedule	RPTH-URB-GEN-02	1:2000	A2	
Urb	Urban Longitudinal Section	RPTH-URB-SEC-01	1:2000	A2	
Urb	Urban Cross Sections	RPTH-URB-SEC-02	1:500	A3	
Urb	3D Views of the urban proposal	RPTH-URB-3D-01	3D	A3	
Struct	Viaduct Plan	RPTH-VIA-PLA-01	1:750	A2	**APPENDIX WP 2.7.5. Viaduct Structural Drawings**
Struct	Widening existing underpasses. Plan view and sections	RPTH-VIA-PLA-02	1:750	A2	
Struct	Viaduct Cross Section	RPTH-VIA-SEC-01	1:75	A2	
Struct	Construction Phase: Viaduct	RPTH-VIA-PHS-01	1:200	A2	
		MULTIMODAL HUB			
Arch	Street Level Floor Plan	RPTH-ARC-PLA-01	1:750	A2	**APPENDIX WP 2.7.6. Multimodal Hub Architectural Drawings**
Arch	Car Parking Level	RPTH-ARC-PLA-02	1:750	A3	
Arch	Platforms Level	RPTH-ARC-PLA-03	1:750	A2	
Arch	Railway Level Floor Plan	RPTH-ARC-PLA-04	1:750	A2	
Arch	Area and Access Diagrams	RPTH-ARC-DIA-01	n/s	A3	
Arch	Cross Section 1, 2 and Longitudinal Section	RPTH-ARC-SEC-01	1:500	A2	
Struct	Foundation level plan (+0.00/-1.40 m)	RPTH-STR-PLA-01	1:500	A2	**APPENDIX WP 2.7.7. Multimodal Hub Structural Drawings**
Struct	Parking level plan (+1.55 m)	RPTH-STR-PLA-02	1:500	A2	
Struct	Platform level plan (+5.00/+6.25 m)	RPTH-STR-PLA-03	1:500	A2	
Struct	Railway Station level plan (+17.55 m)	RPTH-STR-PLA-04	1:500	A2	
Struct	Roof level plan (+23.95 m)	RPTH-STR-PLA-05	1:500	A2	
Struct	Cross sections: longitudinal and transverse	RPTH-STR-SEC-01	1:500	A2	
Struct	Details (I)	RPTH-STR-DET-01	1:100	A2	
Struct	Details (II)	RPTH-STR-DET-02	1:100	A2	
Struct	Details (III)	RPTH-STR-DET-03	1:40	A2	
		TRACK LAYOUT			
Tracks	General Track Layout Plan	RPTH-TRK-LAY-01	1:2500	A3+	**APPENDIX WP 2.7.9. Track layout**
Tracks	Track Layout Structure	RPTH-TRK-LAY-02	1:2500	A3+	
Tracks	Existing and new tracks	RPTH-TRK-LAY-03	1:2500	A3+	
Tracks	Track Layout Details (I)	RPTH-TRK-LAY-04	1:2000	A3	
Tracks	Track Layout Details (II)	RPTH-TRK-LAY-04	1:2000	A3	
Tracks	Track Layout Details (III)	RPTH-TRK-LAY-05	1:2000	A3	
Tracks	Track Layout Details (IV)	RPTH-TRK-LAY-06	1:2000	A3	
Tracks	Track Layout Details (V)	RPTH-TRK-LAY-07	1:2000	A3	
Tracks	Track Layout Details (VI)	RPTH-TRK-LAY-08	1:2000	A3	
Tracks	Track Layout Typical Section	RPTH-TRK-SEC-01	1:100	A3	
		PHASING			
Phasing	Construction Phase: Multimodal Building	RPTH-STR-PHS-01	1:500	A2	**APPENDIX - WP 3.1.1. Phasing and Programme of works**
Phasing	Construction Phase: Viaduct	RPTH-VIA-PHS-01	1:200	A2	

URB- Urban Planning
VIA- Viaduct
ARC- architecture
STR- Structures
TRF- Traffic
TRK- Track layout

Appendix WP 2.7.2 - Urban Planning Drawings



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

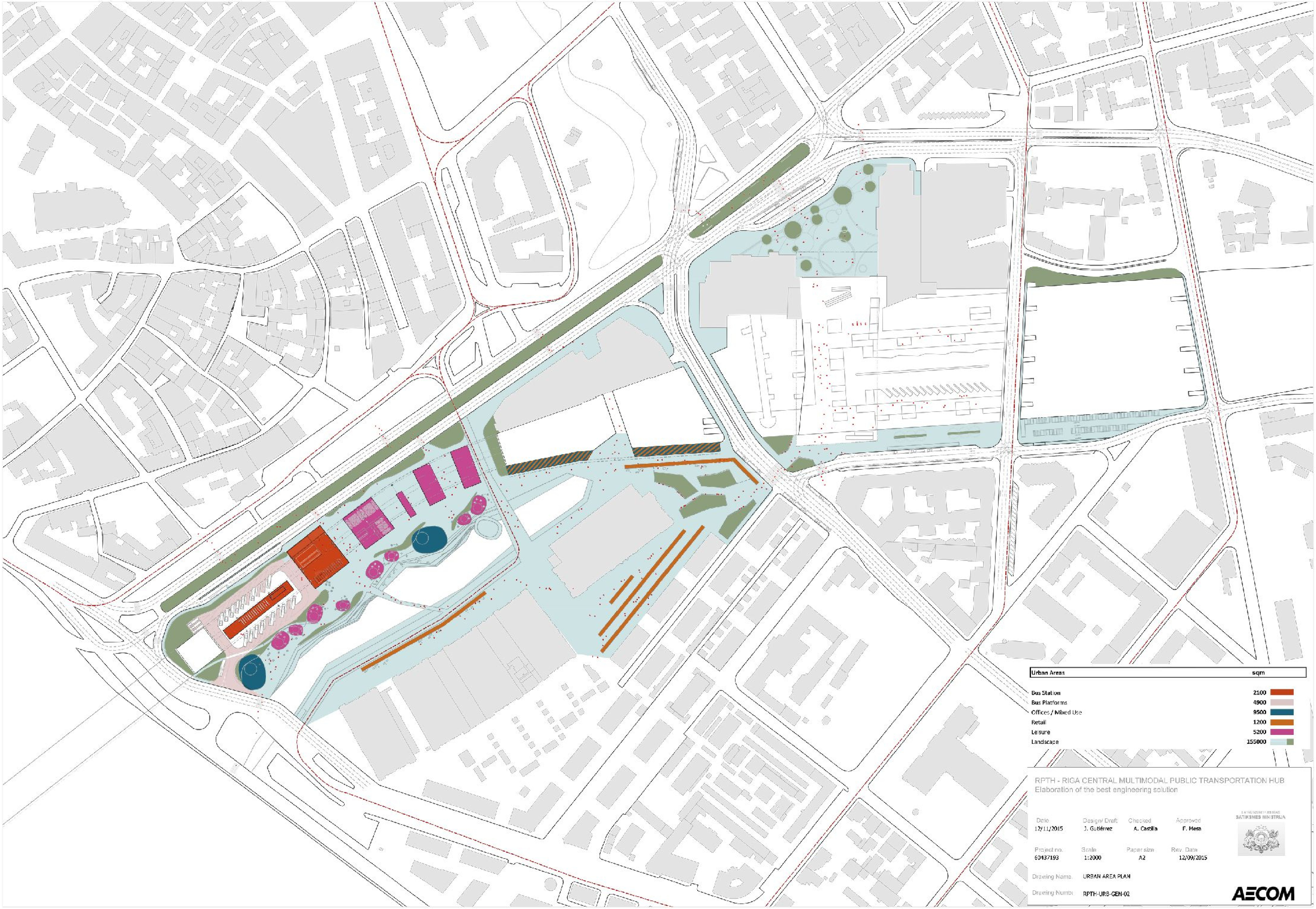
Date	Design/draft	Checked	Approved
12/11/2015	J. Gutiérrez	A. Castilla	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193	1:2000	A2	12/09/2015

Drawing Name. GENERAL URBAN PLAN

Drawing Number. RPTH-URB-GEN-01

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

AECOM



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

Date	Design/ Draft	Checked	Approved
12/11/2015	J. Gutiérrez	A. Castilla	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193	1:2000	A2	12/09/2015

Drawing Name: URBAN AREA PLAN

Drawing Number: RPTH-URB-GEN-02

SATIKSMES MINISTRIJA

AECOM

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

Date 12/11/2015	Design/draft R. Quirós	Checked A. Castilla	Approved F. Masa
Project no. 60437193	Scale 1:2000	Paper size A2	Rev. Date 12/09/2015

Drawing Name: URBAN LONGITUDINAL SECTION

Drawing Number: RPTH-URB-SEC-01

LATVIJAS REPUBLIKAS
SATIKSMES MINISTRIJA

AECOM

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

Date 12/11/2015	Design/draft R. Quirós	Checked A. Castilla	Approved F. Mesa
Project no. 60437193	Scale 1:500	Paper size A2	Rev. Date 12/09/2015

Drawing Name. URBAN CROSS SECTIONS

Drawing Number. RPTH-URB-SEC-02

LATVIJAS REPUBLIKAS
SATIKSMES MINISTRIJA

AECOM

Appendix WP 2.7.3 - Urban Planning Presentation

RPTH RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

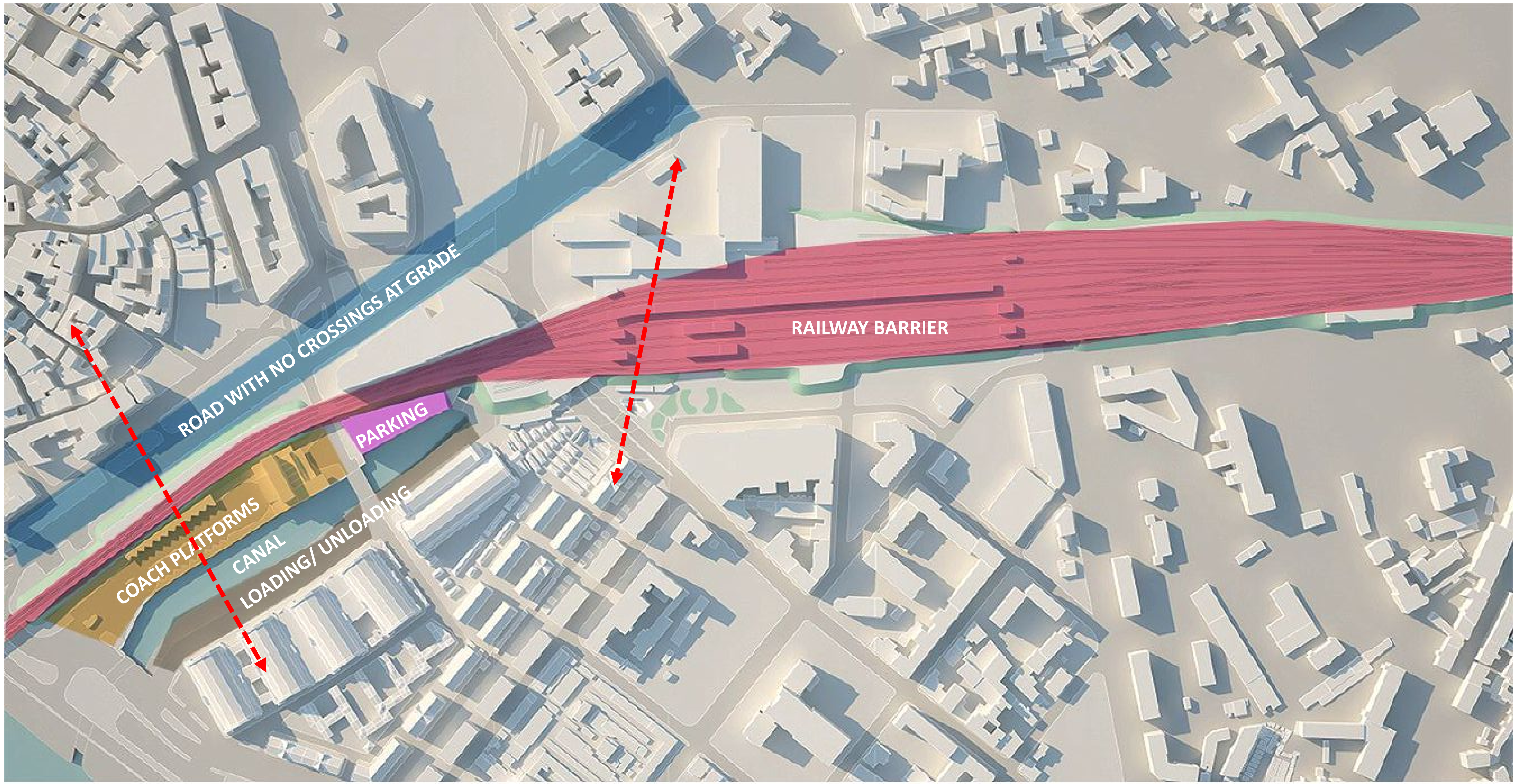
URBAN PROPOSALS based on urban analysis of constrains
BUS STATION OPTIONS

AECOM

Urban Proposals

Based on urban analysis of constrains

URBAN ANALYSIS CONSTRAINS_ Barriers



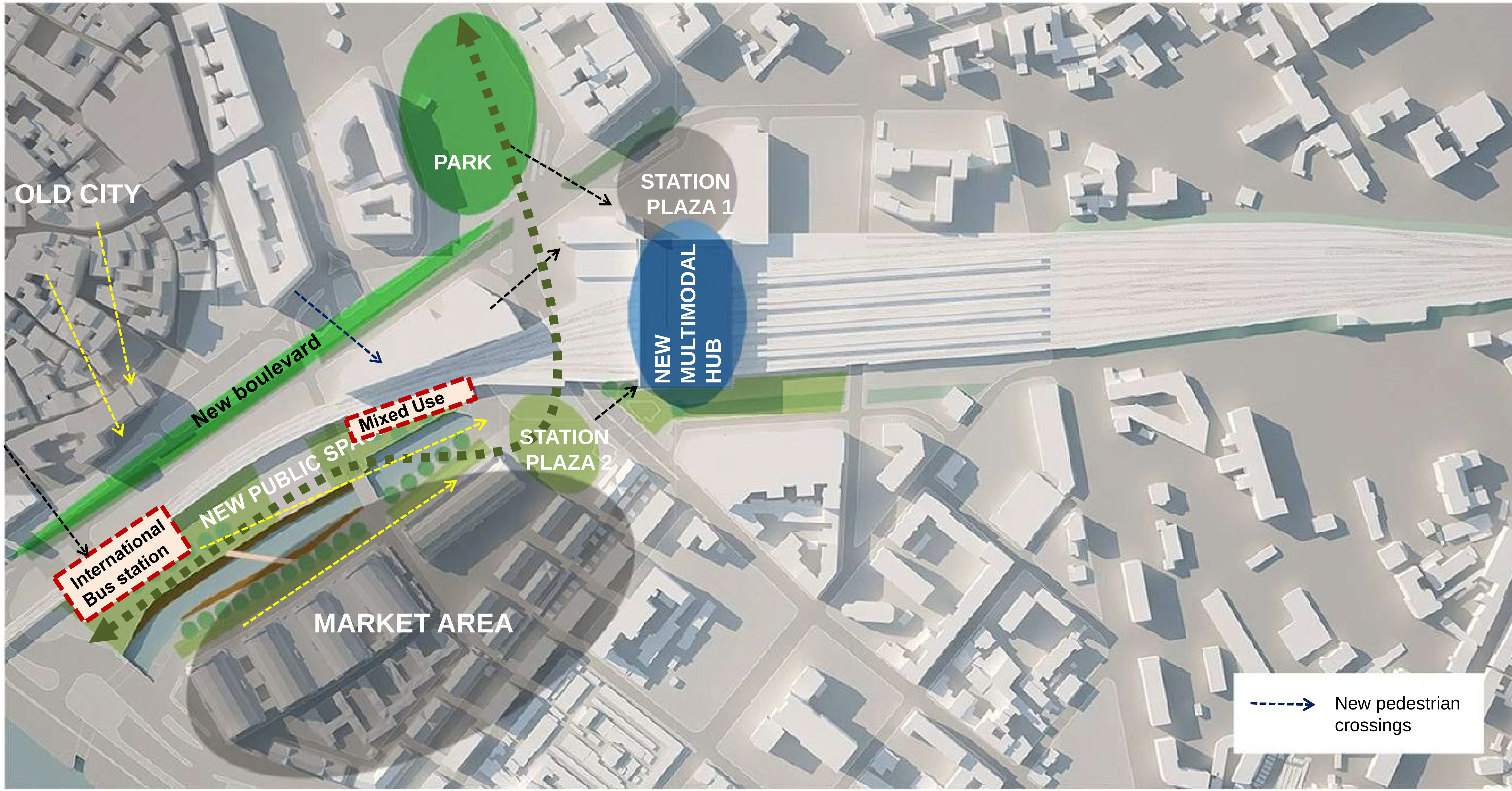
Unsafe Underpasses.

No pedestrian crossings

Weak connections between urban areas

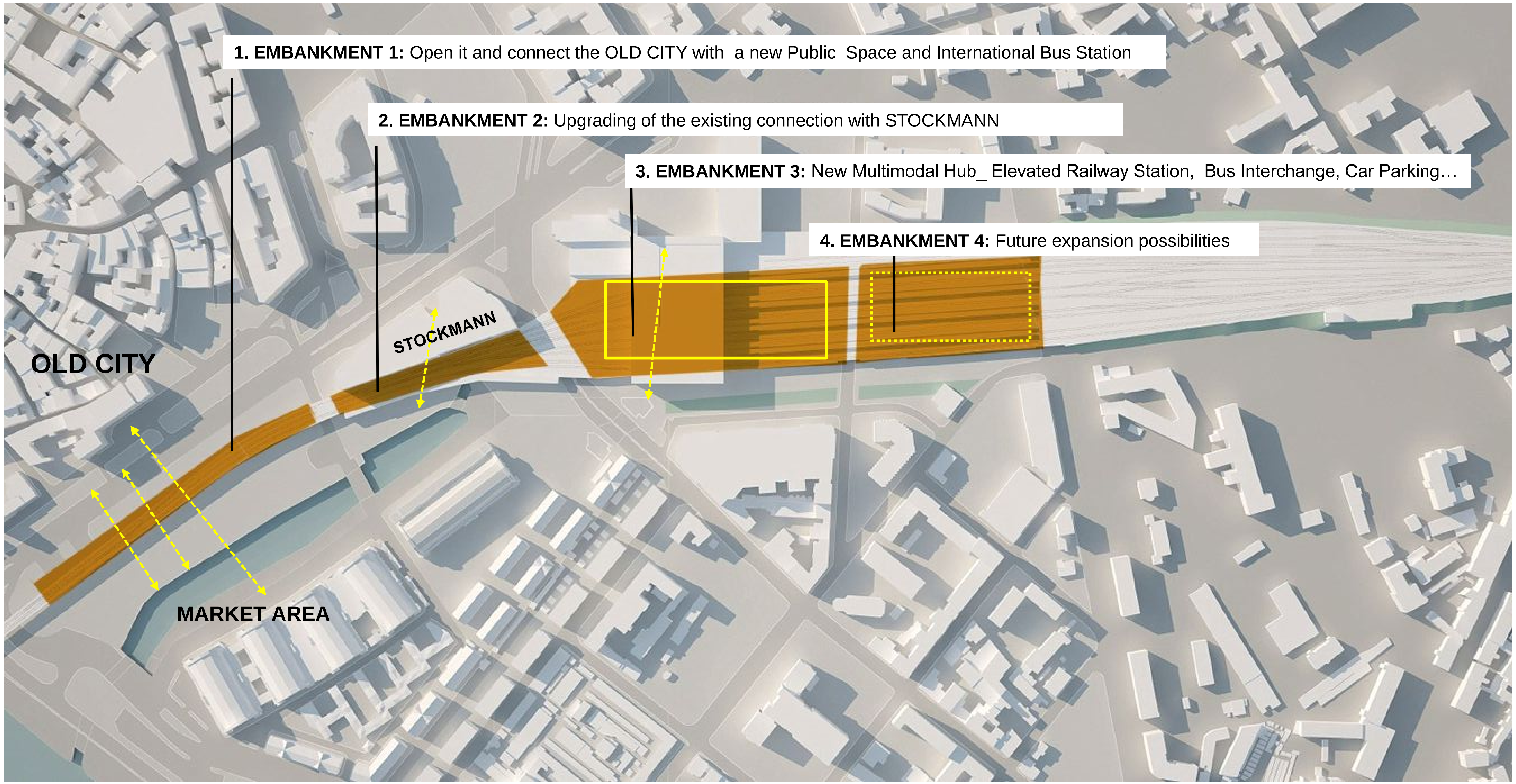
AECOM

URBAN PROPOSALS_ Public Space and Urban integration



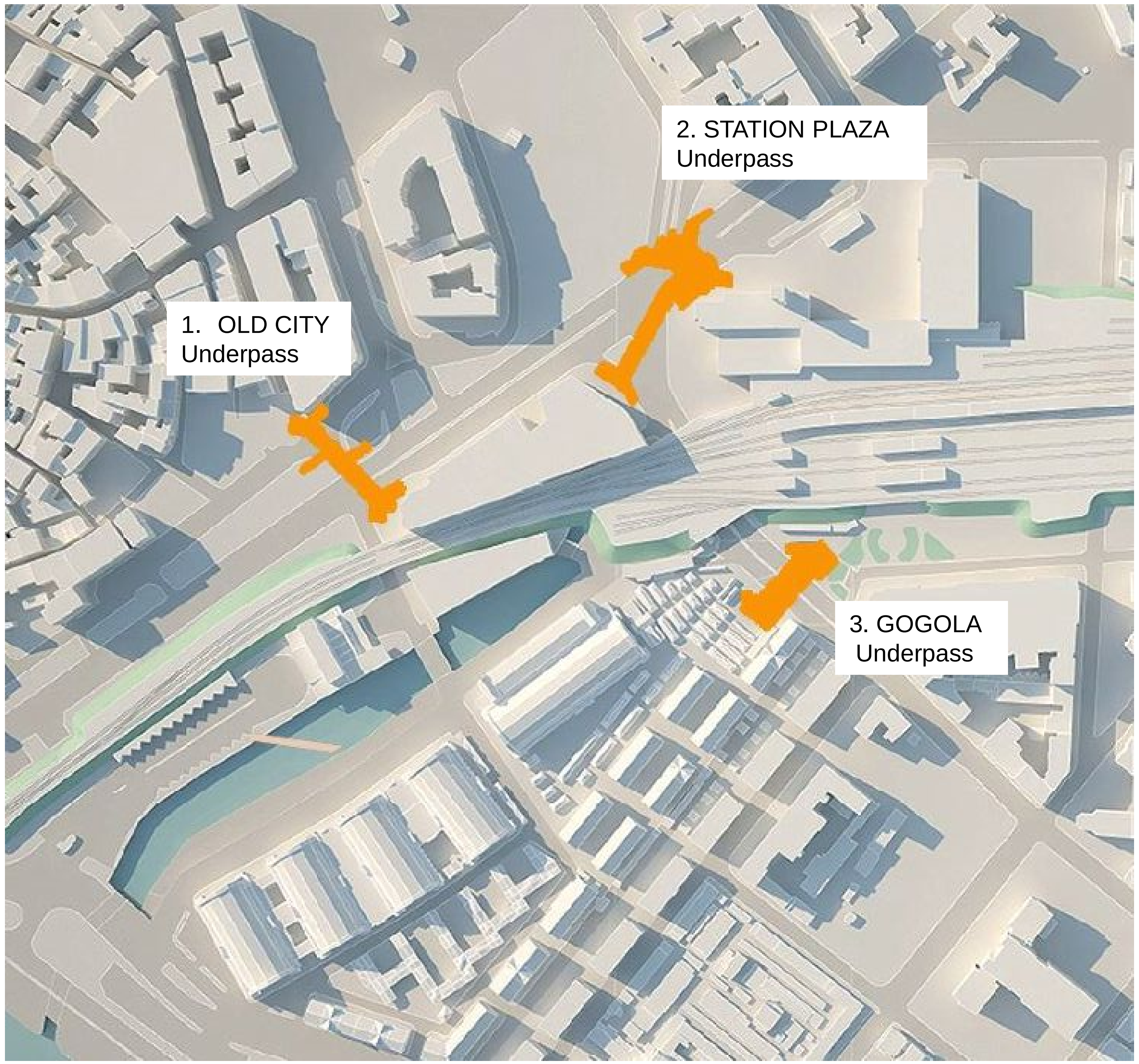
AECOM

URBAN PROPOSALS_ Proposals for the Embankments



AECOM

URBAN PROPOSALS_ Underpasses



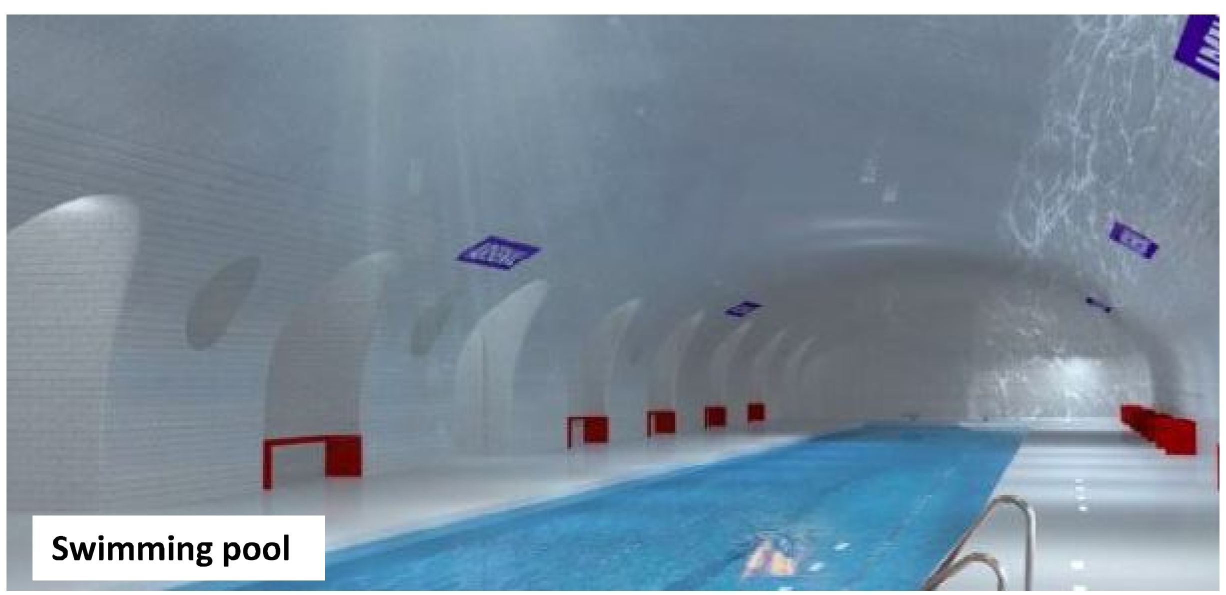
PROBLEMS: Dark, unsafe, unconfortable connections

PROPOSALS: Reuse the existing infrastructure for NEW FUNCTIONS related to cultural uses, for example.

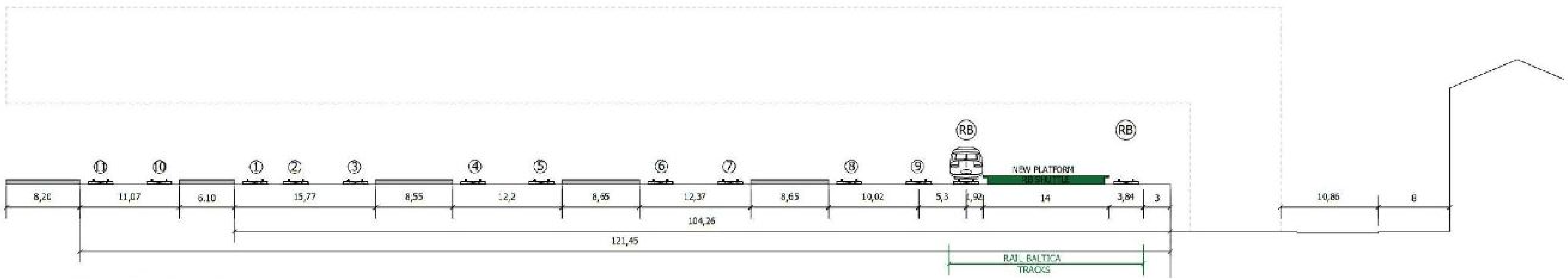
Pedestrians will cross
NEW PEDESTRIAN CROSSINGS AT GRADE

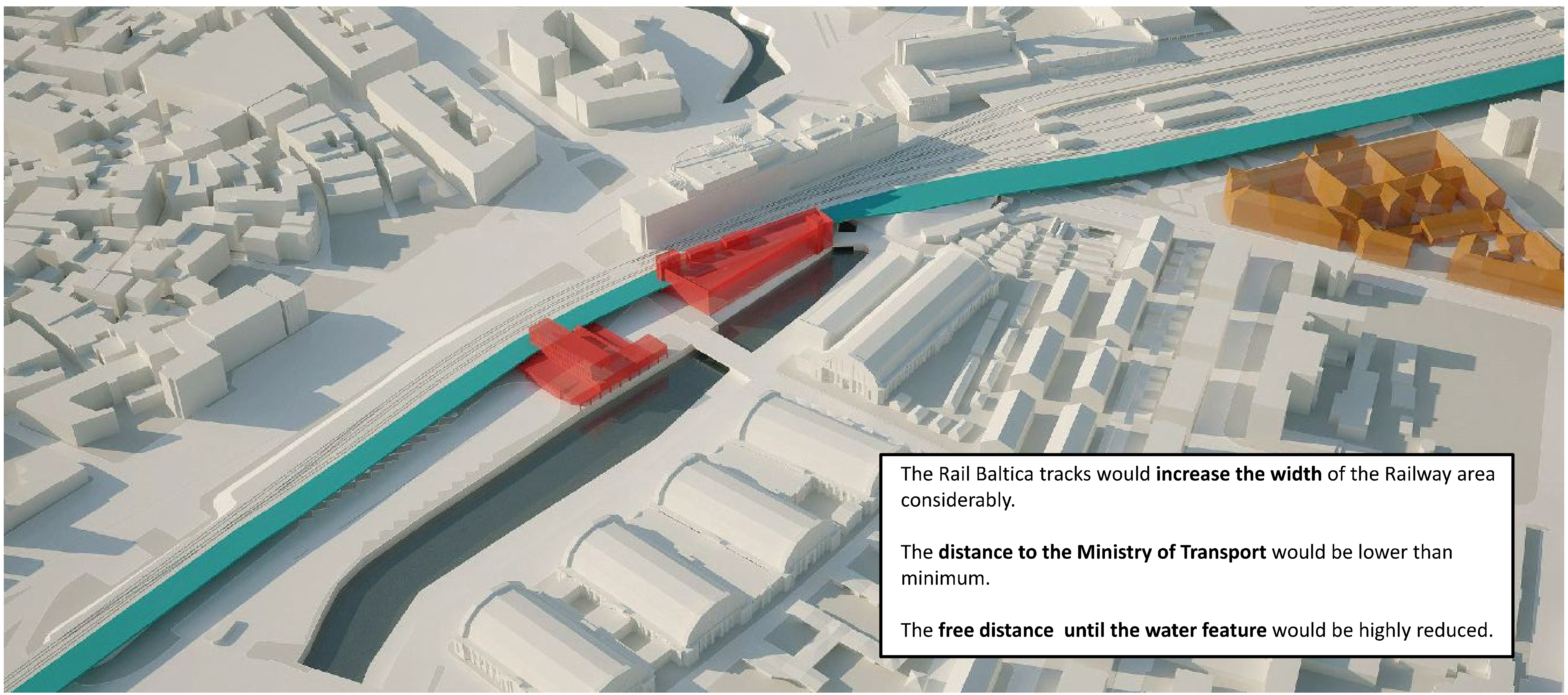
URBAN PROPOSALS_ Underpasses References for New functions

Abandoned metro stations in Paris will become swimming pools, restaurants and other cultural and leisure centres:



RAIL BALTICA TRACKS added to the existing track layout



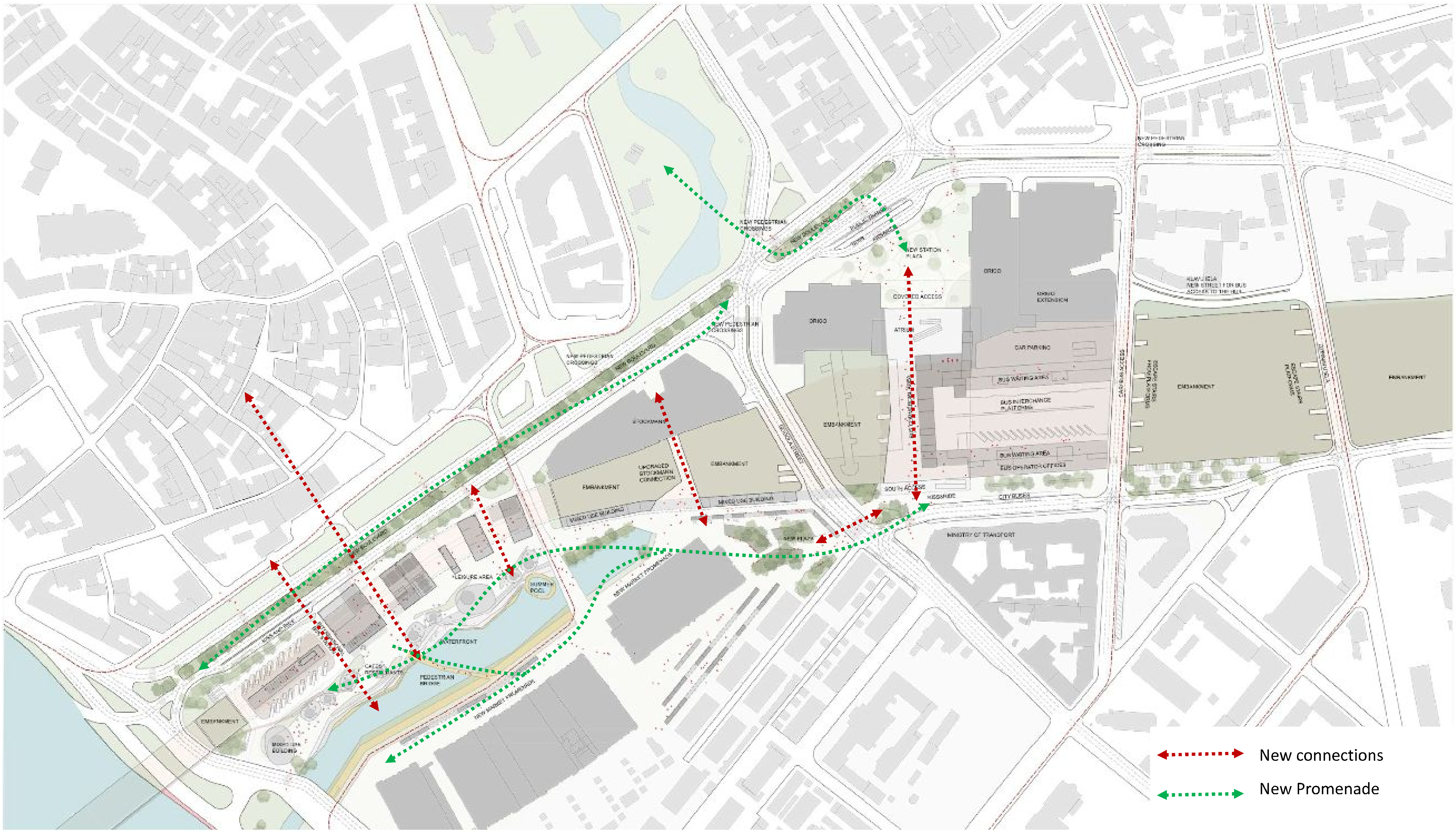


The Rail Baltica tracks would **increase the width** of the Railway area considerably.

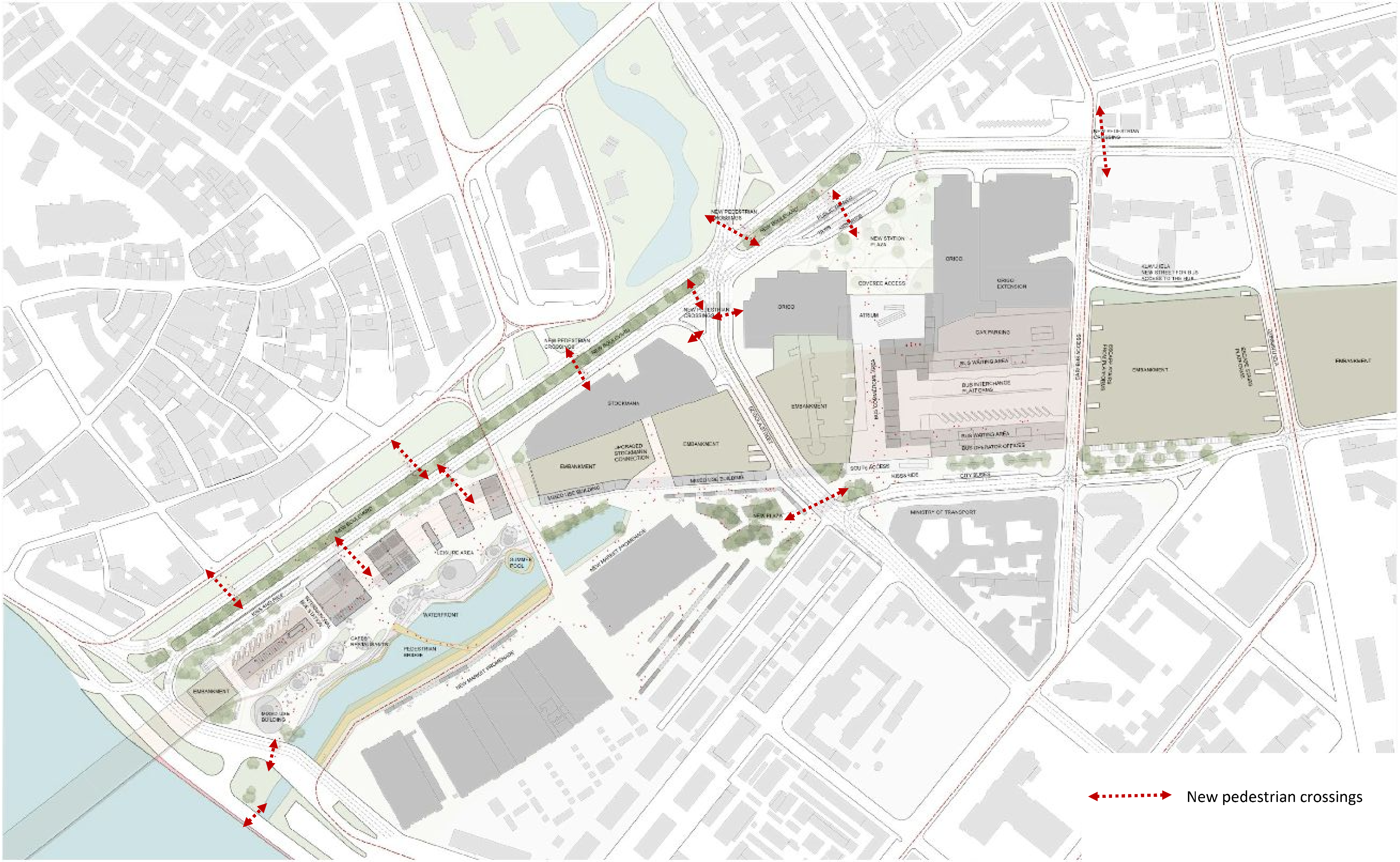
The **distance to the Ministry of Transport** would be lower than minimum.

The **free distance until the water feature** would be highly reduced.

URBAN BEST SOLUTION_Urban New pedestrian connections

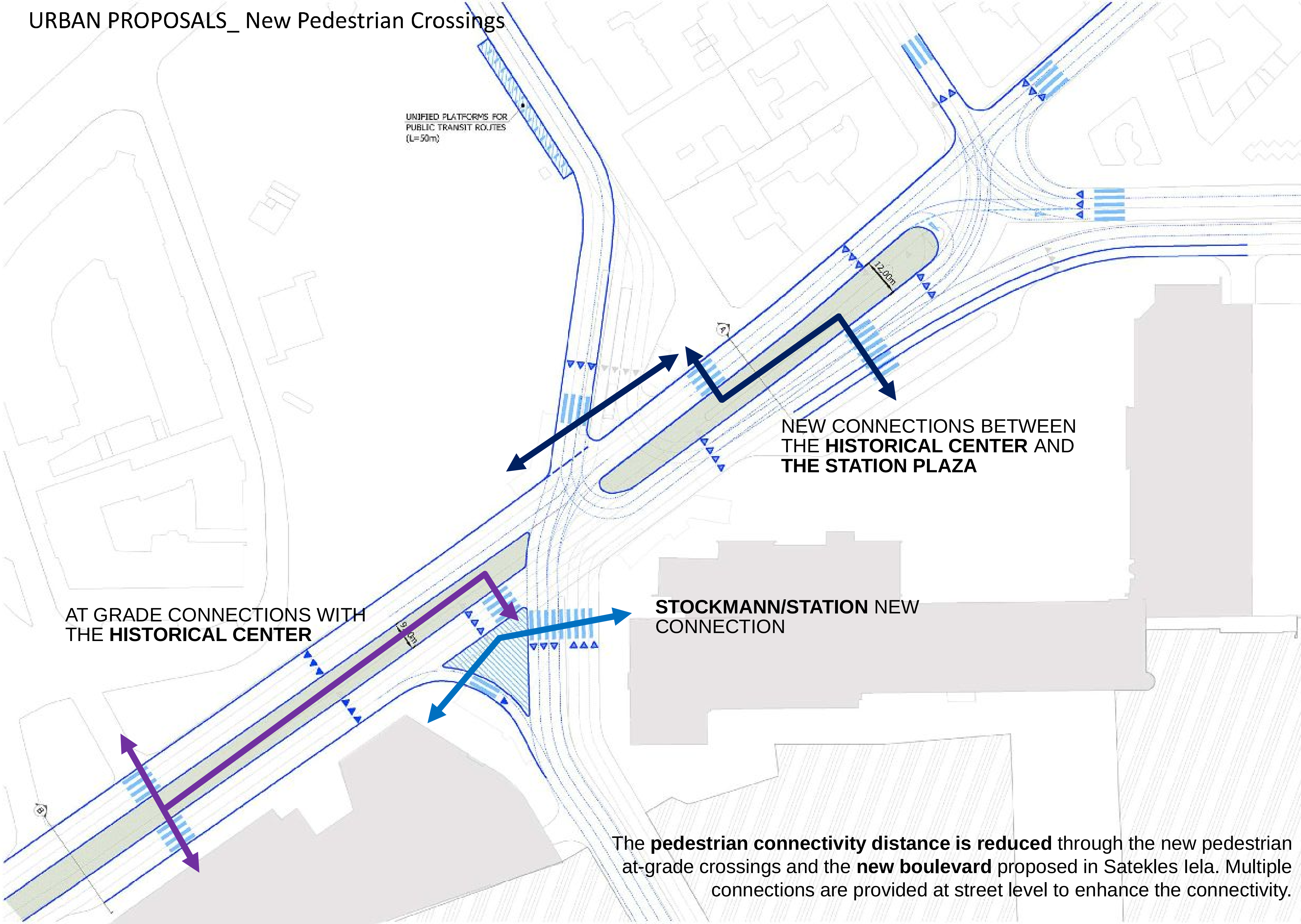


New pedestrian crossings



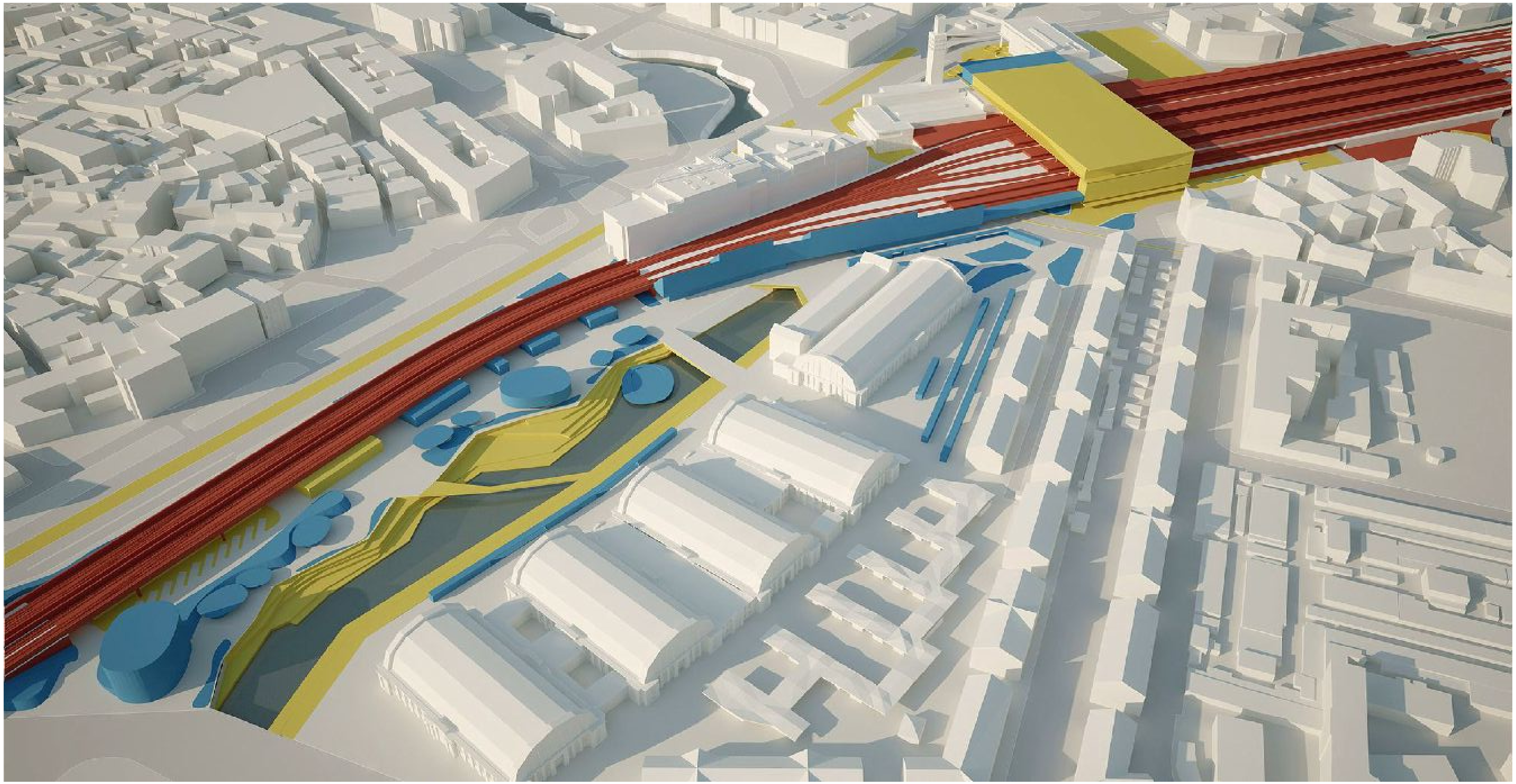
AECOM

URBAN PROPOSALS_ New Pedestrian Crossings

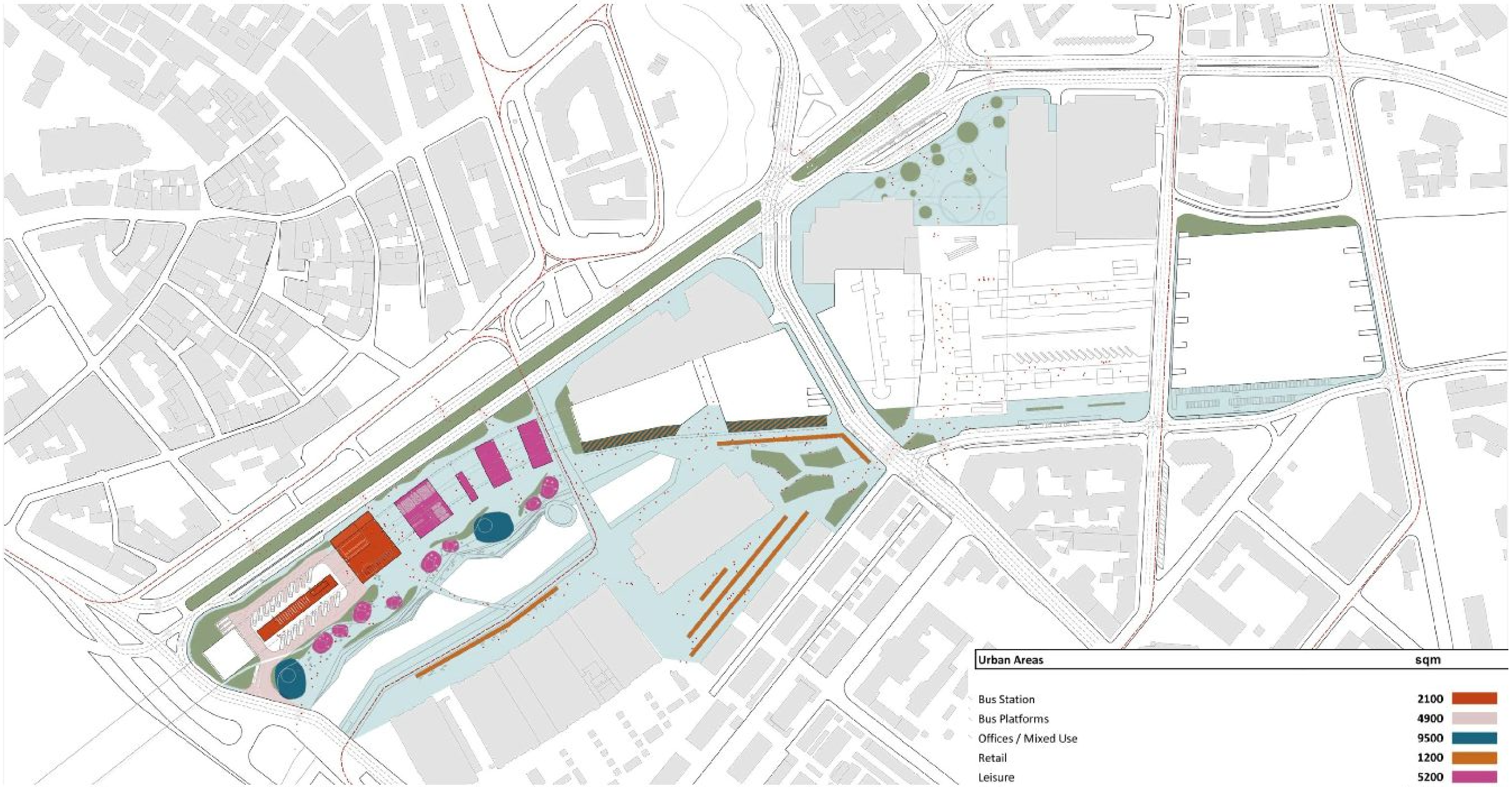


The **pedestrian connectivity distance is reduced** through the new pedestrian at-grade crossings and the **new boulevard** proposed in Satekles Iela. Multiple connections are provided at street level to enhance the connectivity.

Options for Compromise



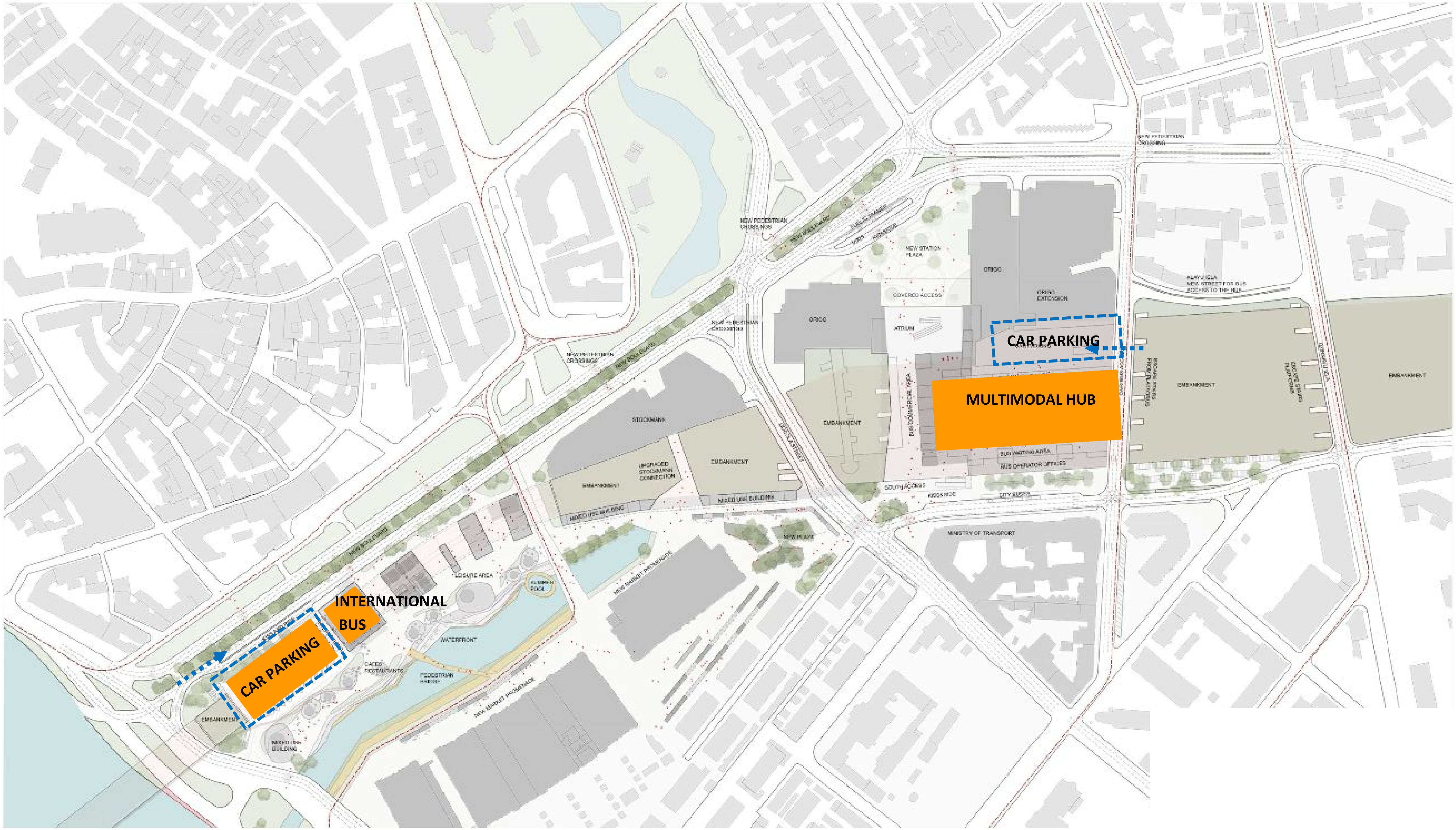
AREAS AND USES



Urban Areas	sqm
Bus Station	2100
Bus Platforms	4900
Offices / Mixed Use	9500
Retail	1200
Leisure	5200
Landscape	155000

AECOM

New Car Parking related to New Bus Station and Multimodal Hub



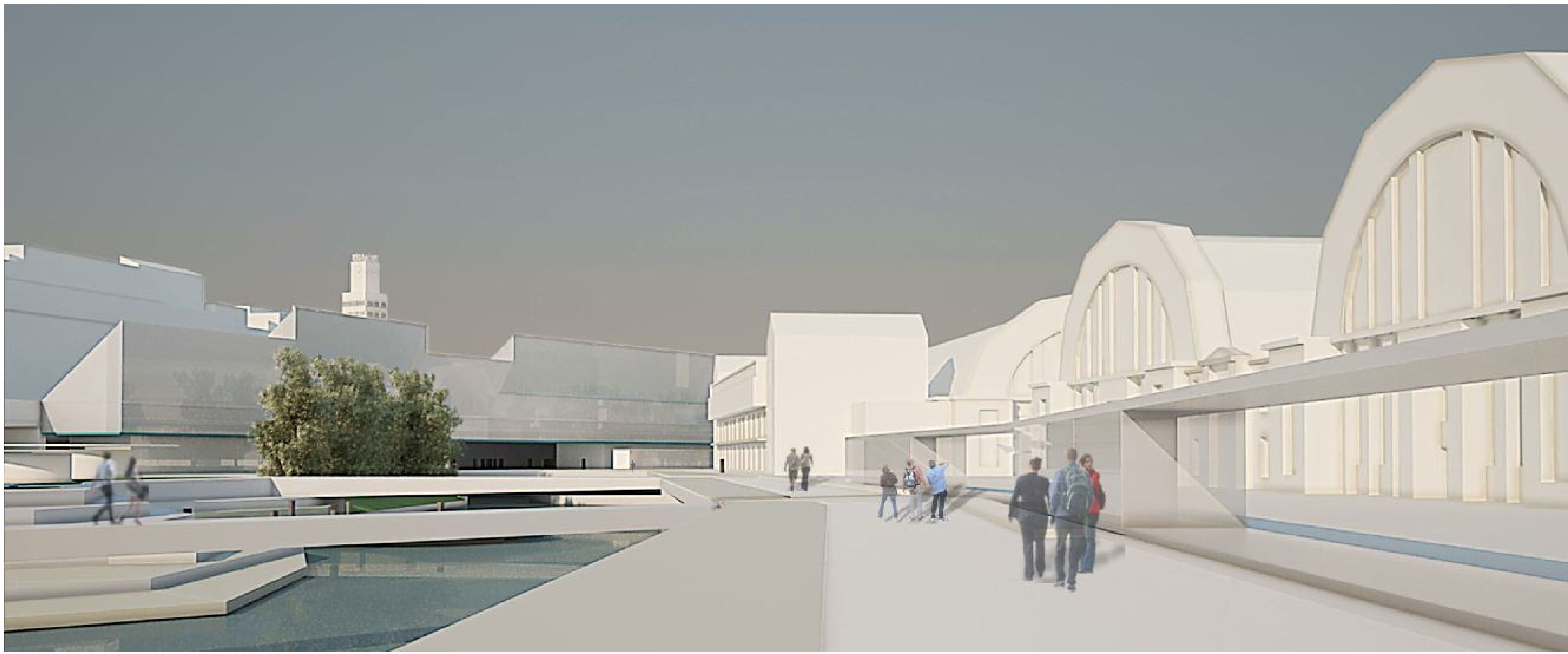
AECOM

URBAN BEST SOLUTION: Overall view

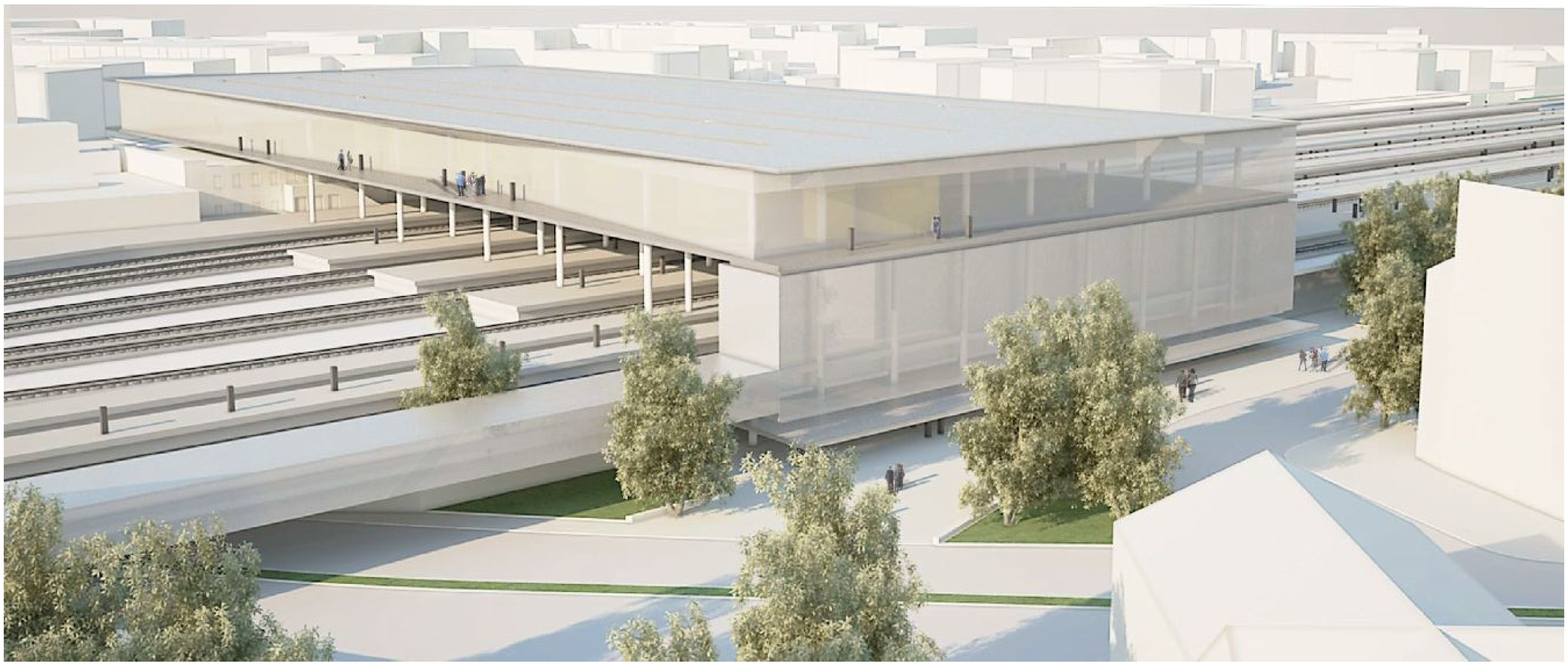
URBAN BEST SOLUTION: Overall view from City Center

URBAN BEST SOLUTION: Waterfront

URBAN BEST SOLUTION: Market area



URBAN BEST SOLUTION: South Entrance to Multimodal Hub



AECOM

URBAN BEST SOLUTION: North Entrance to Multimodal Hub

AECOM

URBAN BEST SOLUTION: Views from the Multimodal Hub

URBAN BEST SOLUTION: Bus Interchange in the Multimodal Hub

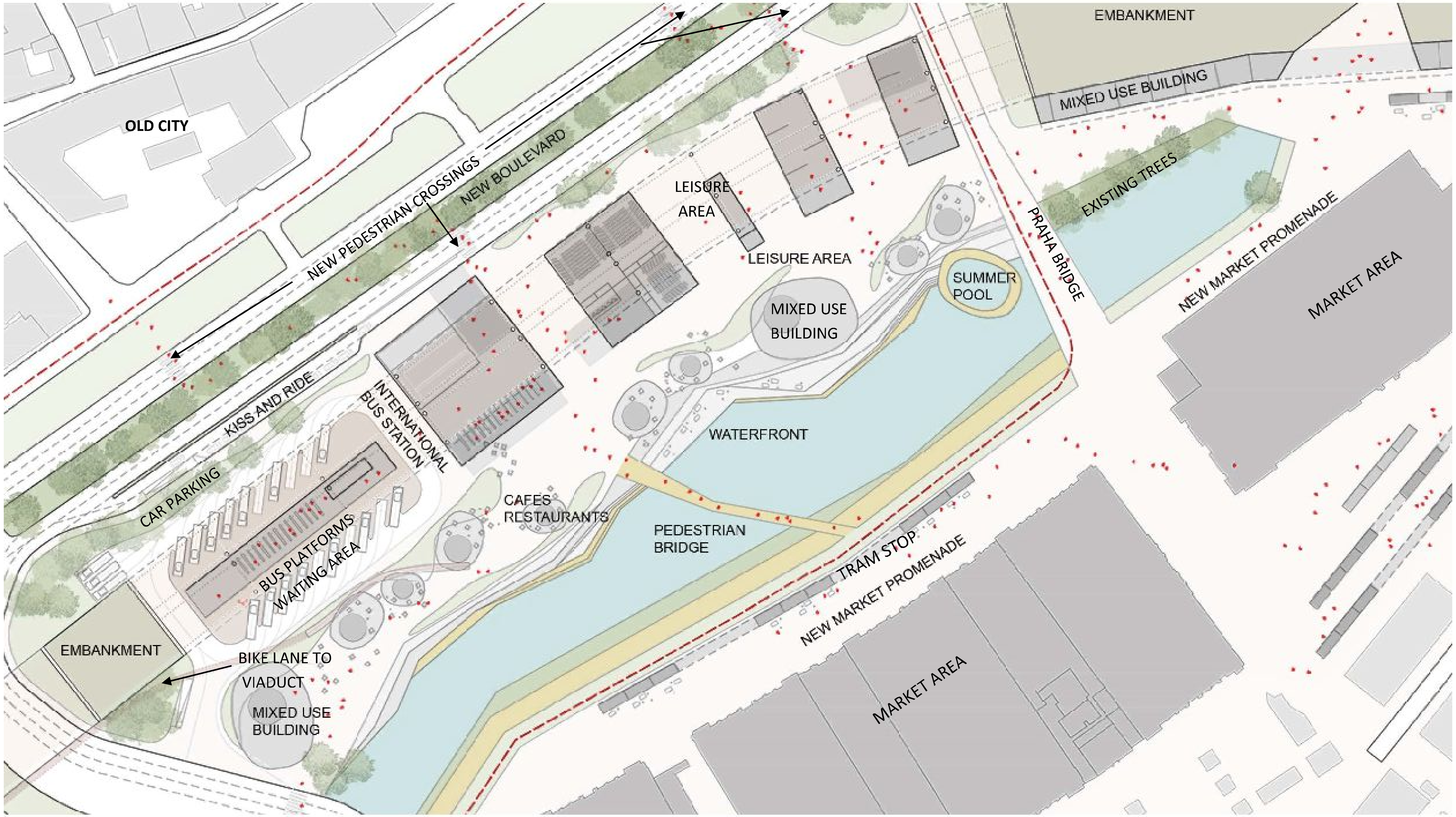
AECOM

URBAN BEST SOLUTION: International Bus Station Façade to the City

URBAN BEST SOLUTION: International Bus Station

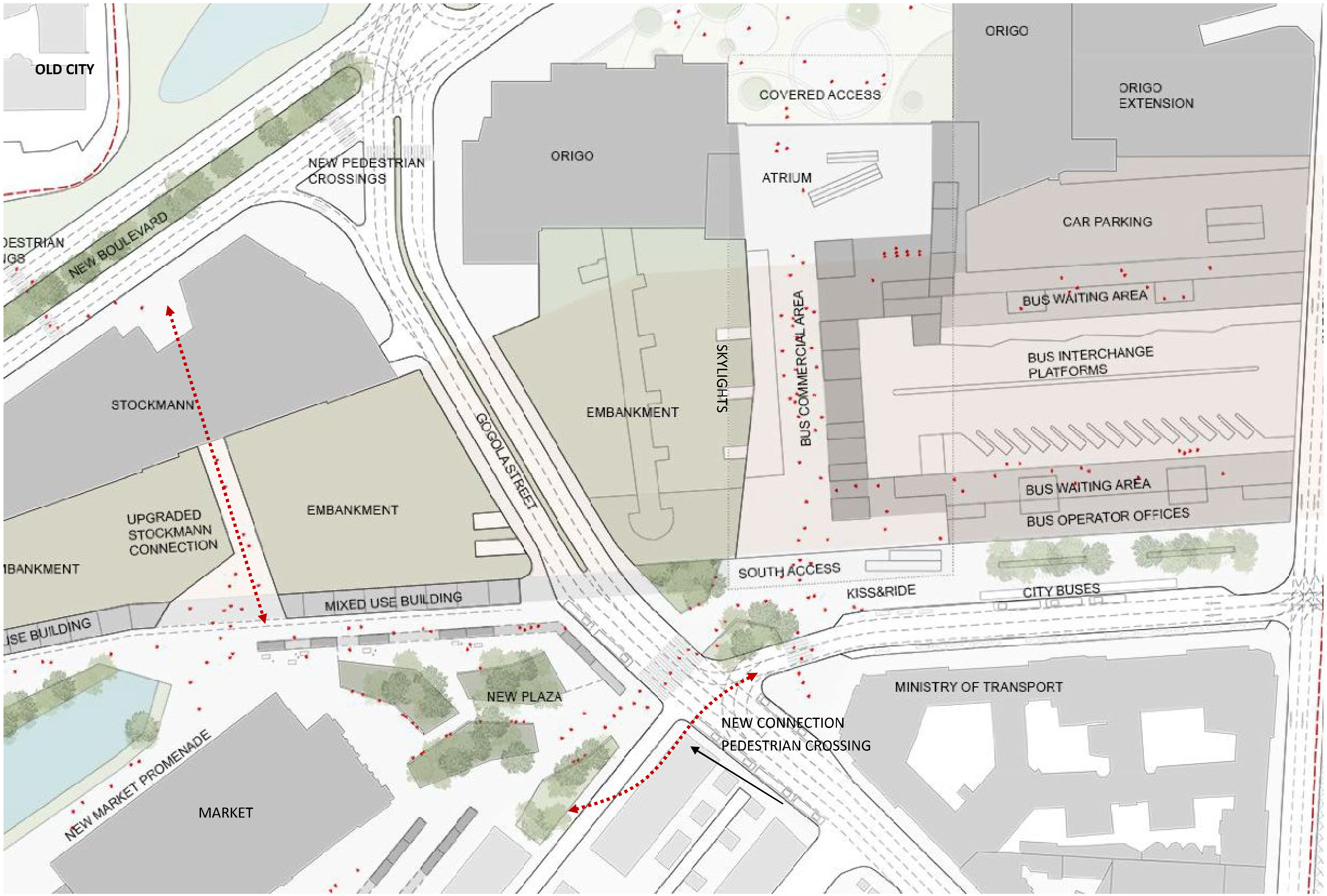
AECOM

URBAN INTEGRATION: Waterfront Area



AECOM

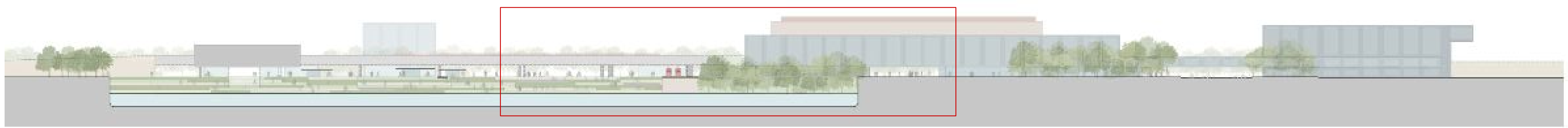
URBAN INTEGRATION: Gogola iela Area

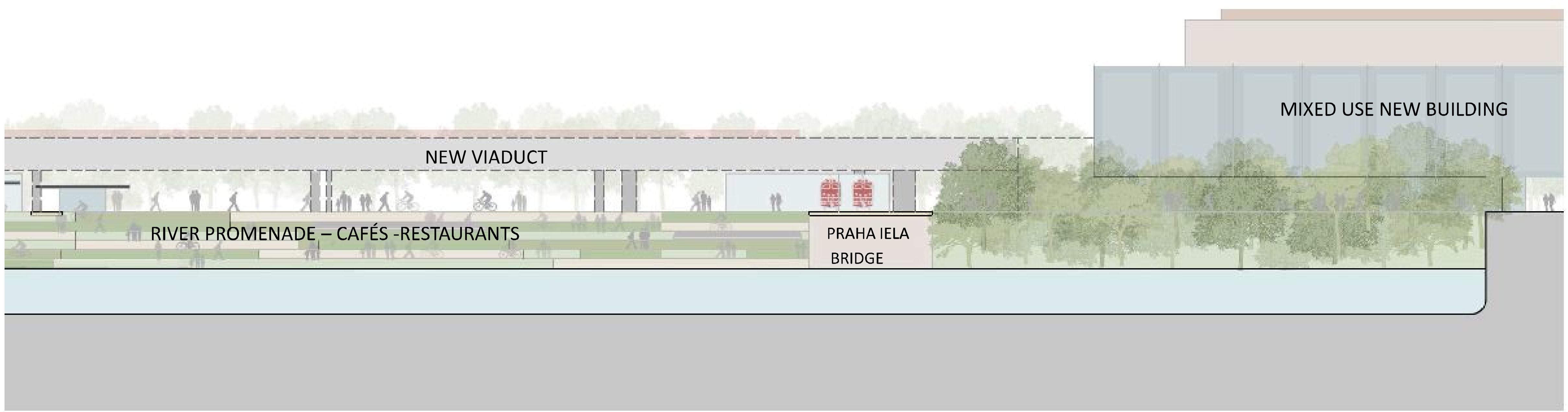


AECOM

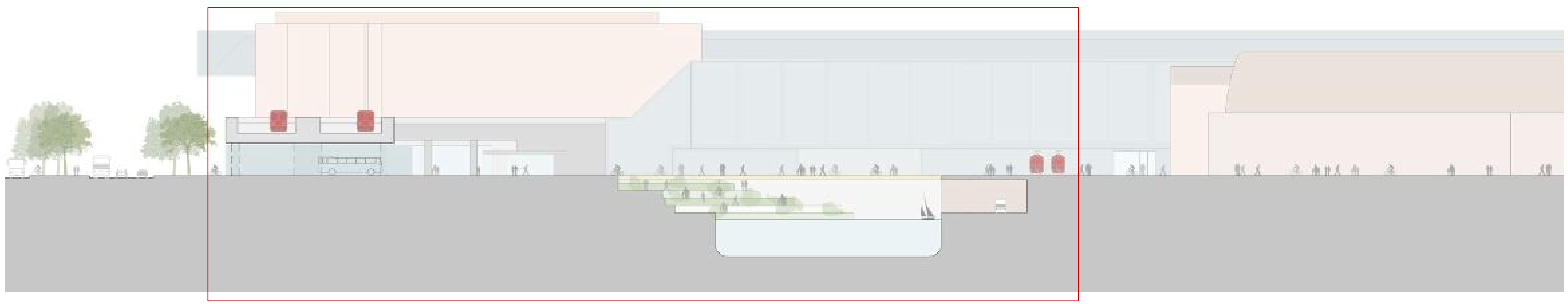
URBAN INTEGRATION: Main access Area

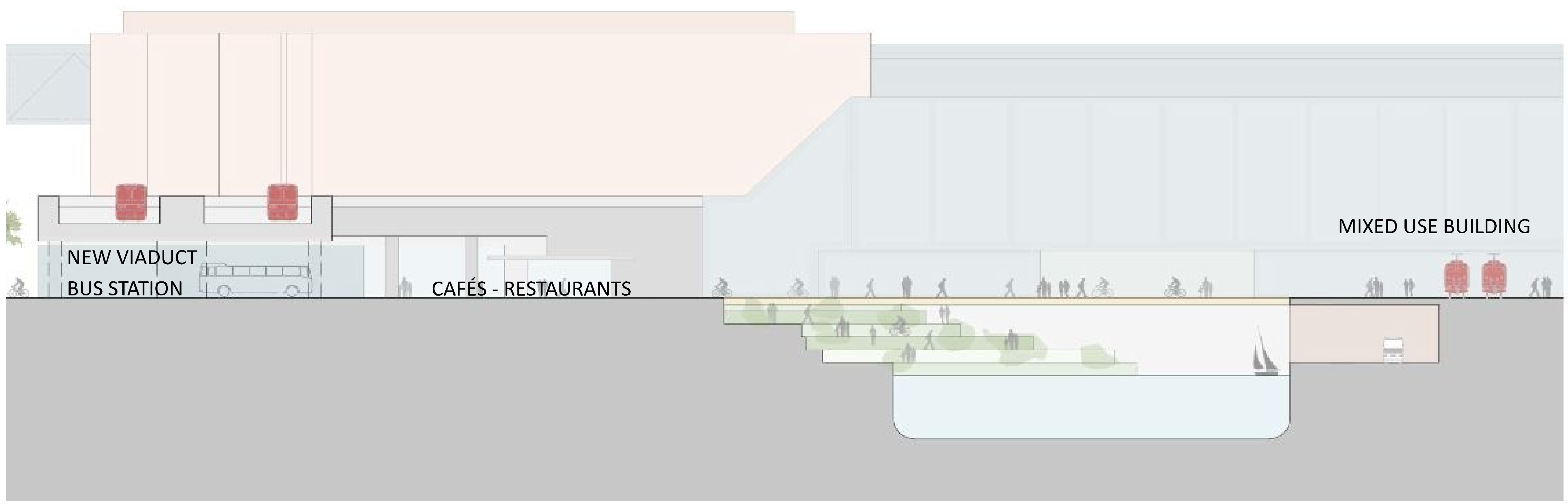
URBAN INTEGRATION: Longitudinal section



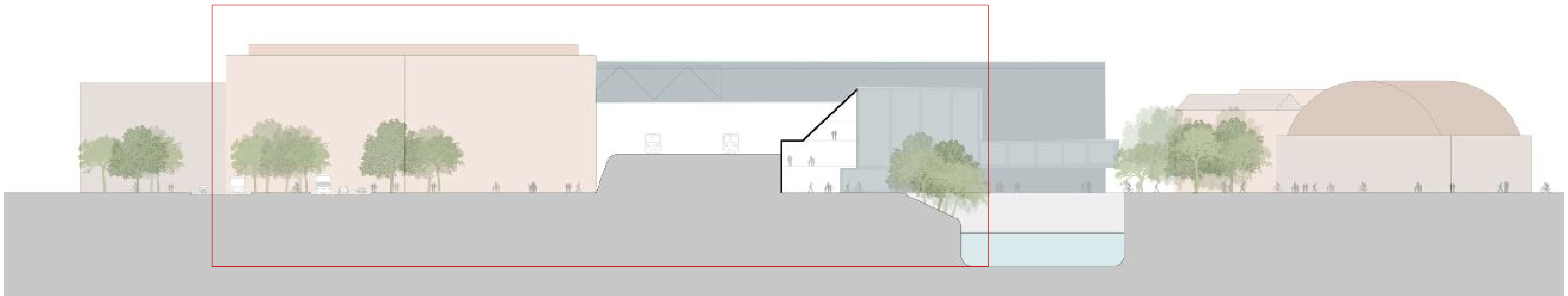


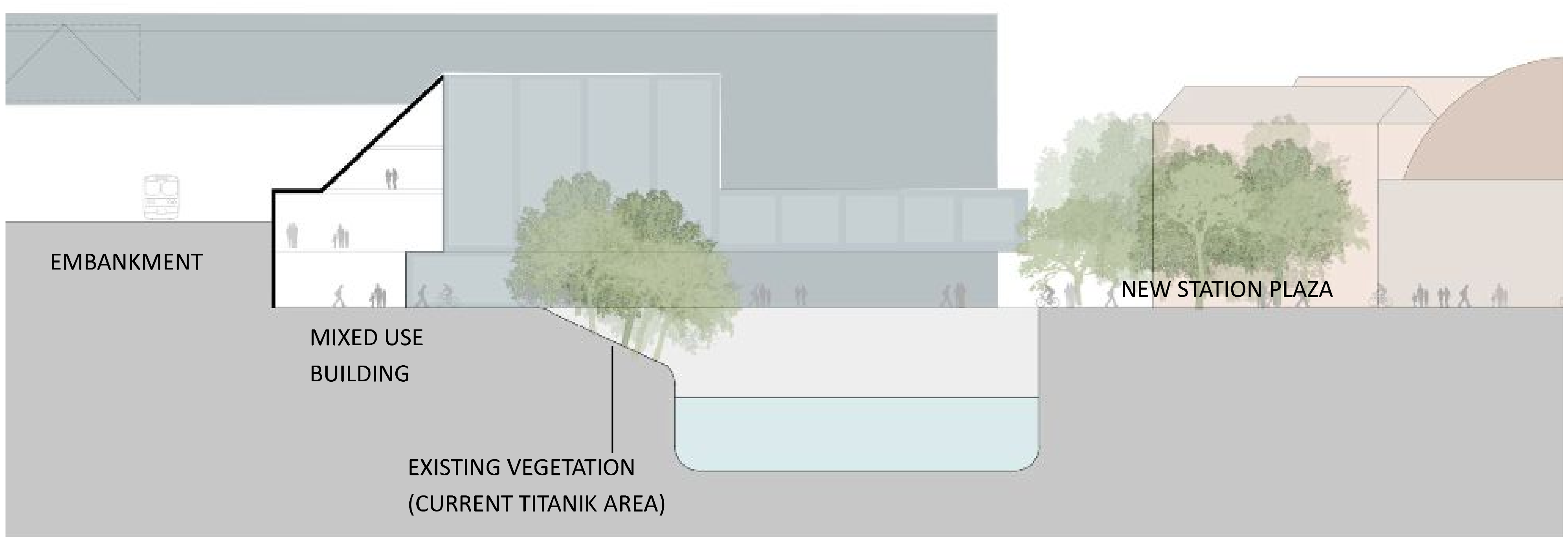
URBAN INTEGRATION: Cross section -Waterfront





URBAN INTEGRATION: Cross section –Mixed Use Building





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Bus Station Options

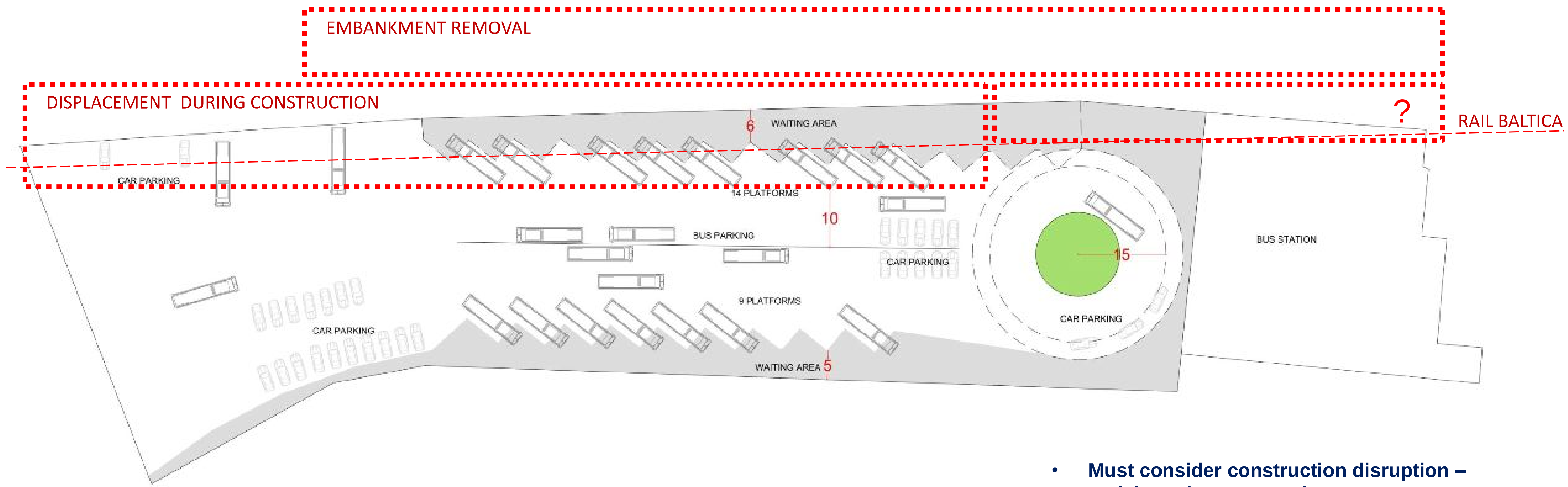
RAIL BALTICA ALIGNMENT

Rail Baltica alignment affects the following buildings and existing volumes:
- Titaniks Car Parking
- Coach Station
- Coach Platforms

AECOM

RAIL BALTICA ALIGNMENT – PHASE 1 CONSTRUCTION IMPLEMENTATION

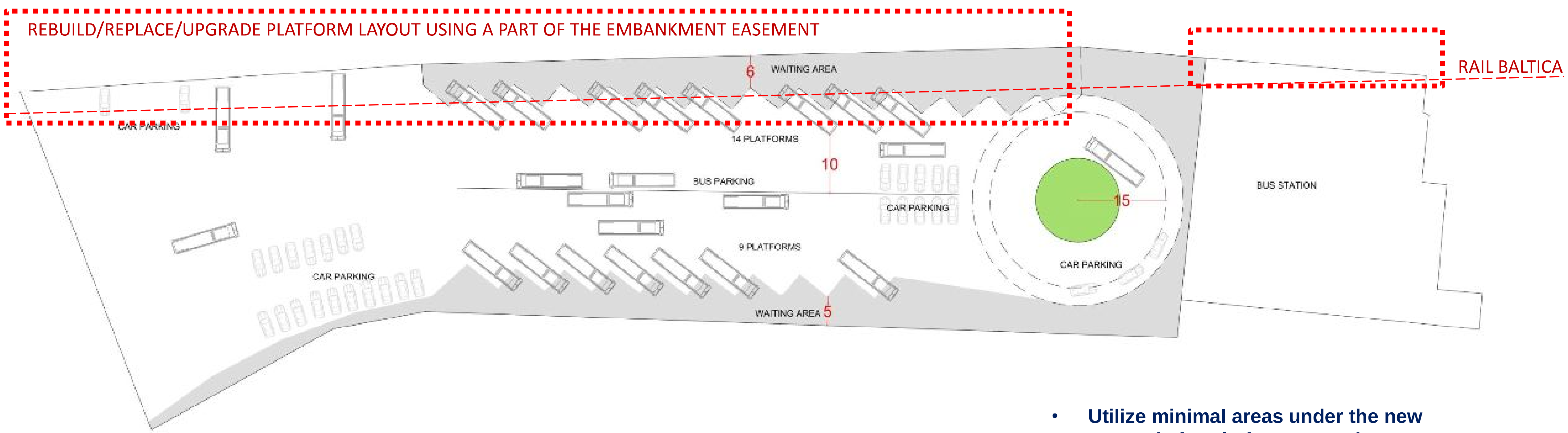
- 23 Bus platforms
- Car Parking serving the bus station



- Must consider construction disruption – anticipated 24-36 months
- Partial occupancy possible – partial relocation to alternate off-site location may be required (Torņakalns?)

MINIMAL INTERVENTION – FULL FUNCTION REPLACEMENT

- 23 (+) Bus platforms – maintain existing routes and services
- Car Parking serving the bus station
- Additional car parking and other transport access from 13.janvara iela



- **Utilize minimal areas under the new estacade for platform upgrade purposes.**
- **Renovate existing bus station at current location**
- **Possible ancillary functions under the estacade – parking, taxis, kiss & ride – access from 13. janvara iela.**

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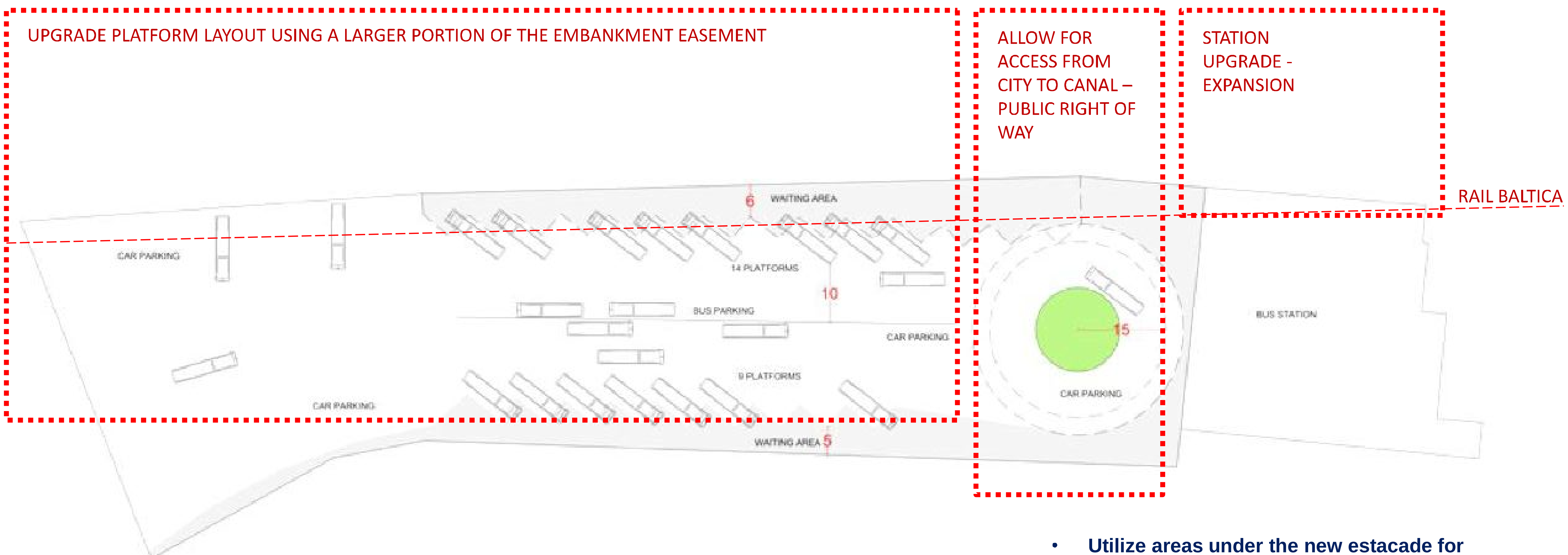
MEDIUM INTERVENTION – FUNCTION ĖNHANCEMENT

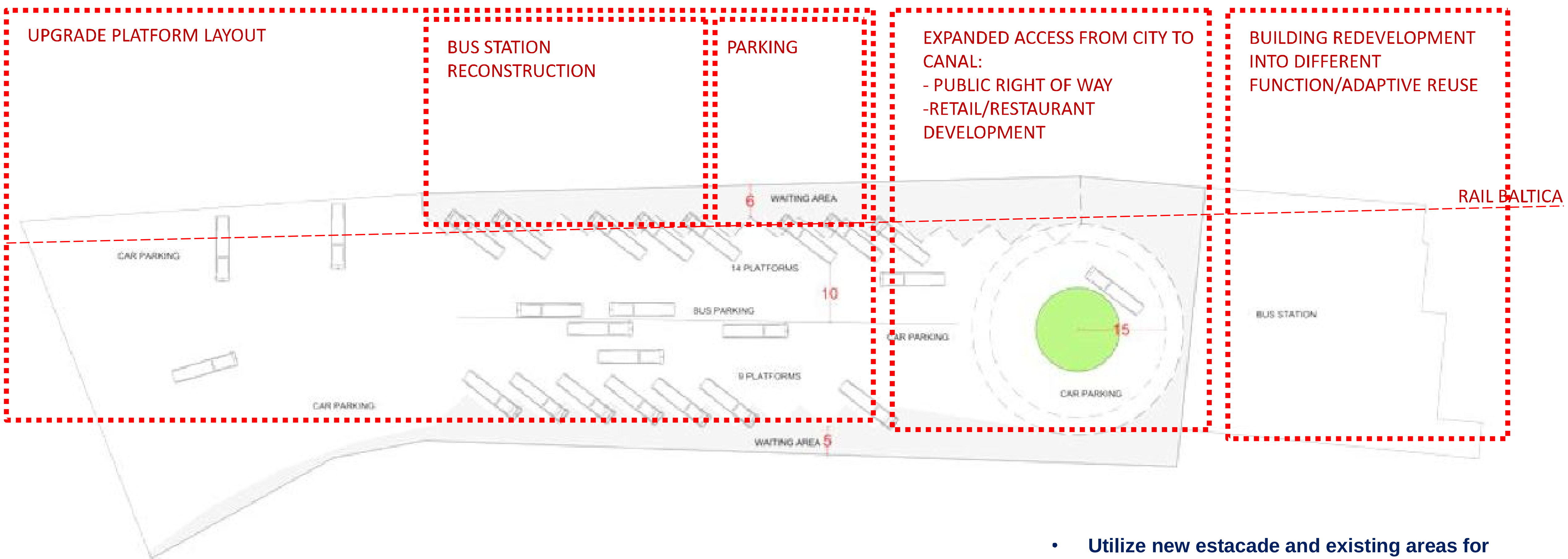
- 30 (+) Bus platforms – for all coach routes
- Car Parking serving the bus station
- Additional car parking and other transport access from 13.janvara iela



- **Utilize areas under the new estacade for significant platform upgrade purposes and possible pedestrian public access from old town to canal.**
- **Expand existing bus station at current location.**
- **Ancillary functions under the estacade – parking, taxis, kiss & ride – access from 13. janvara iela.**

MEDIUM + INTERVENTION – FUNCTION SEGREGATION

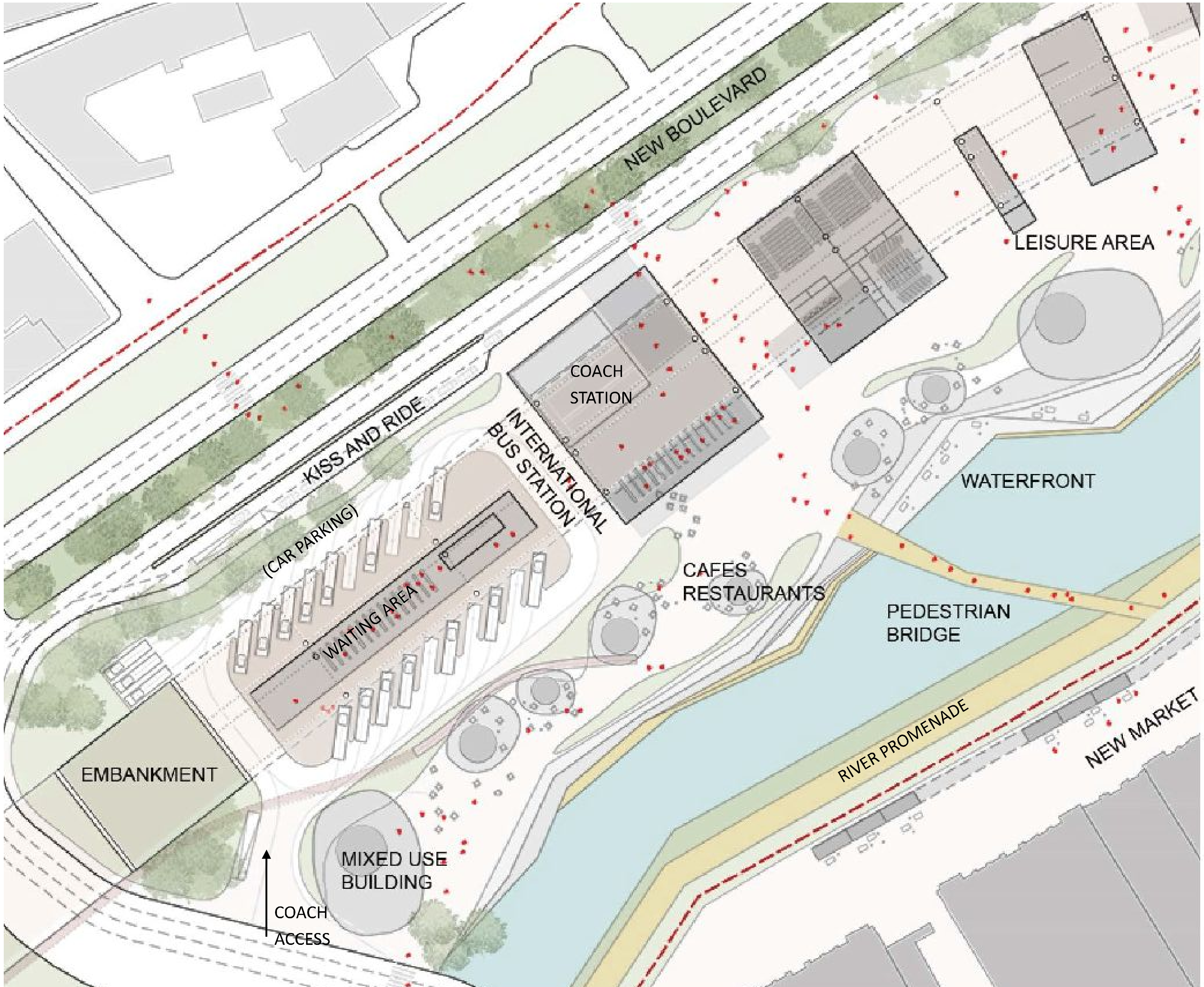
- 20 (+) Bus platforms for Tourist + all International Service
- Car Parking serving the bus station
- Additional car parking and other transport access from 13.janvara iela
- Regional bus service partially relocated to Torņakalns and Central Rail Station



- Utilize new estacade and existing areas for platform upgrade purposes and possible pedestrian public access from old town to canal.
- Reconstruct bus station at new location with access from 13.janvara iela.
- Ancillary functions under the estacade – parking, taxis, kiss & ride – access from 13. janvara iela.

AECOM

BUS LAYOUT ALTERNATIVE – FUNCTIONS UNDER NEW VIADUCT



AECOM

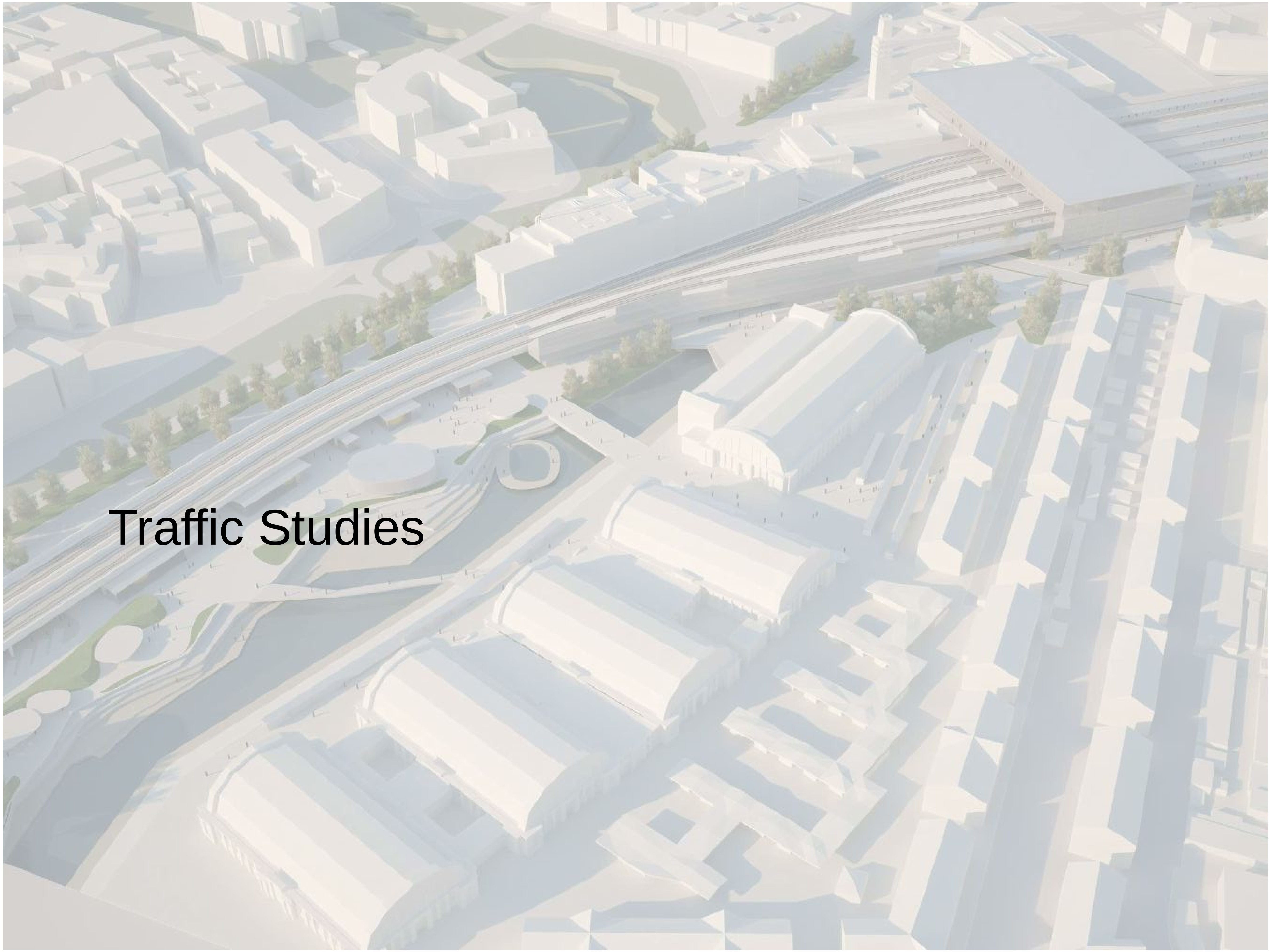
Appendix WP 2.7.4 - Traffic Studies

RPTH RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

TRAFFIC STUDIES

AECOM

Traffic Studies



ROAD NETWORK CONNECTIONS – STREET DIRECTIONS 1

Street directions

STREET DIRECTIONS – CITY TRANSPORT AXIS

- Elizabetes iela – Timoteja iela – Turgeņeva iela - **SOUTHBOUND**
- Puškina iela – Dzirnavu iela – **NORTHBOUND**

Creation of City Axis from/to Krasta iela –

CONNECTION TO LATVIAN HIGHWAYS NETWORK THROUGH *Autoceļš A6*

TO LATVIAN NETWORK

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ROAD NETWORK CONNECTIONS – STREET DIRECTIONS 2

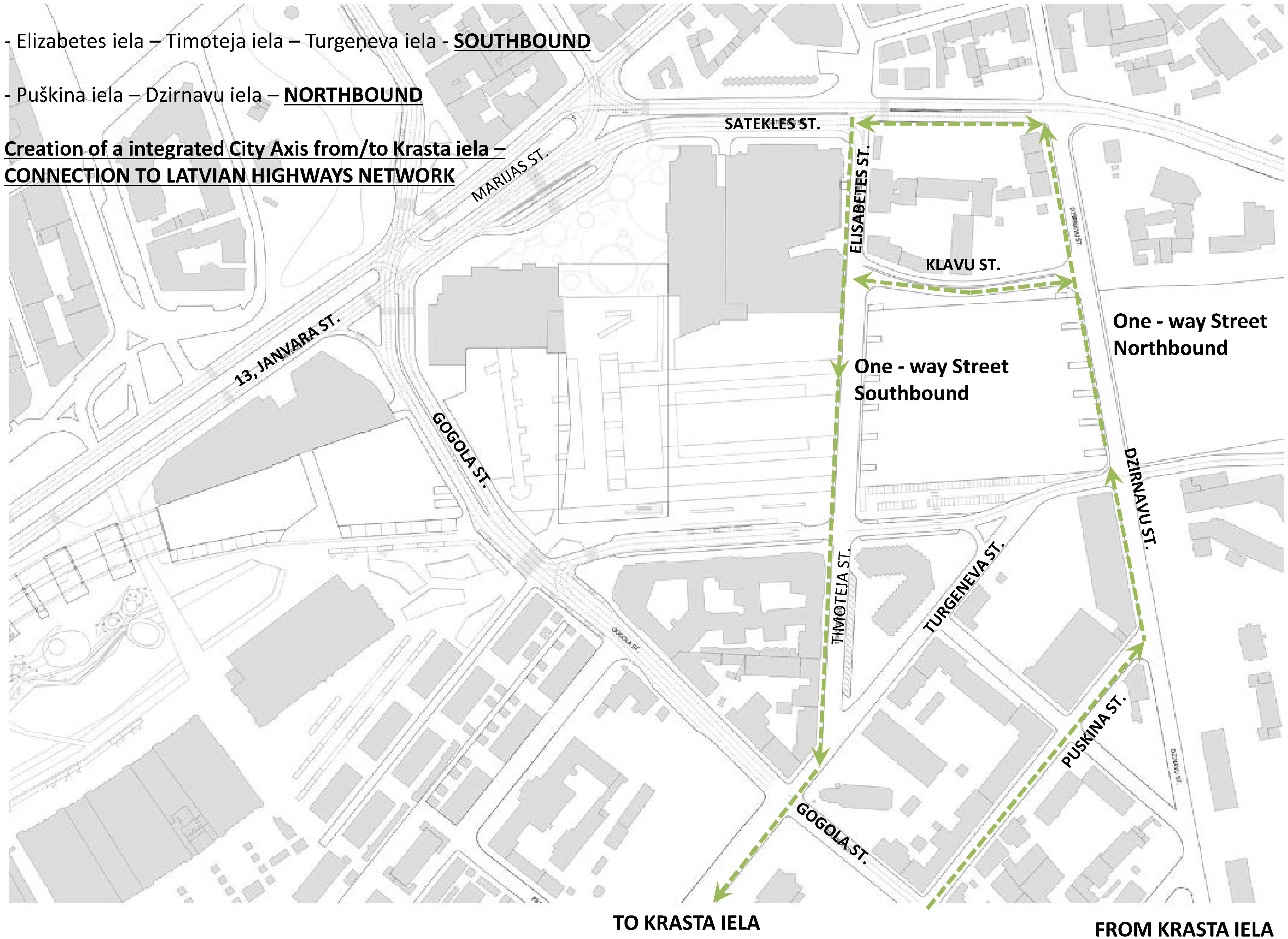
Street directions

STREET DIRECTIONS – CITY TRANSPORTION AXIS

- Elizabetes iela – Timoteja iela – Turgeņeva iela - **SOUTHBOUND**

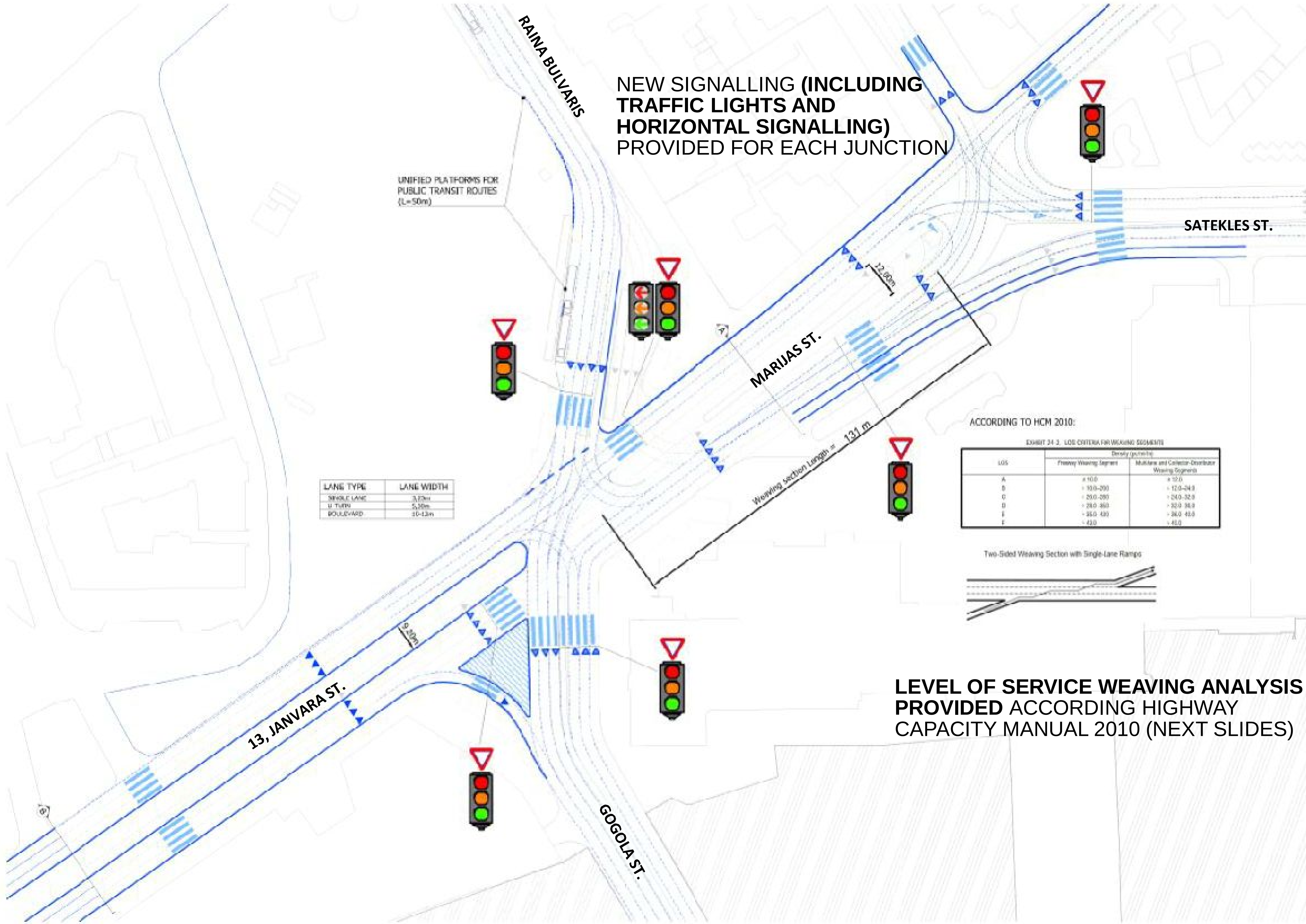
- Puškina iela – Dzirnavu iela – **NORTHBOUND**

Creation of a integrated City Axis from/to Krasta iela – CONNECTION TO LATVIAN HIGHWAYS NETWORK



AECOM

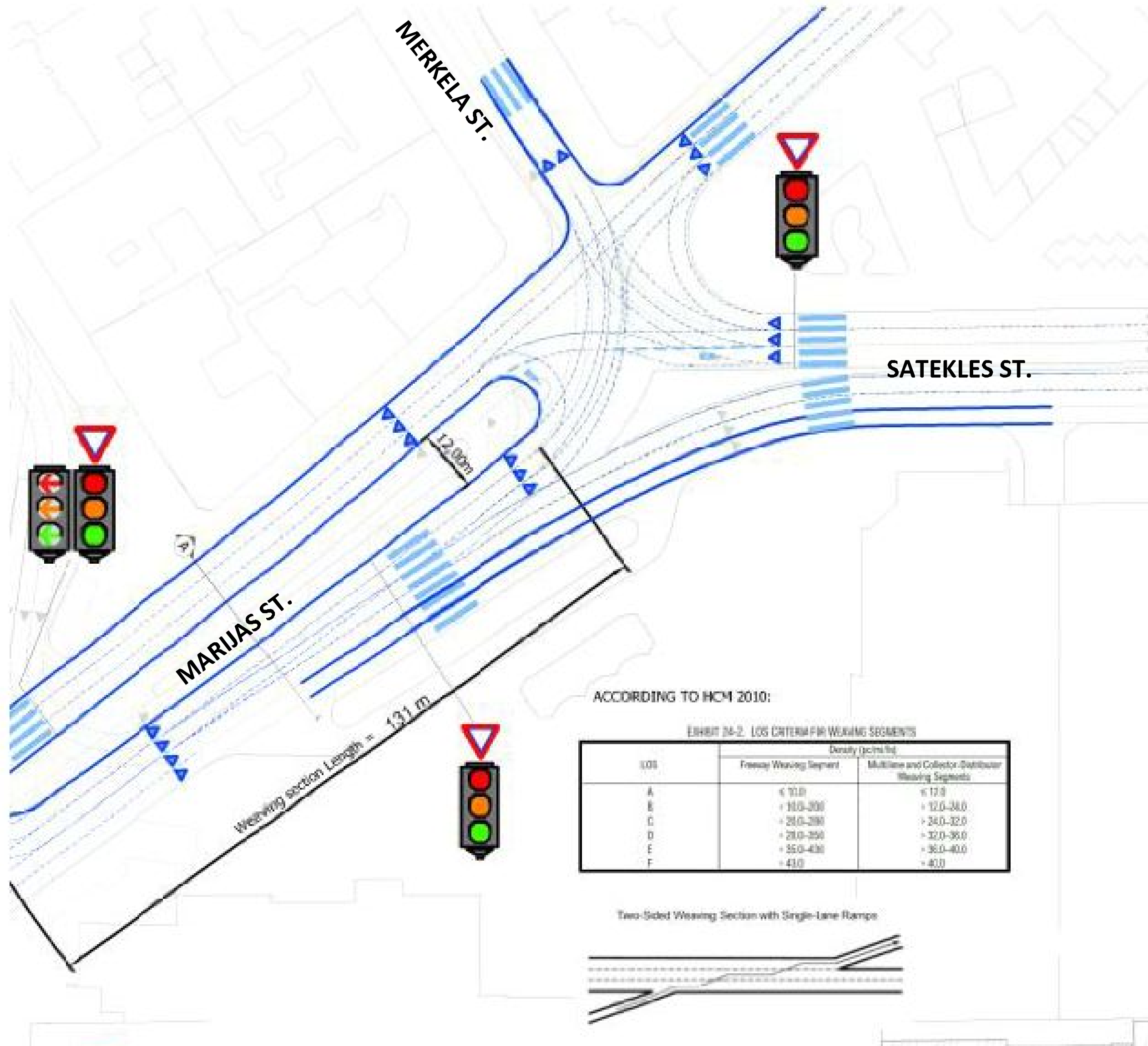
URBAN PROPOSALS_ Junctions in Marijas iela – 13. janvara iela – Satekles iela proposals.



AECOM

URBAN PROPOSALS_ Junctions in Marijas iela – 13. janvara iela – Satekles iela proposals.
Weaving capacity analysis - 1

LEVEL OF SERVICE WEAVING ANALYSIS PROVIDED
.ACCORDING HIGHWAY CAPACITY MANUAL 2010



FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	Eastbound
Agency/Company	AECOM	Weaving Seg Location	Marijas Iela
Date Performed	12/11/2015	Jurisdiction	Riga
Analysis Time Period	8:00 - 9:00	Analysis Year	2015

Inputs

Freeway free-flow speed, S_{FF} (km/h)	60	Weaving type	C
Weaving number of lanes, N	4	Volume ratio, VR	0.45
Weaving seg length, L (m)	130	Weaving ratio, R	0.03
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	456	0.85	15	0	1.5	1.2	0.930	1.00	576
Vo2	887	0.85	15	0	1.5	1.2	0.930	1.00	1121
Vw1	31	0.85	15	0	1.5	1.2	0.930	1.00	39
Vw2	1060	0.85	15	0	1.5	1.2	0.930	1.00	1340
Vw				1379	Vnw				1697
V									3076

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (i = nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.30	6.00		
c (Exhibit 24-6)	0.80	1.10		
d (Exhibit 24-6)	0.60	0.60		
Weaving intensity factor, Wi	1.01	0.73		
Weaving and non-weaving speeds, Si (km/h)	45.90	49.45		

Number of lanes required for unconstrained operation, Nw 2.90
Maximum number of lanes, Nw (max) 3.00

☑ If Nw < Nw(max) unconstrained operation ☐ If Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (km/h)	47.79
Weaving segment density, D (pc/km/ln)	16.09
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	5339
Capacity as a 15-minute flow rate, c (veh/h)	4967
Capacity as a full-hour volume, c_h (veh/h)	4222

Notes

a. Weaving segments longer than 750 m. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

URBAN PROPOSALS_ Junctions in Marijas iela – 13. janvara iela – Satekles iela proposals.
Weaving capacity analysis - 2

LEVEL OF SERVICE WEAVING ANALYSIS PROVIDED
.ACCORDING HIGHWAY CAPACITY MANUAL 2010

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	Eastbound
Agency/Company	AECOM	Weaving Seg Location	Marijas iela
Date Performed	12/11/2015	Jurisdiction	Riga
Analysis Time Period	13:00 - 14:00	Analysis Year	2015

Inputs

Freeway free-flow speed, S_{FF} (km/h)	60	Weaving type	C
Weaving number of lanes, N	4	Volume ratio, VR	0.41
Weaving seg length, L (m)	130	Weaving ratio, R	0.05
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	589	0.85	15	0	1.5	1.2	0.930	1.00	744
Vo2	279	0.85	15	0	1.5	1.2	0.930	1.00	352
Vw1	33	0.85	15	0	1.5	1.2	0.930	1.00	41
Vw2	579	0.85	15	0	1.5	1.2	0.930	1.00	732
Vw				773	Vnw				1096
V									1869

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.30	6.00		
c (Exhibit 24-6)	0.80	1.10		
d (Exhibit 24-6)	0.60	0.60		
Weaving intensity factor, Wi	0.64	0.36		
Weaving and non-weaving speeds, Si (km/h)	50.82	56.25		

Number of lanes required for unconstrained operation, Nw 2.87
Maximum number of lanes, Nw (max) 3.00
☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment speed, S (km/h)	53.87
Weaving segment density, D (pc/km/ln)	8.67
Level of service, LOS	B
Capacity of base condition, c_b (pc/h)	5451
Capacity as a 15-minute flow rate, c (veh/h)	5071
Capacity as a full-hour volume, c_h (veh/h)	4310

Notes

a. Weaving segments longer than 750 m. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	Eastbound
Agency/Company	AECOM	Weaving Seg Location	Marijas iela
Date Performed	12/11/2015	Jurisdiction	Riga
Analysis Time Period	17:00 - 18:00	Analysis Year	2015

Inputs

Freeway free-flow speed, S_{FF} (km/h)	60	Weaving type	C
Weaving number of lanes, N	4	Volume ratio, VR	0.39
Weaving seg length, L (m)	130	Weaving ratio, R	0.05
Terrain	Level		

Conversions to pc/h Under Base Conditions

(pc/h)	V	PHF	Truck %	RV %	E_T	E_R	f_{HV}	f_p	v
Vo1	421	0.85	15	0	1.5	1.2	0.930	1.00	532
Vo2	812	0.85	15	0	1.5	1.2	0.930	1.00	1026
Vw1	43	0.85	15	0	1.5	1.2	0.930	1.00	54
Vw2	746	0.85	15	0	1.5	1.2	0.930	1.00	943
Vw				997	Vnw				1558
V									2555

Weaving and Non-Weaving Speeds

	Unconstrained		Constrained	
	Weaving (i = w)	Non-Weaving (i = nw)	Weaving (i = w)	Non-Weaving (= nw)
a (Exhibit 24-6)	0.08	0.00		
b (Exhibit 24-6)	2.30	6.00		
c (Exhibit 24-6)	0.80	1.10		
d (Exhibit 24-6)	0.60	0.60		
Weaving intensity factor, Wi	0.79	0.47		
Weaving and non-weaving speeds, Si (km/h)	48.56	54.03		

Number of lanes required for unconstrained operation, Nw 2.86
Maximum number of lanes, Nw (max) 3.00
☑ If Nw < Nw(max) unconstrained operation ☐ if Nw > Nw (max) constrained operation

Weaving Segment Speed, Density, Level of Service, and Capacity

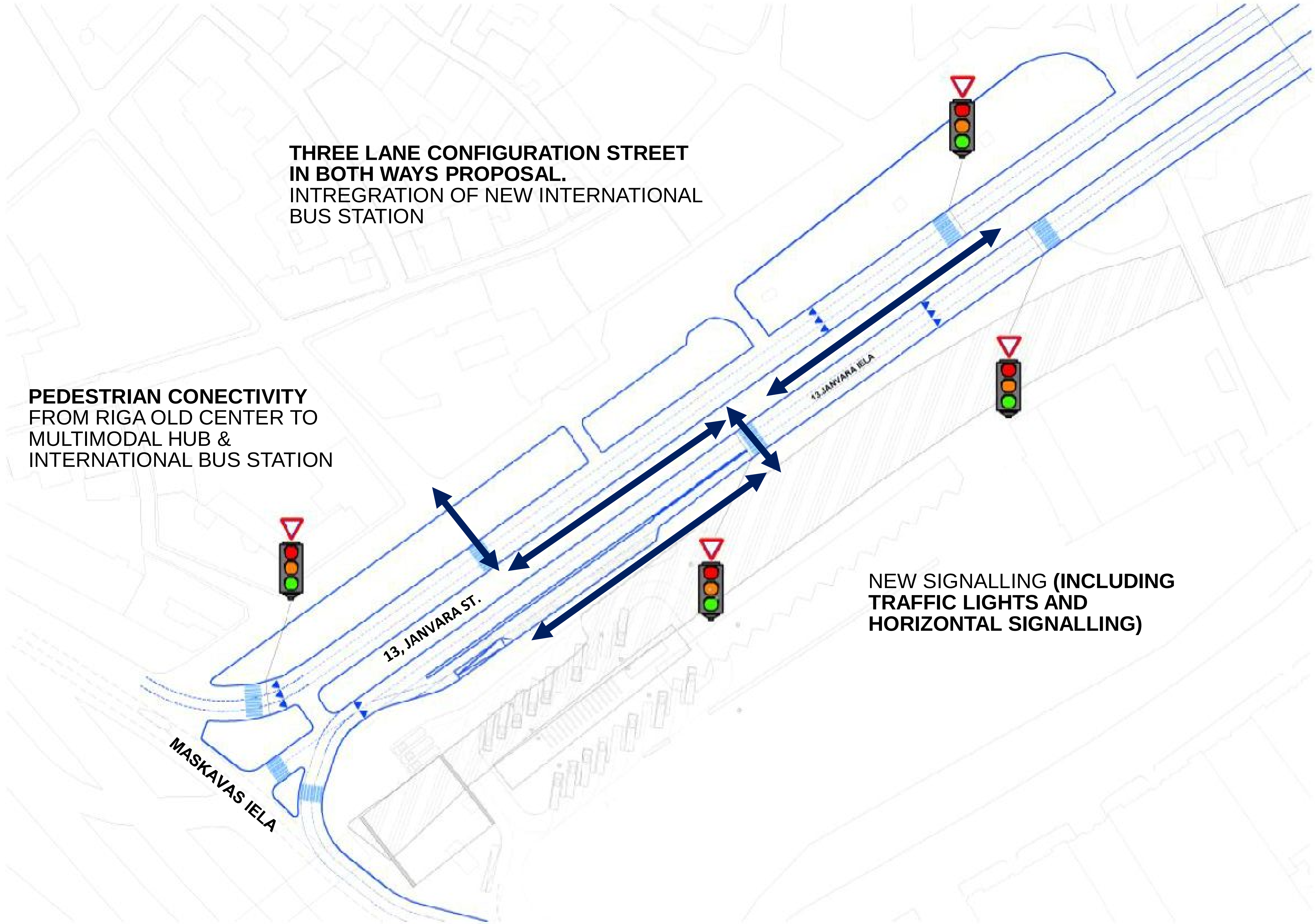
Weaving segment speed, S (km/h)	51.76
Weaving segment density, D (pc/km/ln)	12.34
Level of service, LOS	C
Capacity of base condition, c_b (pc/h)	5600
Capacity as a 15-minute flow rate, c (veh/h)	5209
Capacity as a full-hour volume, c_h (veh/h)	4428

Notes

a. Weaving segments longer than 750 m. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

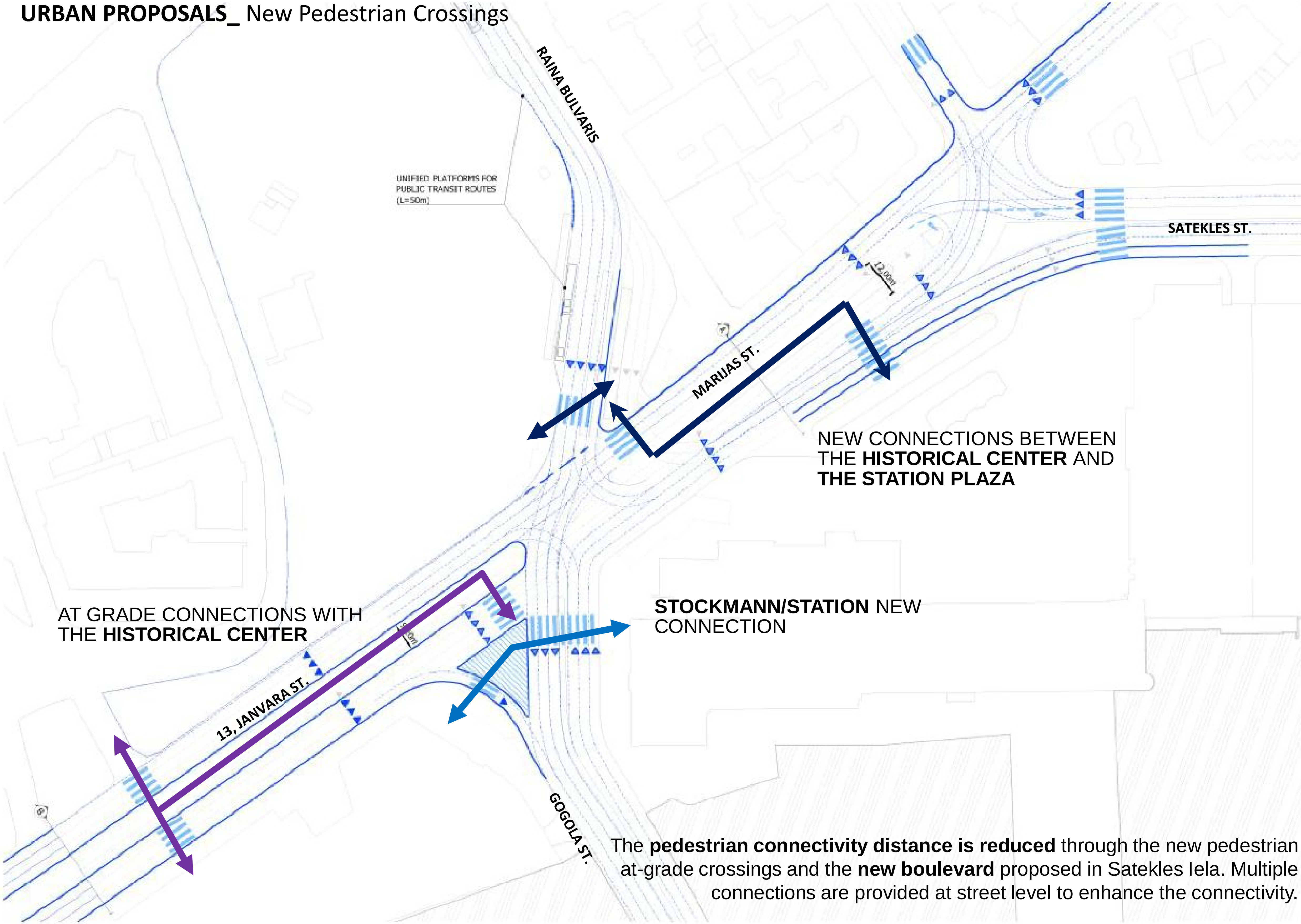
AECOM

URBAN PROPOSALS_ 13. janvara iela – International Bus Station configuration



AECOM

URBAN PROPOSALS_ New Pedestrian Crossings

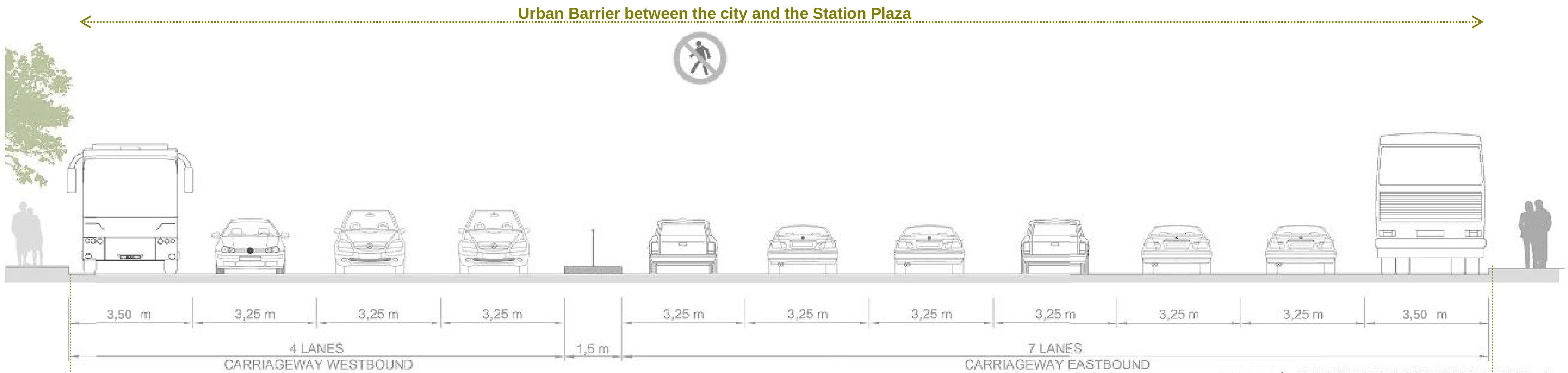


The **pedestrian connectivity distance is reduced** through the new pedestrian at-grade crossings and the **new boulevard** proposed in Satekles Iela. Multiple connections are provided at street level to enhance the connectivity.

AECOM

URBAN PROPOSALS_ Marijas Iela Section

-EXISTING



MARIJAS IELA STREET EXISTING SECTION - A
E: 1/100

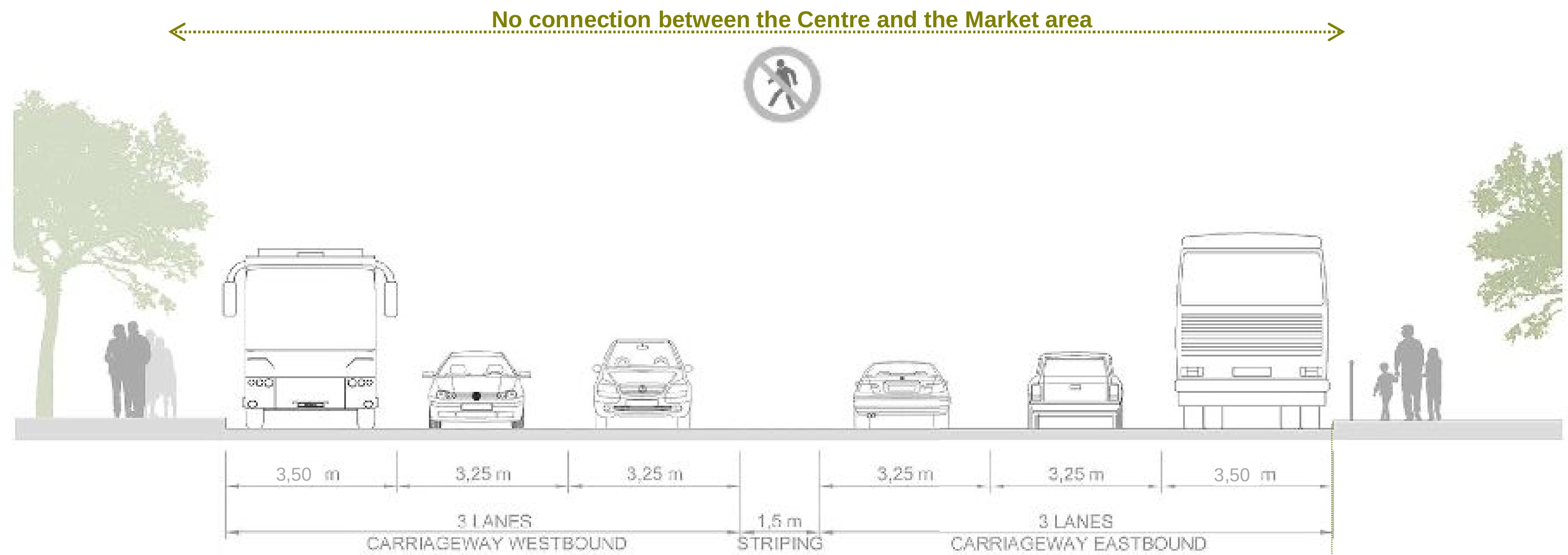
-PROPOSED: The New Boulevar will allow to define an at-grade connection between the city and the Station Plaza

MARIJAS IELA STREET PROPOSED SECTION - A
E: 1/100

AECOM

URBAN PROPOSALS_ 13.janvara iela Section

-EXISTING



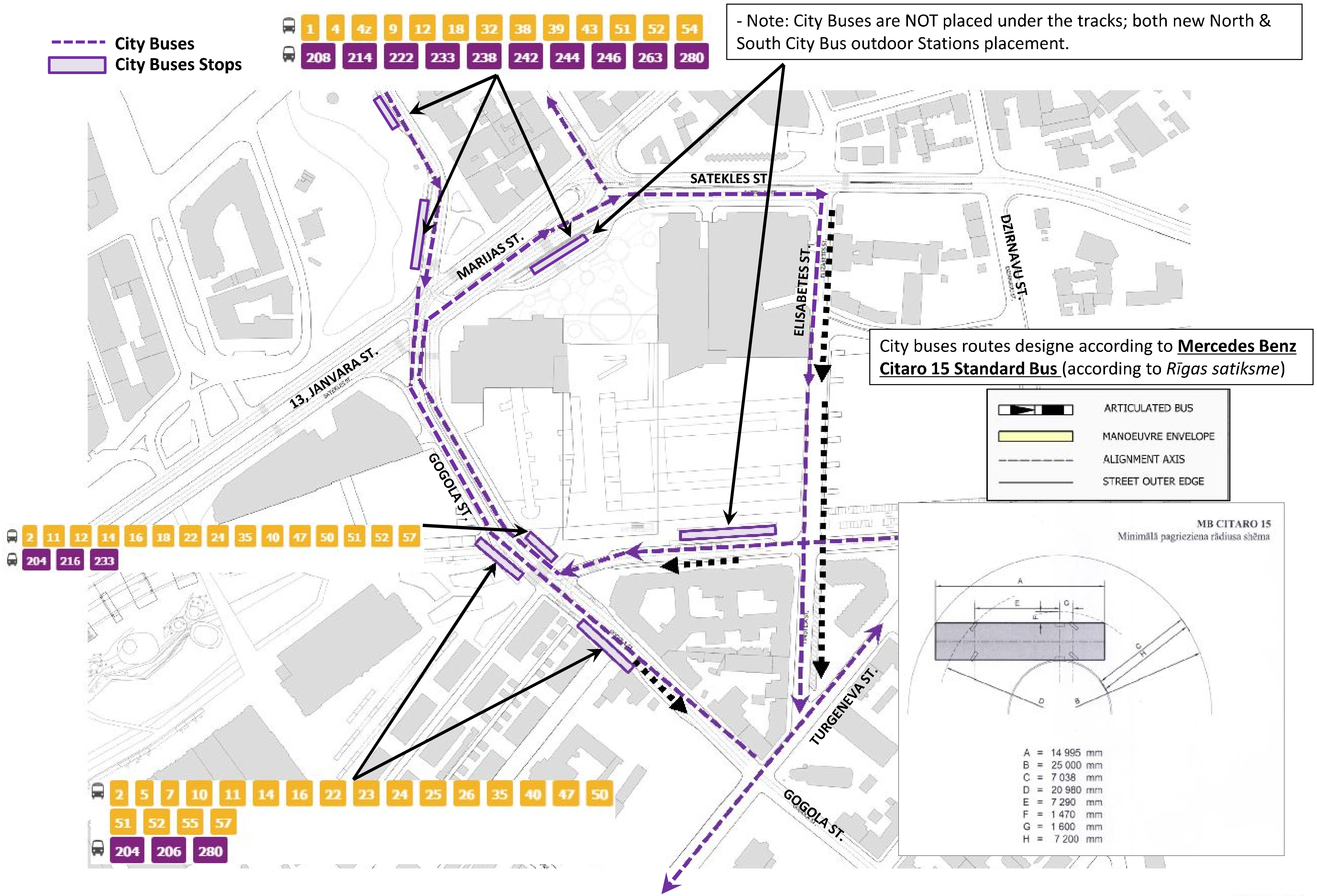
JANVARA IELA STREET TYPICAL SECTION
E: 1/100

-PROPOSED: The New Boulevar will allow to define an at-grade connection between the Historical centre and the Market Area

JANVARA IELA STREET PROPOSED SECTION - B
E: 1/100

AECOM

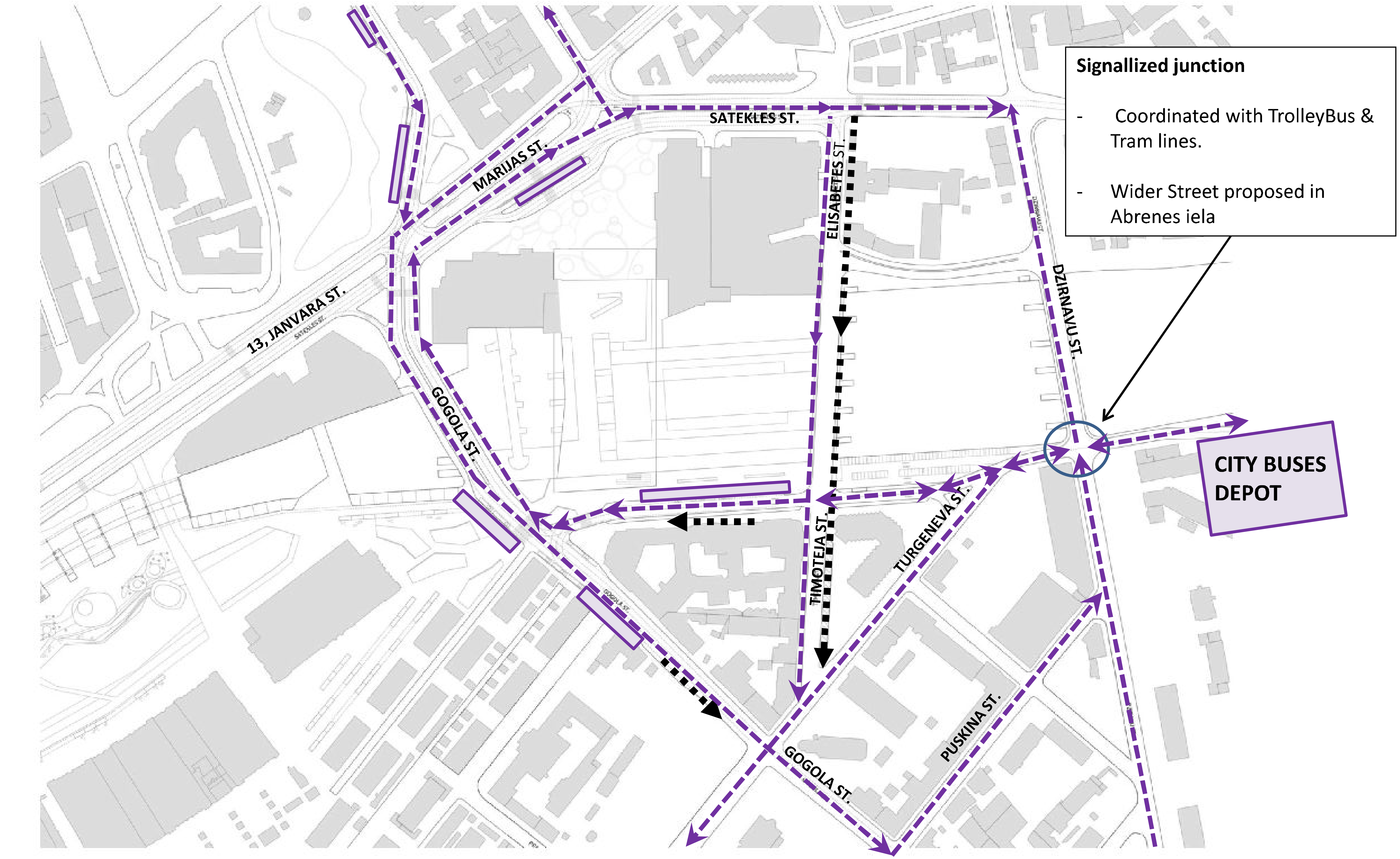
CITY BUSES & MINIBUSES NETWORK PROPOSAL



AECOM

CITY BUSES & MINIBUSES NETWORK PROPOSAL - 2
(CITY BUSES DEPOT)

- **City Buses Depot**: New Access from Dzirnavu from North & South City



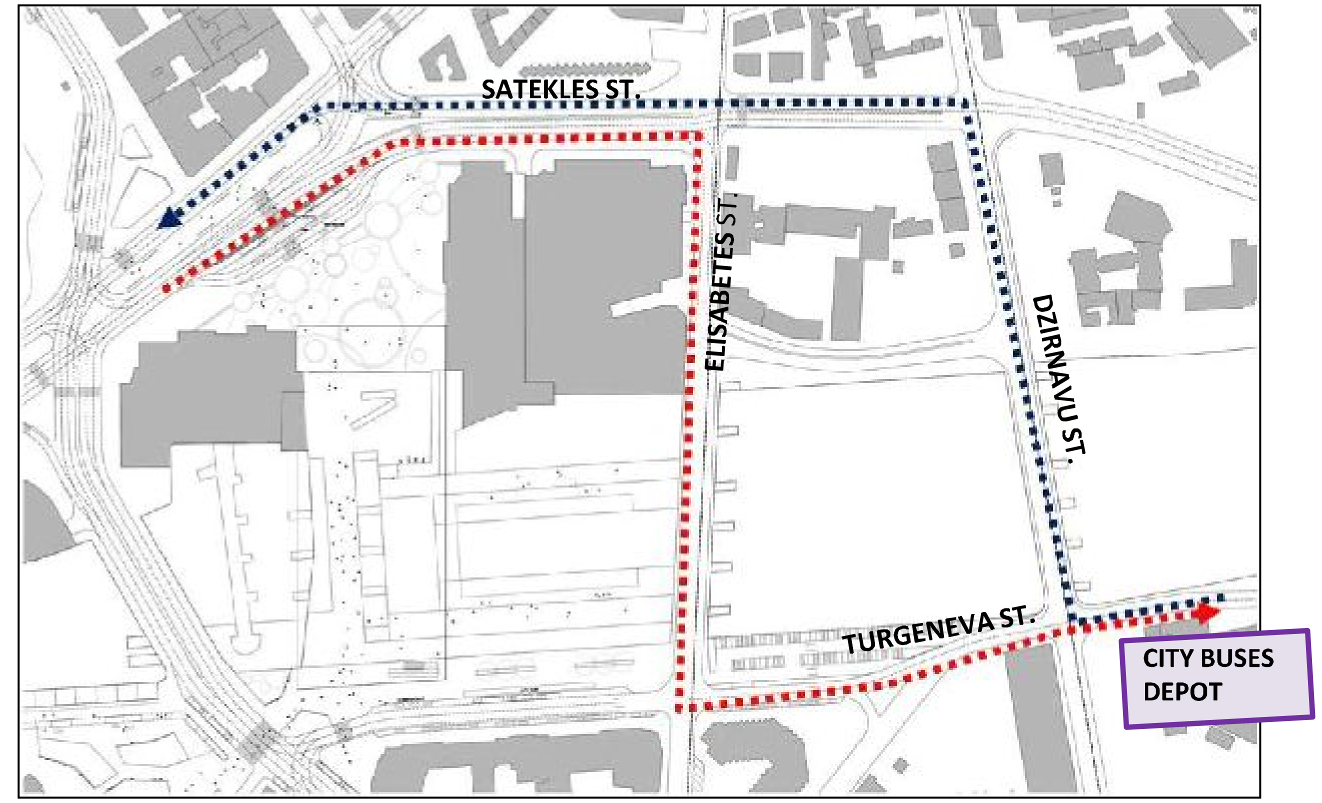
AECOM

CITY BUSES & MINIBUSES NETWORK PROPOSAL - 3
(CITY BUSES DEPOT)

City Bus Routes
City Buses Stops

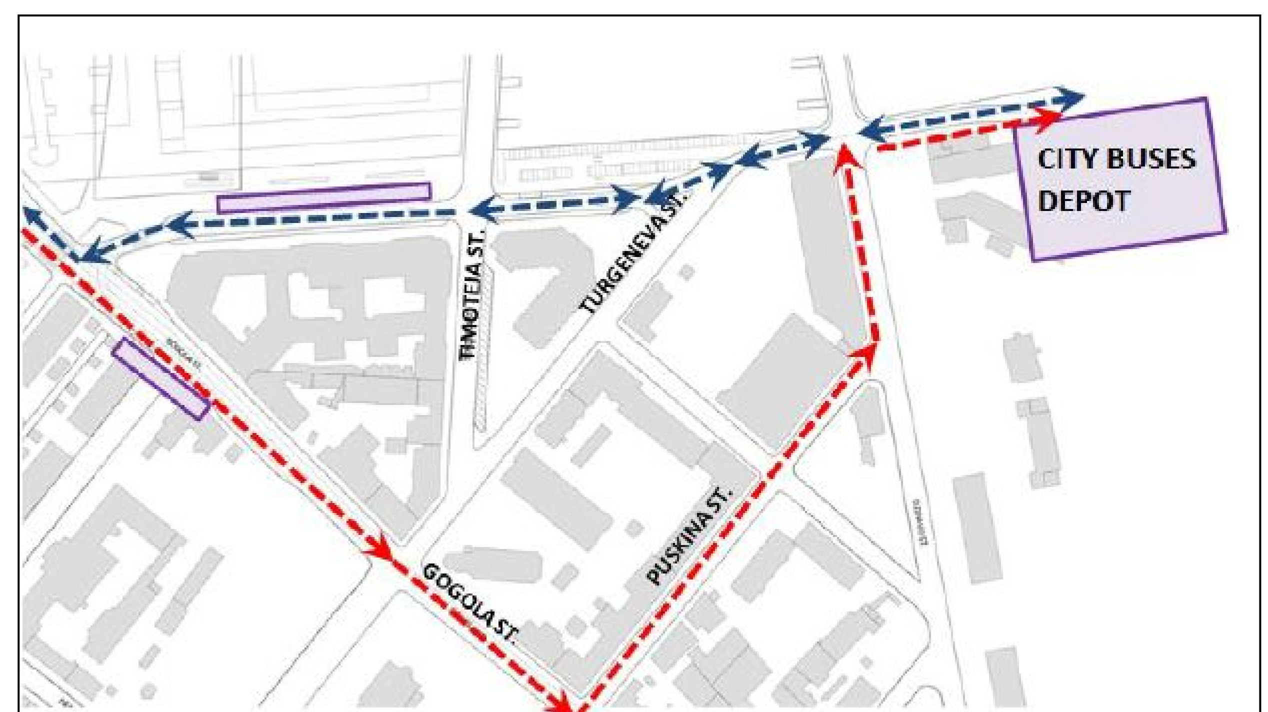
- **City Buses Depot (Dzirnavu/Elisabetes/Turgeneva iela)**:

Buses route proposal for lines whose stop is located in *Stacijas laukums, with separated traffic ways for Northbound and Southbound routes from/to Abrenes iela.*



- **City Buses Depot (Gogola/Puskina/Turgeneva iela)**:

Buses route proposal for lines whose stop is located in *Centrāltirgus, with separated traffic ways for Westbound and Eastbound routes from/to Abrenes iela.*

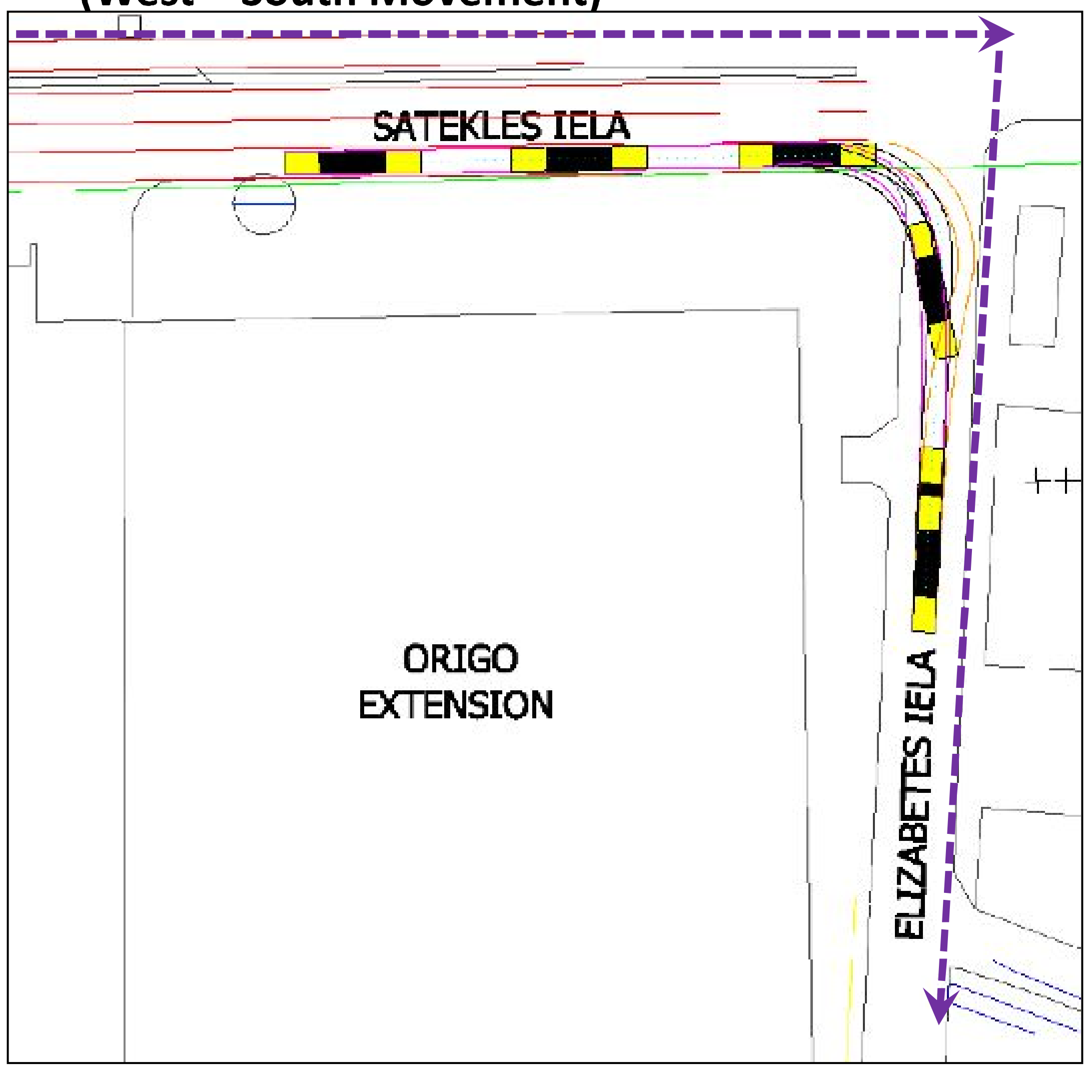


AECOM

CITY BUSES & MINIBUSES NETWORK PROPOSAL - 4

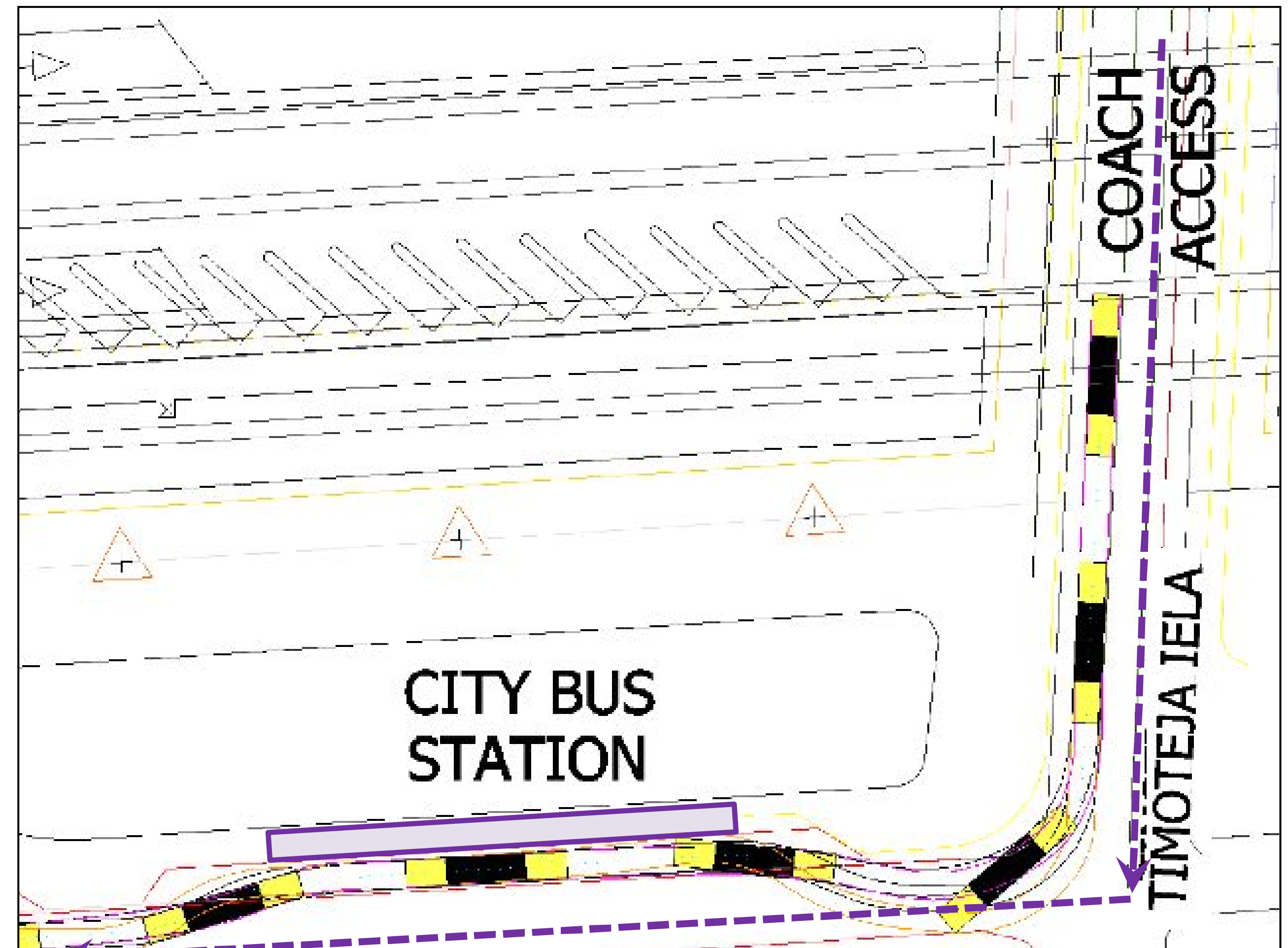
City Buses
City Buses Stops

SATEKLES – ELISABETES SWEPT PATH ANALYSIS (West – South Movement)



- Adopted Mercedes Benz Citaro 15 Autobuss.
- Safety Turn proposed from Satekles iela Right Lane (Eastbound) to Elisabetes iela (Southbound).
- Adapted SW Crosswalk to avoid conflicts with City Utilities & Pedestrian Crossings.

ELISABETES - BUS STATION SWEPT PATH ANALYSIS

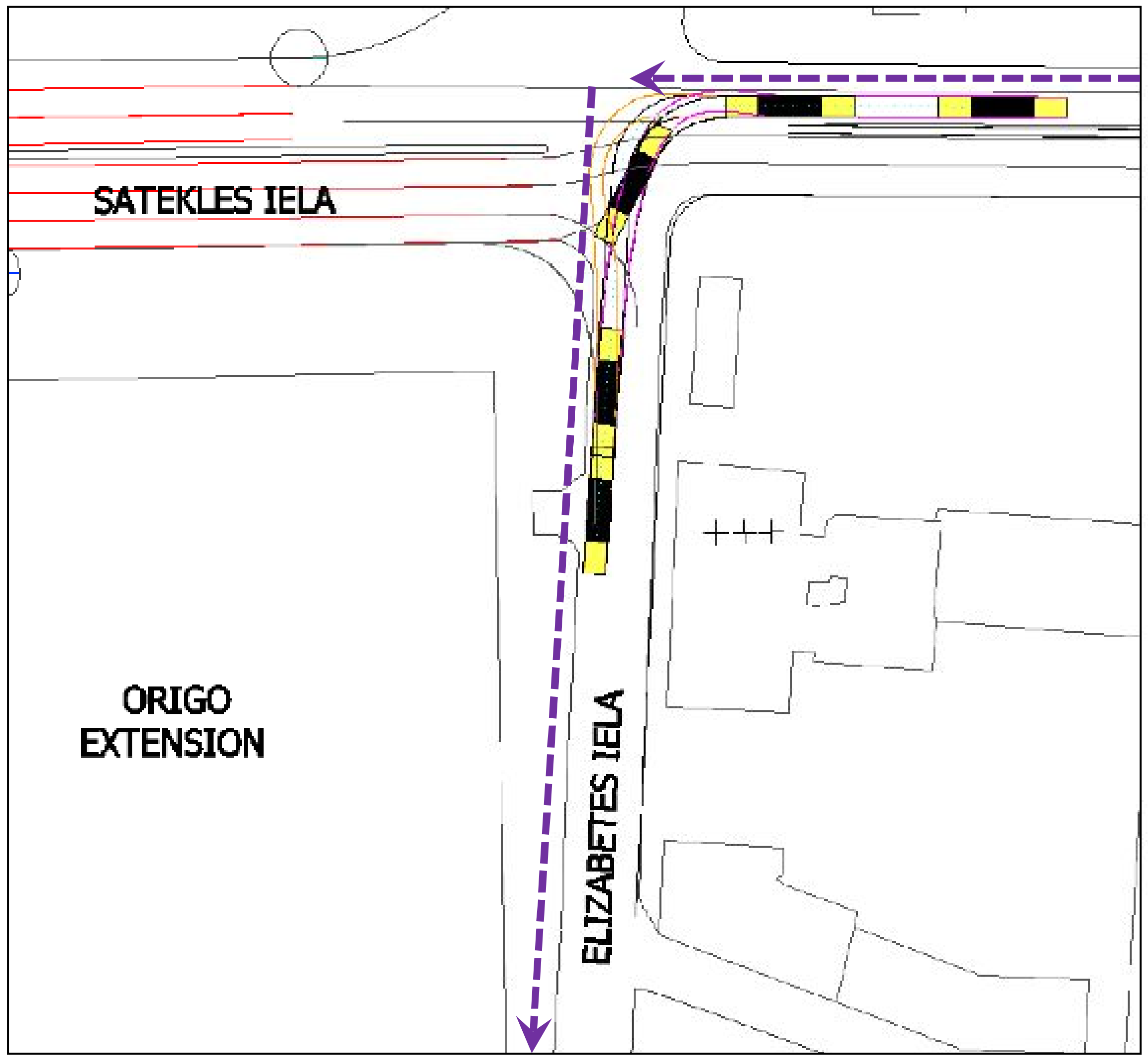


- Adopted Mercedes Benz Citaro 15 Autobuss.
- Safety right turn from Timoteja iela (Southbound) to City Bus Station new Street (Westbound).
- No conflicts in right turn area from Timoteja iela to Bus Station. Free space to accomodate crosswalk and pedestrians area.
- Vehicle Swept Path Analysis made in software ISTRAM/ISPOL.

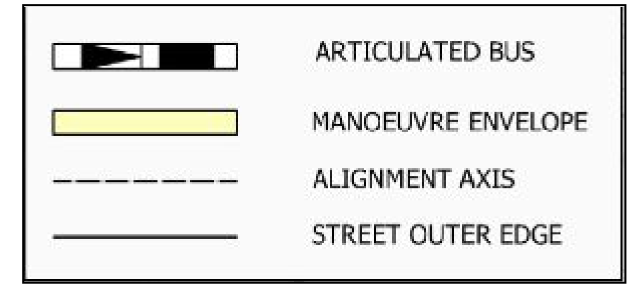
CITY BUSES & MINIBUSES NETWORK PROPOSAL – 5

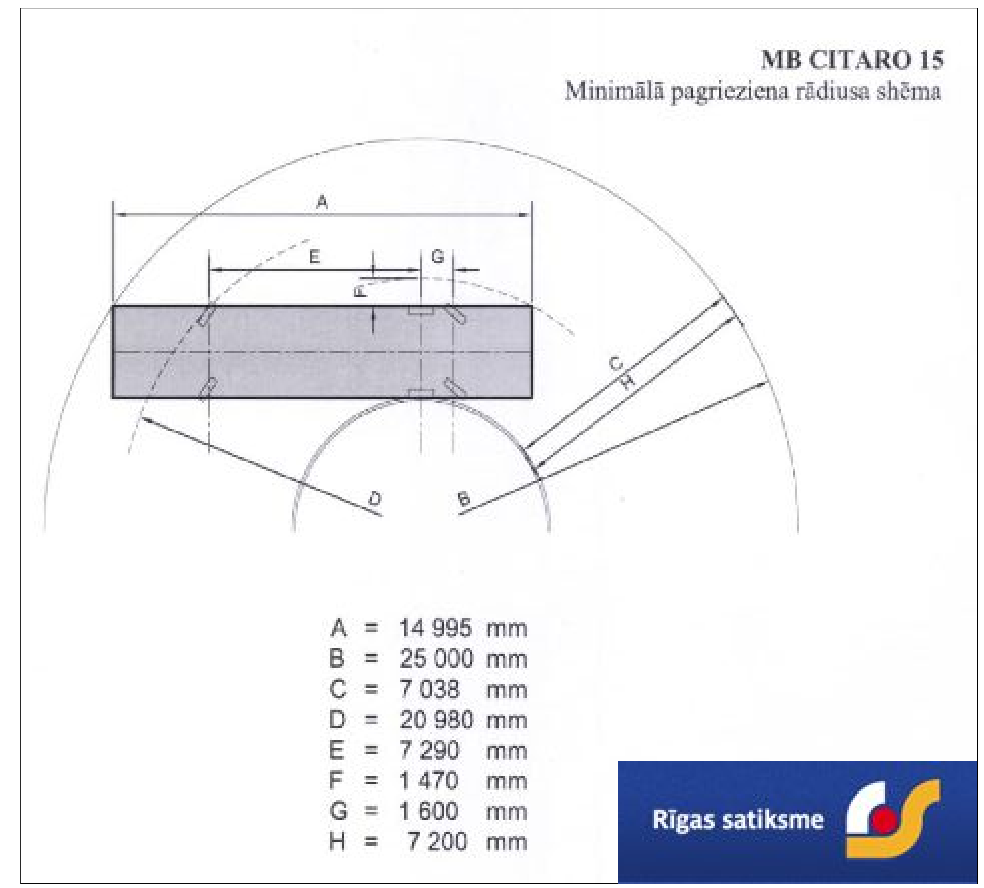
City Buses
City Buses Stops

SATEKLES – ELISABETES SWEPT PATH ANALYSIS (East –South MOVEMENT)



- Adopted Mercedes Benz Citaro 15 Autobuss.
- Safety Turn proposed from Satekles iela Right Lane (Westbound) to Elisabetes iela (Southbound).
- Adapted SW Crosswalk to avoid conflicts with City Utilities & Pedestrian Crossings.





- Standard Design vehicle: **MERCEDES BENZ CITARO 15**
- Standard Design Bus according to **City of Riga Public Transport Company *Rīgas satiksme.***
- Vehicle Swept Path Analysis made in software **ISTRAM/ISPOL**.

AECOM

INTERNATIONAL COACHES - 1

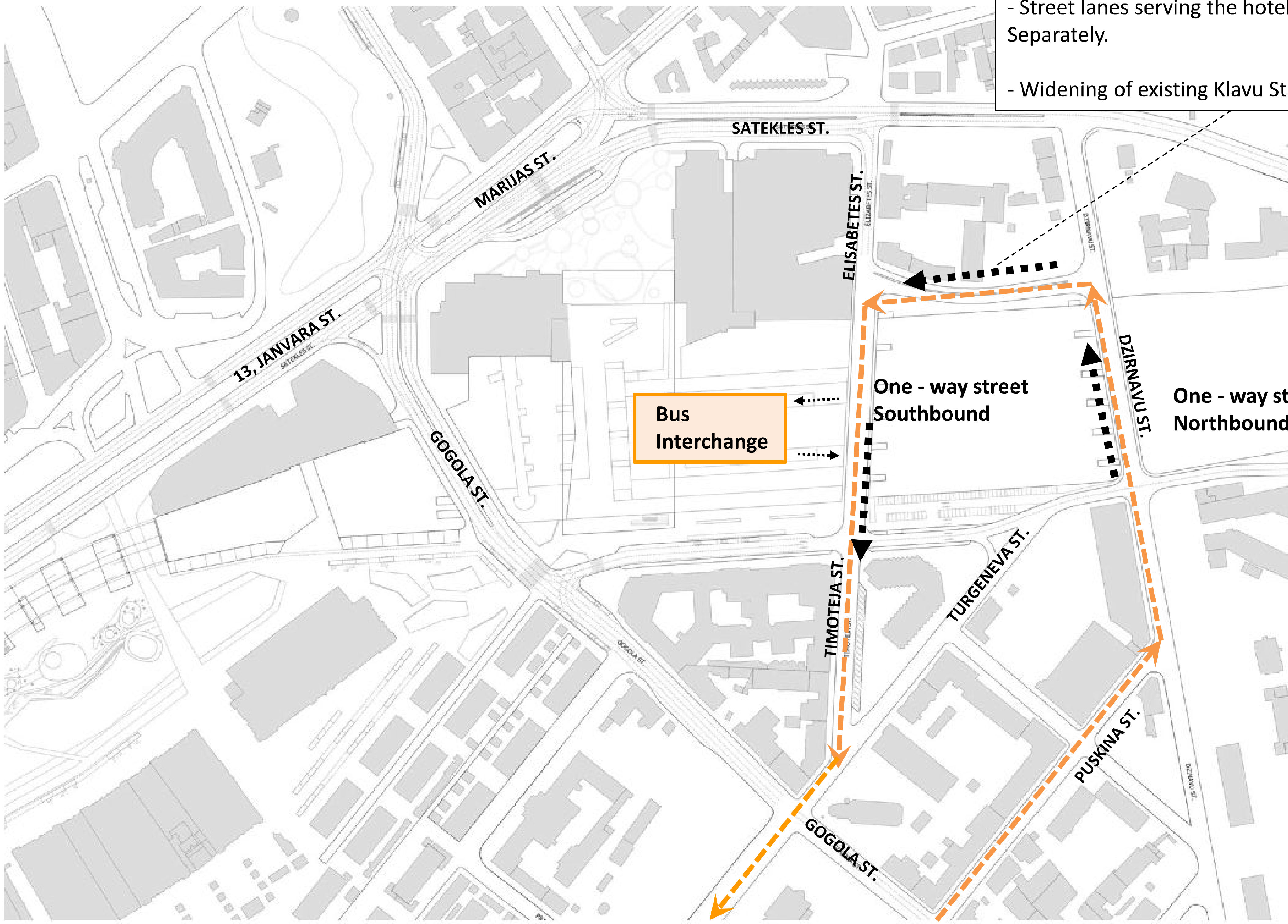
International Coaches

New street definititon in Klavu iela

- Excavation of the embankment (track 12 diverted)

- Street lanes serving the hotel and coaches Separately.

- Widening of existing Klavu Street



TO KRASTA IELA

FROM KRASTA IELA

AECOM

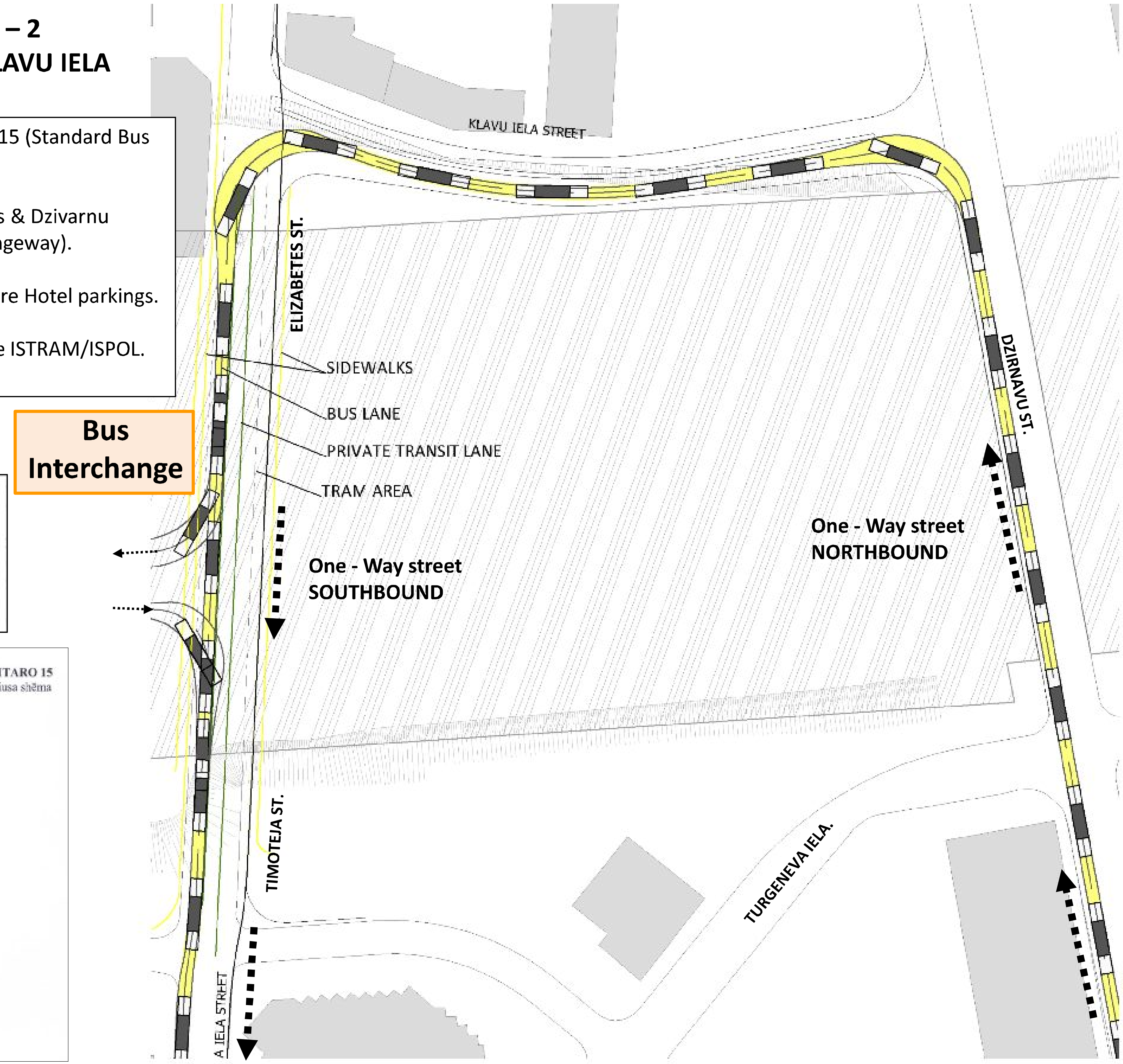
INTERNATIONAL COACHES – 2
NEW STREET SECTION – KLAVU IELA

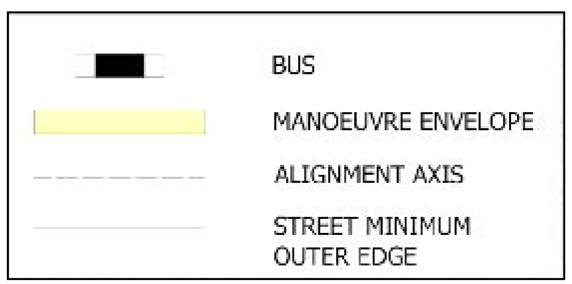
- New Alignment adapted to MB Citaro 15 (Standard Bus *Rīgas satiksme).*

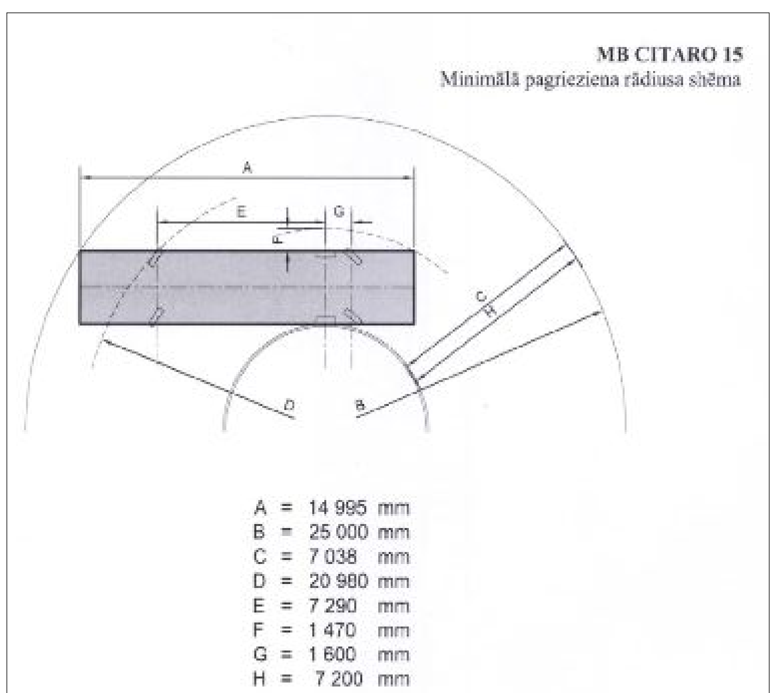
- Widening in T-Junctions with Elizabetes & Dzivarnu Streets (at least 5,50 m for the left carriageway).

- Connection between hostel and Mercure Hotel parkings.

- Vehicle Swept Path Analysis in software ISTRAM/ISPOL.







AECOM

INTERNATIONAL COACHES - 3

- ACCESS & EXIT TO THE STATION

Bus Station Access & Exits

- Access adapted to new way dìsposed in Elisabetes iela.

- Solved conflicts between Exit & Access (separated areas).

- Turns accomodated to Mercedes Benz Citaro 15 (Standard Bus *Rīgas satiksme*)

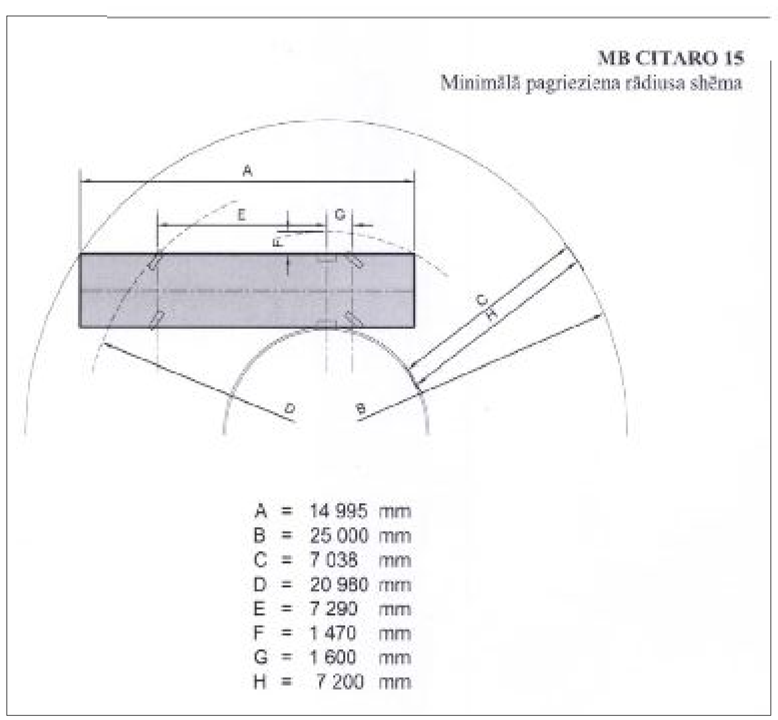
- Vehicle Swept Path Analysis made in software ISTRAM/ISPOL.

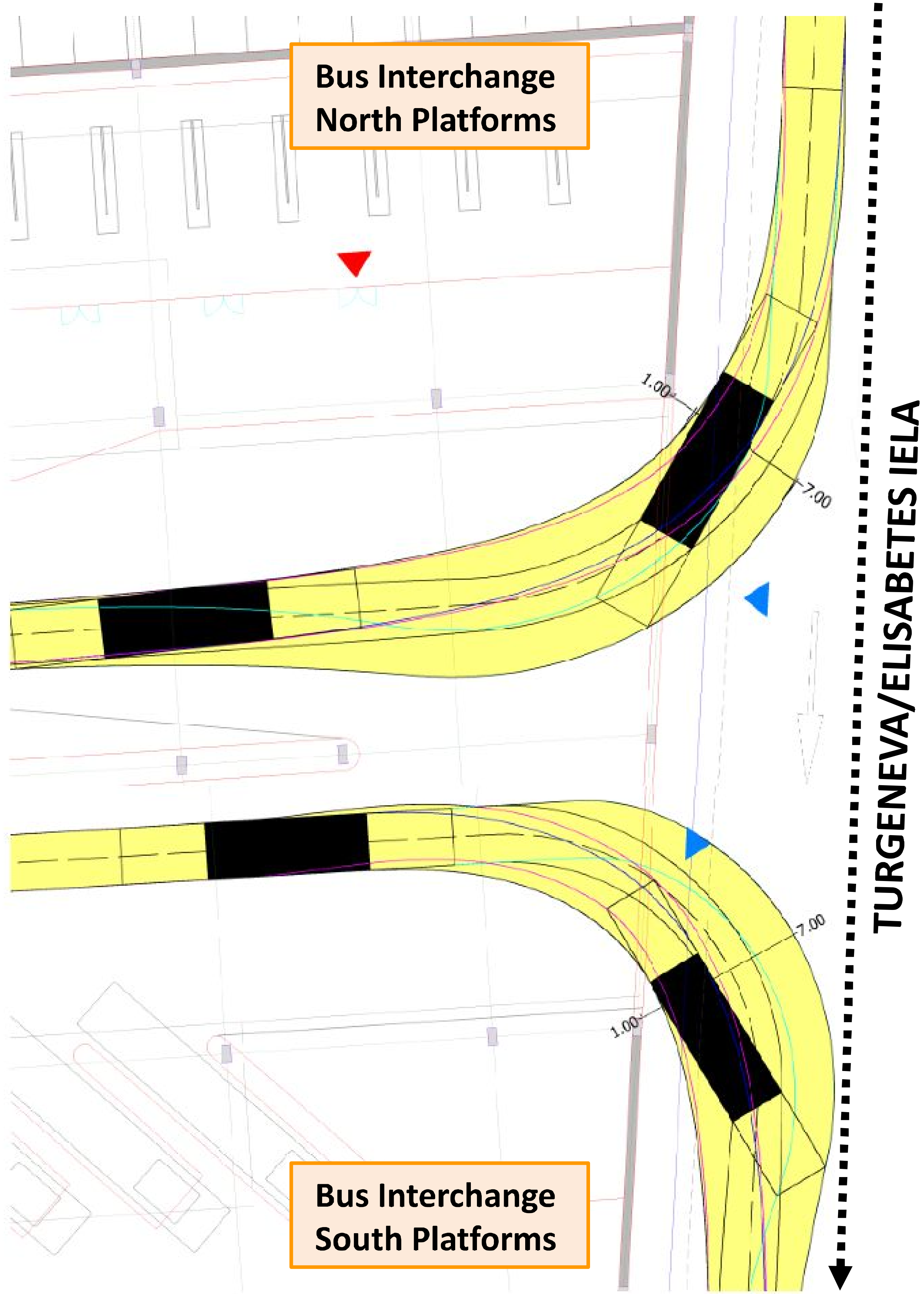
BUS

MANOEUVRE ENVELOPE

ALIGNMENT AXIS

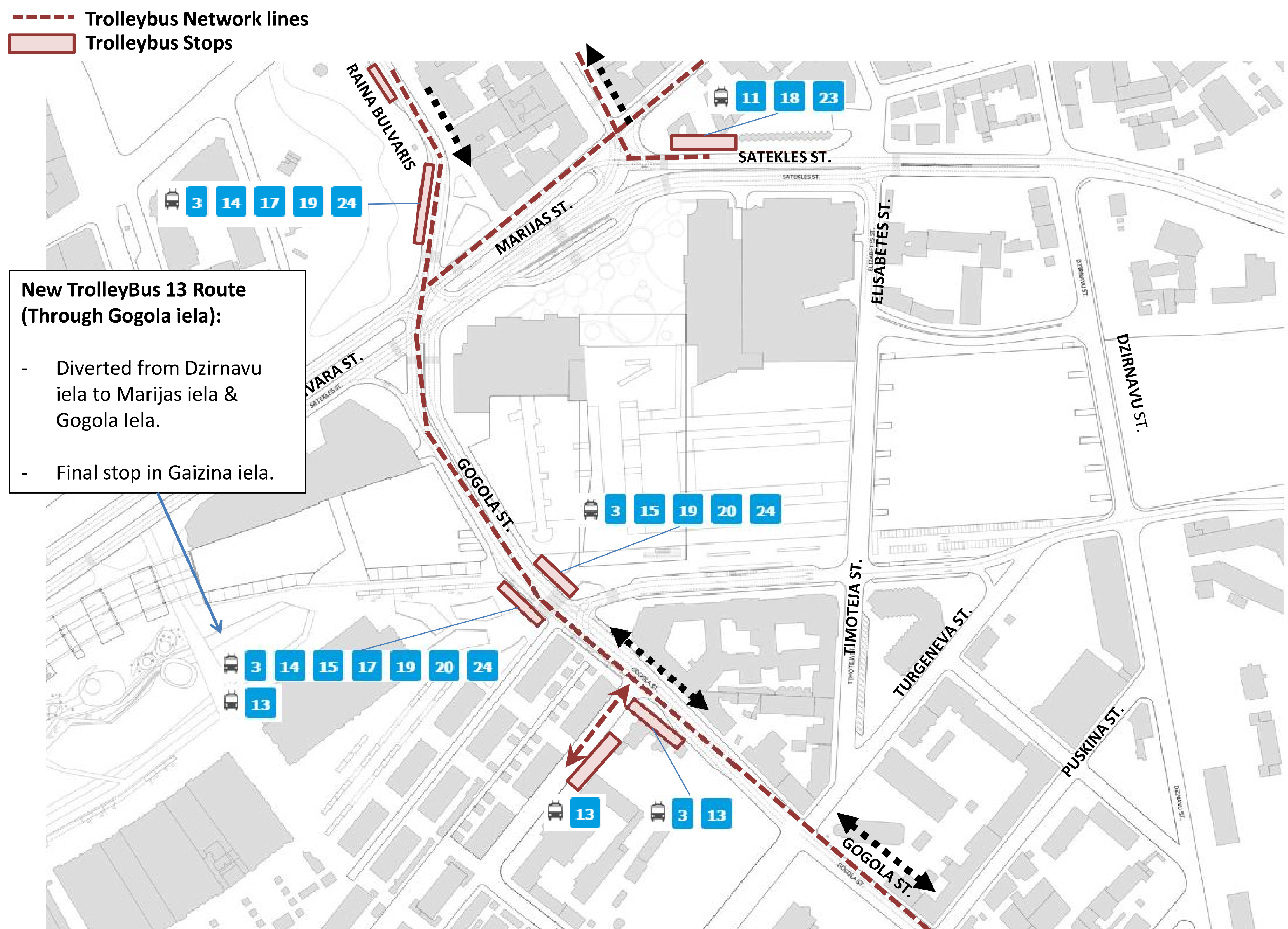
STREET MINIMUM OUTER EDGE





AECOM

TROLLEY BUS NETWORK PROPOSAL

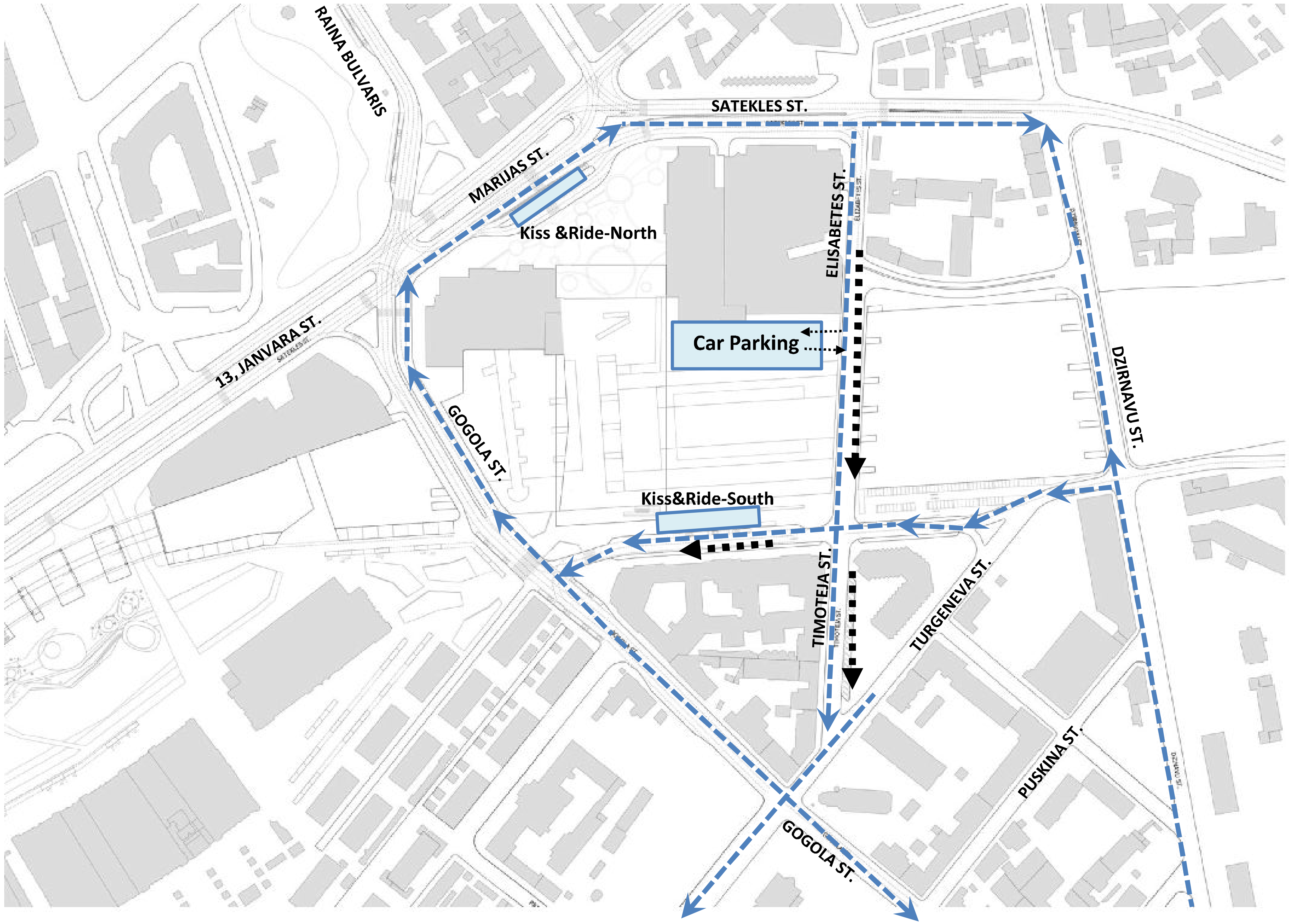


New TrolleyBus 13 Route (Through Gogola iela):

- Diverted from Dzirnavu iela to Marijas iela & Gogola Iela.
- Final stop in Gaizina iela.

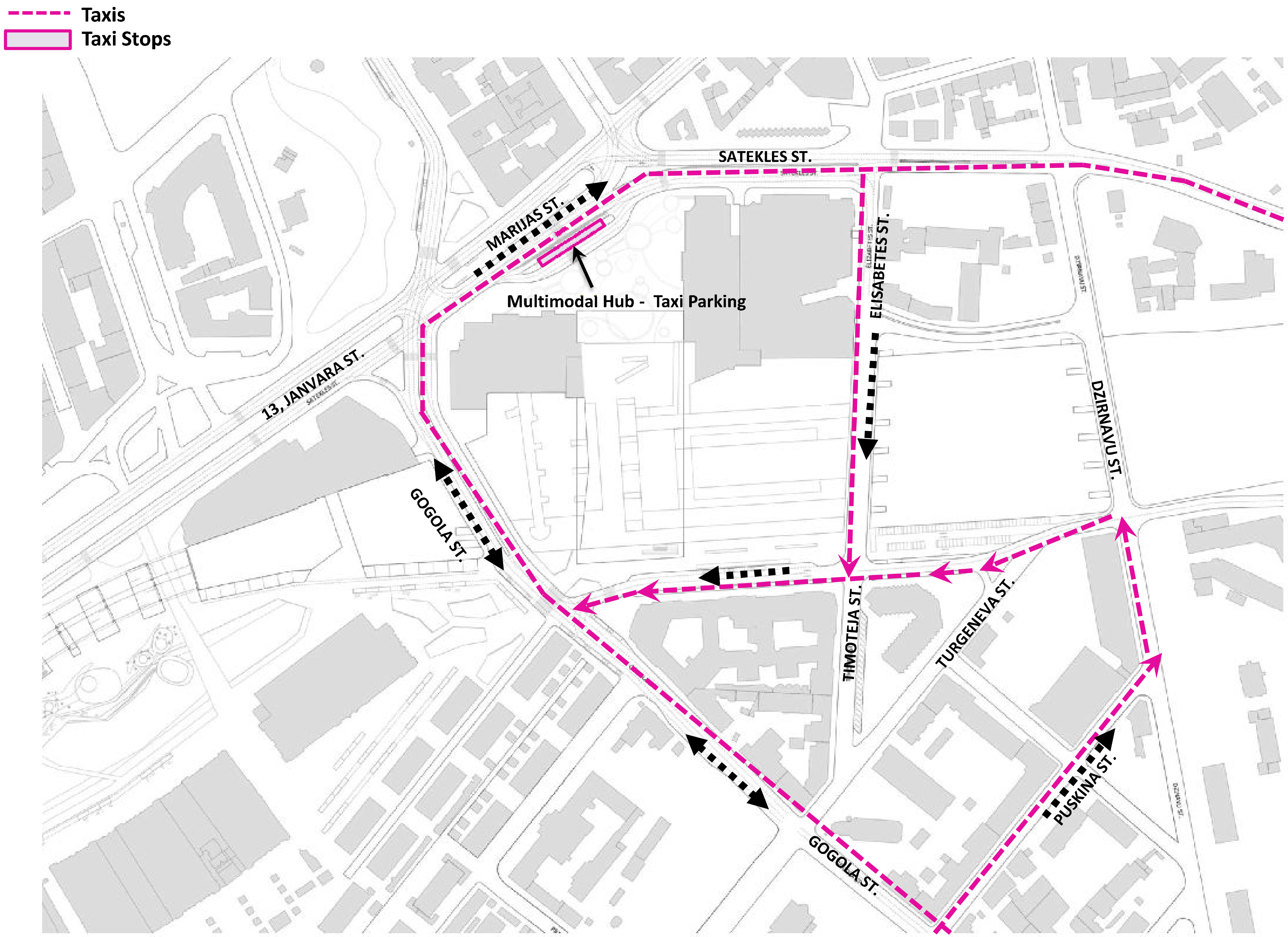
PRIVATE CARS (to Kiss & Ride / Car Parking)

Private Cars
Kiss &Ride/ Parking



AECOM

TAXIS ROUTES



AECOM

KISS & RIDE NORTH

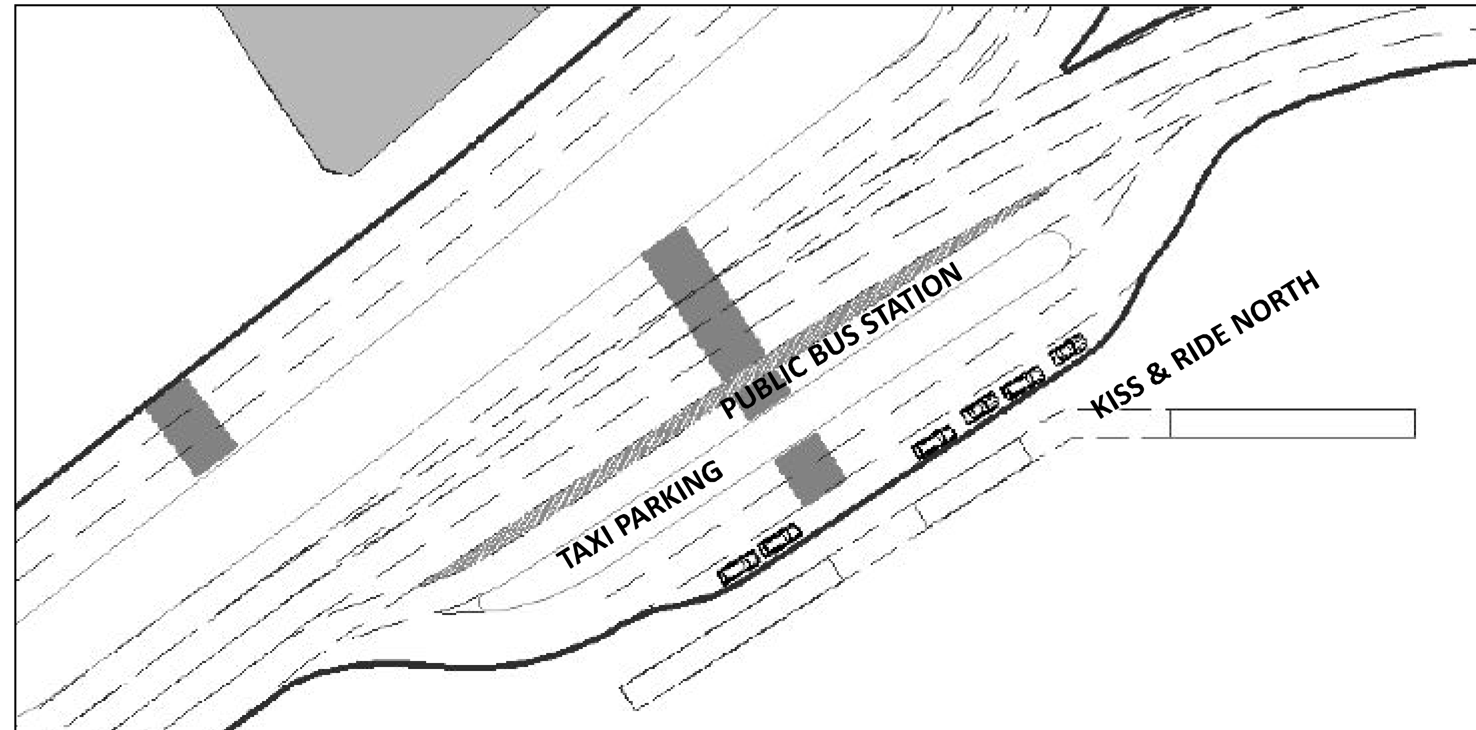
Private & Taxi Cars
Kiss &Ride/ Parking

Kiss & Ride North

- Integrated option with Public Transport/ Taxi Parking/ Kiss & Ride

- Direct access through 13.janvara iela & Marijas iela from Old Riga City and Krasta iela.

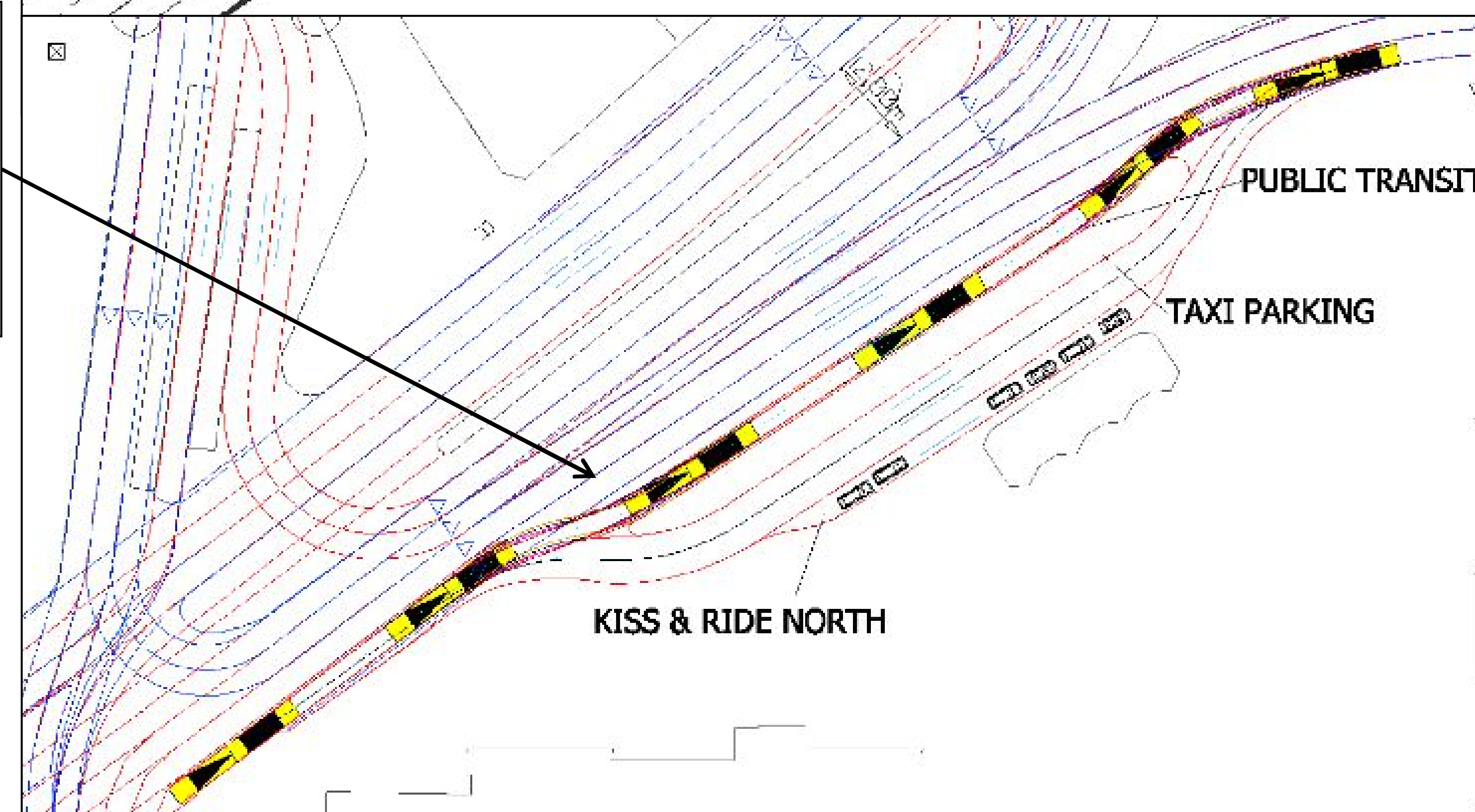
- Taxi Parking disposed in the North to provide a unified exit for passengers in the Multimodal Hub Principal Entrance.



Kiss & Ride North

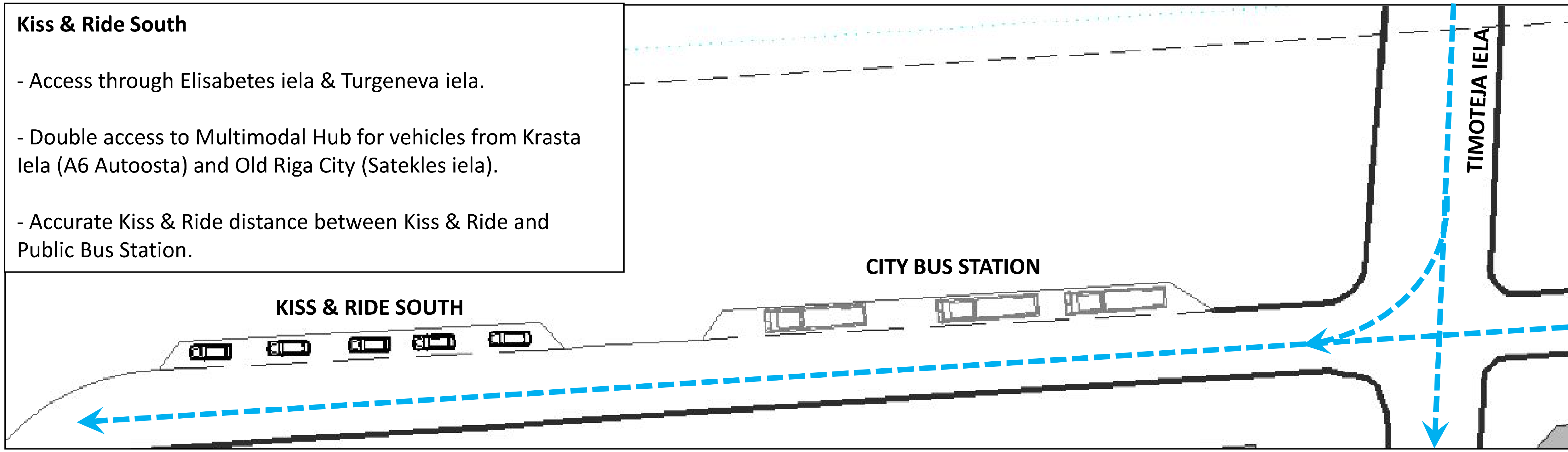
- Manoeuvre accomodated Mercedes Benz Citaro 15 (Standard Bus Rīgas satiksme).

- Vehicle Swept Path Analysis made in software ISTRAM/ISPOL.



KISS & RIDE SOUTH

Private Cars
Kiss &Ride/ Parking

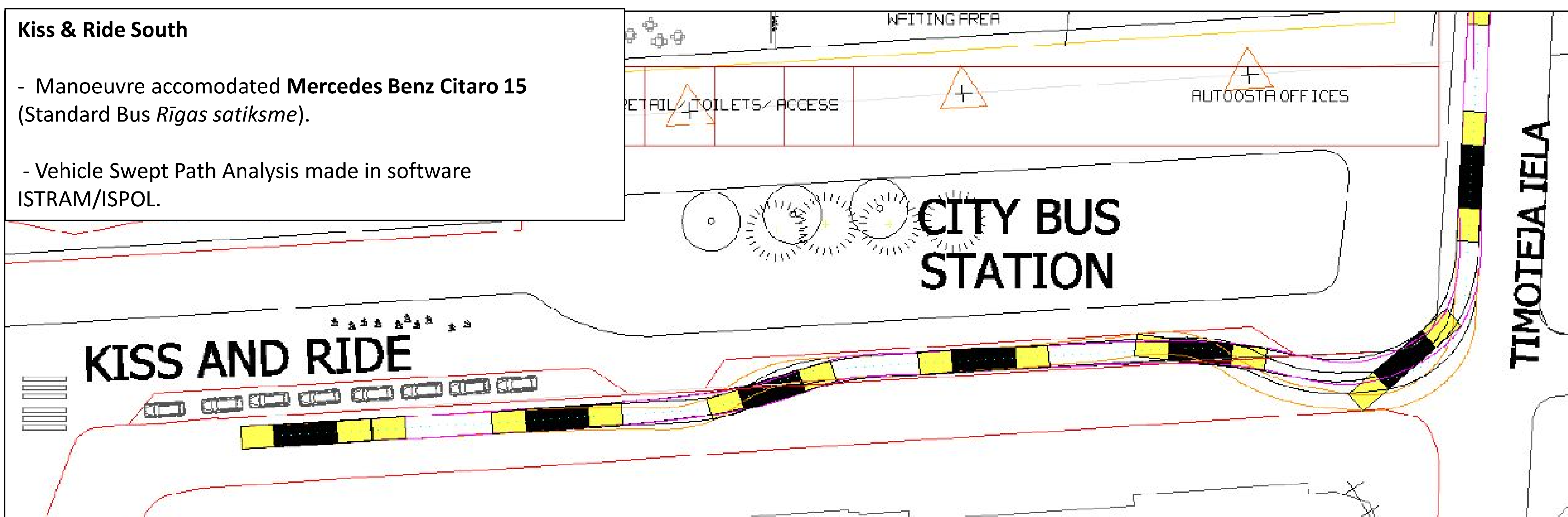


Kiss & Ride South

- Access through Elisabetes iela & Turgeneva iela.

- Double access to Multimodal Hub for vehicles from Krasta Iela (A6 Autoosta) and Old Riga City (Satekles iela).

- Accurate Kiss & Ride distance between Kiss & Ride and Public Bus Station.



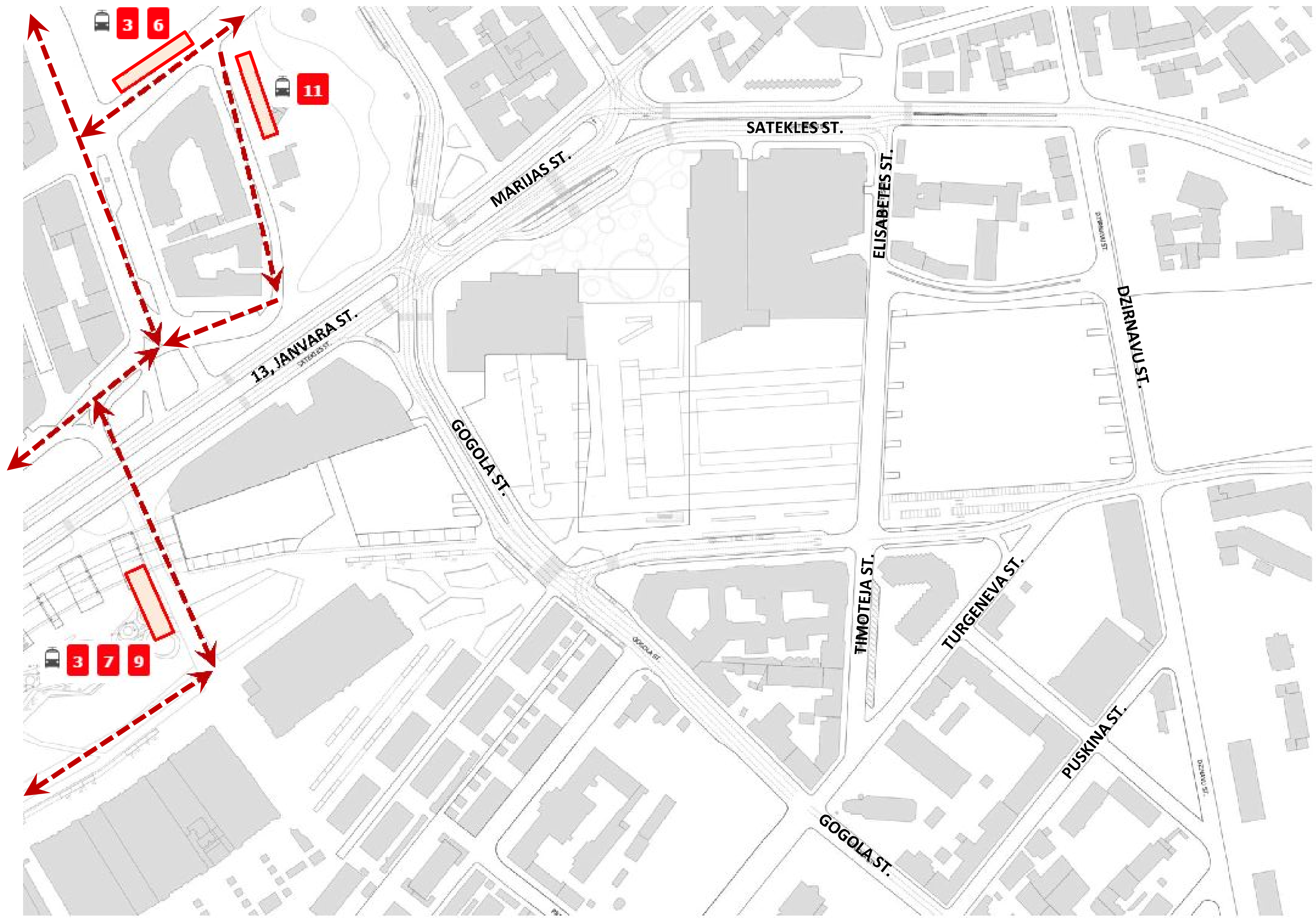
Kiss & Ride South

- Manoeuvre accomodated **Mercedes Benz Citaro 15** (Standard Bus *Rīgas satiksme*).

- Vehicle Swept Path Analysis made in software ISTRAM/ISPOL.

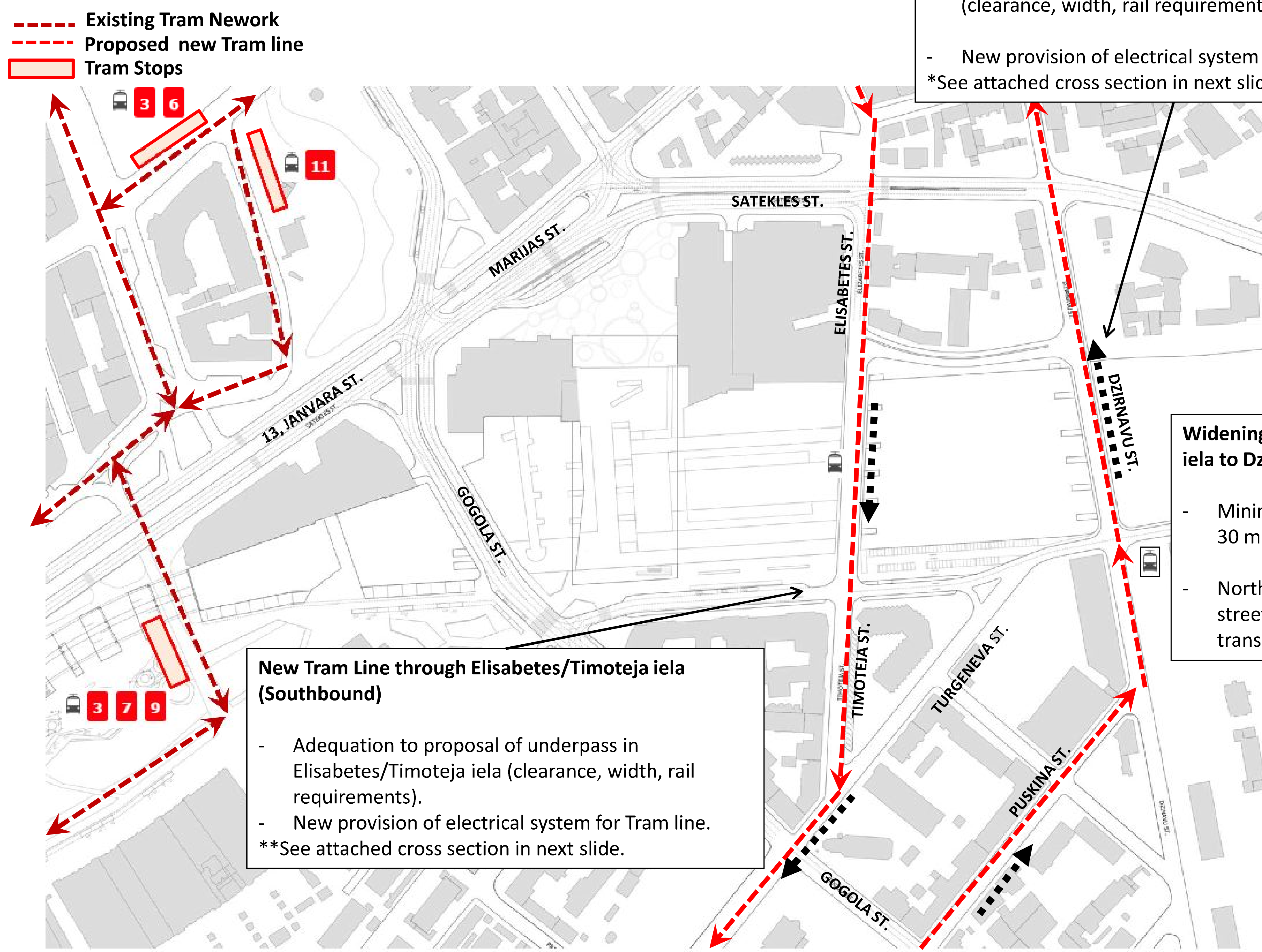
TRAM NETWORK - EXISTING

Existing Riga Tram Network
Tram Stops



AECOM

TRAM NETWORK – PROPOSAL OF NEW LINE - 1



New Tram Line through Dzirnavu iela (Northbound)

- Adequation to existing underpass in Dzirnavu iela (clearance, width, rail requirements).
- New provision of electrical system for Tram line.

*See attached cross section in next slide.

Widening from Puskina iela to Dzirnavu iela:

- Minimum tram radius 30 m.
- Northbound One-Way street shared with bus transit lines.

New Tram Line through Elisabetes/Timoteja iela (Southbound)

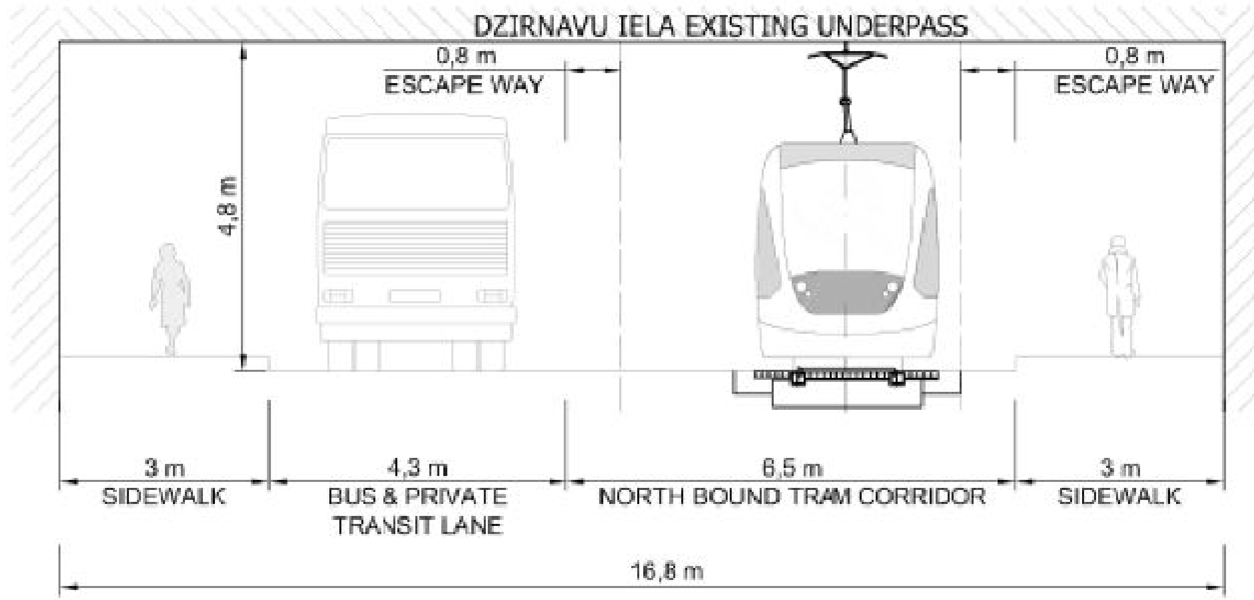
- Adequation to proposal of underpass in Elisabetes/Timoteja iela (clearance, width, rail requirements).
- New provision of electrical system for Tram line.

**See attached cross section in next slide.

AECOM

TRAM NETWORK – PROPOSAL OF NEW LINE – 2

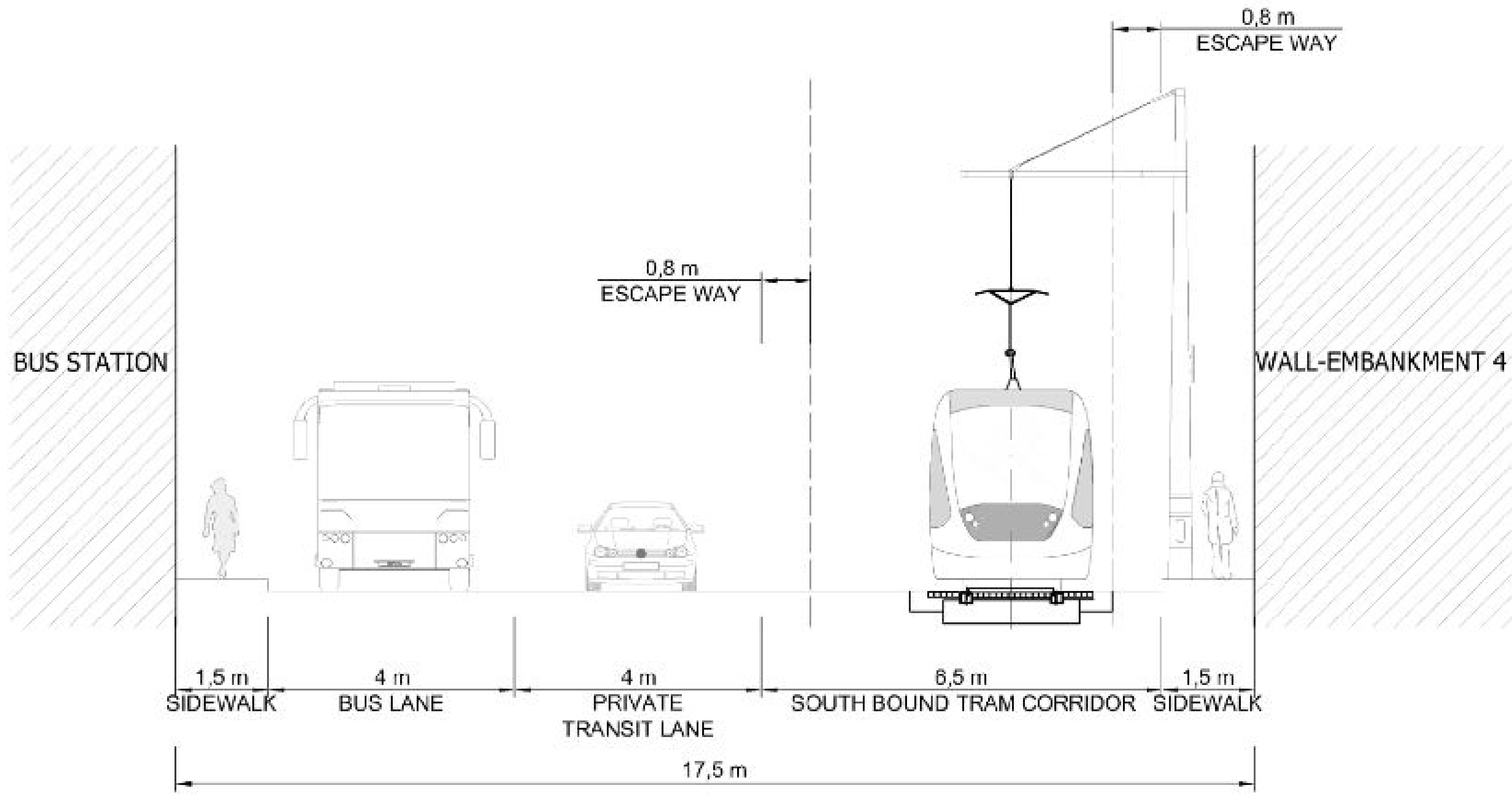
DZIRNAVU IELA CROSS SECTION – NORTHBOUND NEW TRAM LINE



*New Tram Line through Dzirnavu iela (Northbound)**

- Adequation to existing underpass in Dzirnavu iela (clearance, width, rail requirements).
- New provision of electrical system for Tram line.

ELISABETES/TURGENEVA IELA CROSS SECTION – SOUTHBOUND NEW TRAM LINE



ELISABETES / TURGENEVA IELA CROSS SECTION
E: 1/100

****New Tram Line through Elisabetes/Timoteja iela (Southbound)**

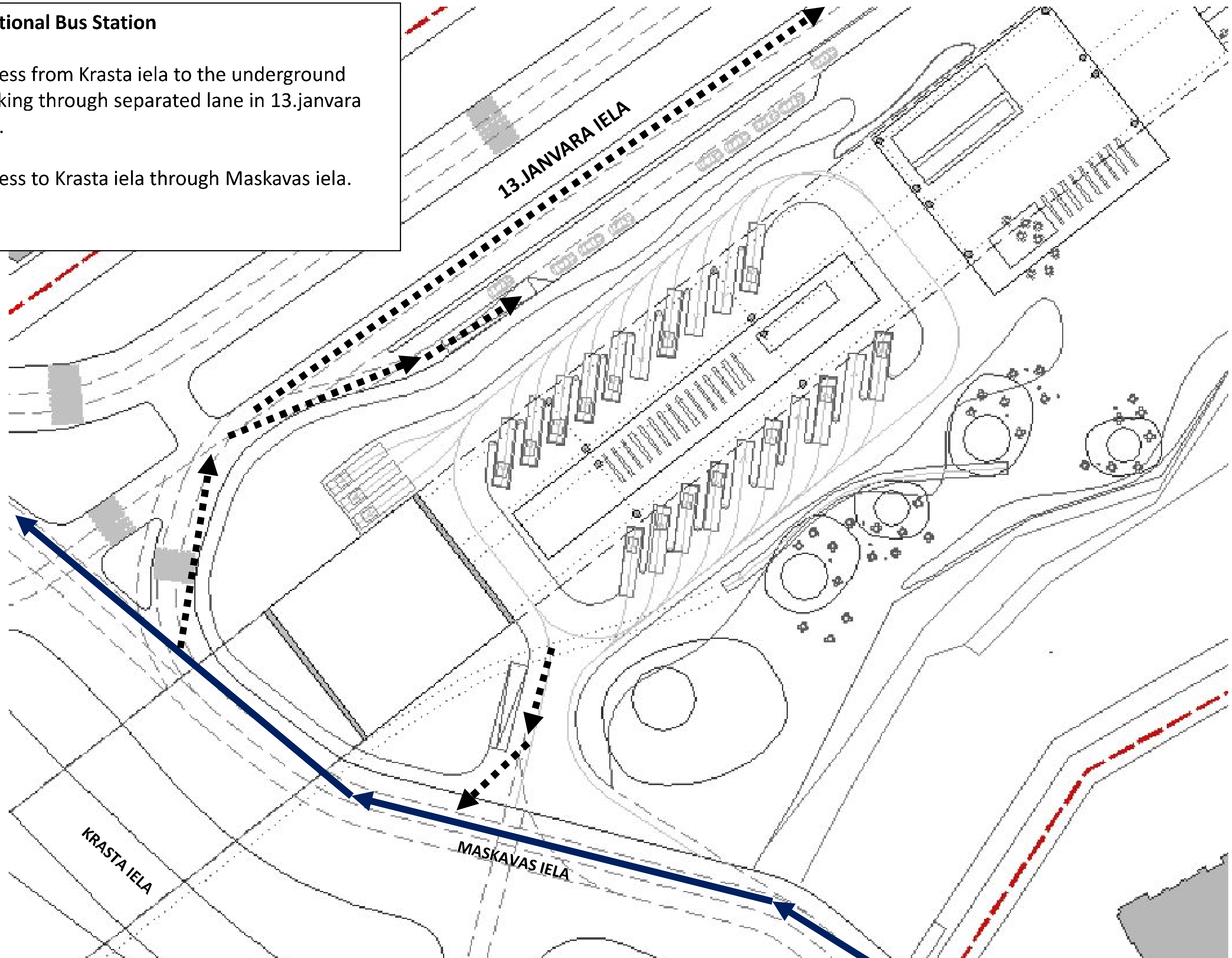
- Adequation to proposal of underpass in Elisabetes/Timoteja iela (clearance, width, rail requirements).
- New provision of electrical system for Tram line.

AECOM

INTERNATIONAL BUS STATION – ACCESS FROM RIGA ROAD NETWORK

International Bus Station

- Access from Krasta iela to the underground parking through separated lane in 13.janvara iela.
- Access to Krasta iela through Maskavas iela.



AECOM

INTERNATIONAL BUS STATION – PUBLIC TRANSIT AND KISS & RIDE

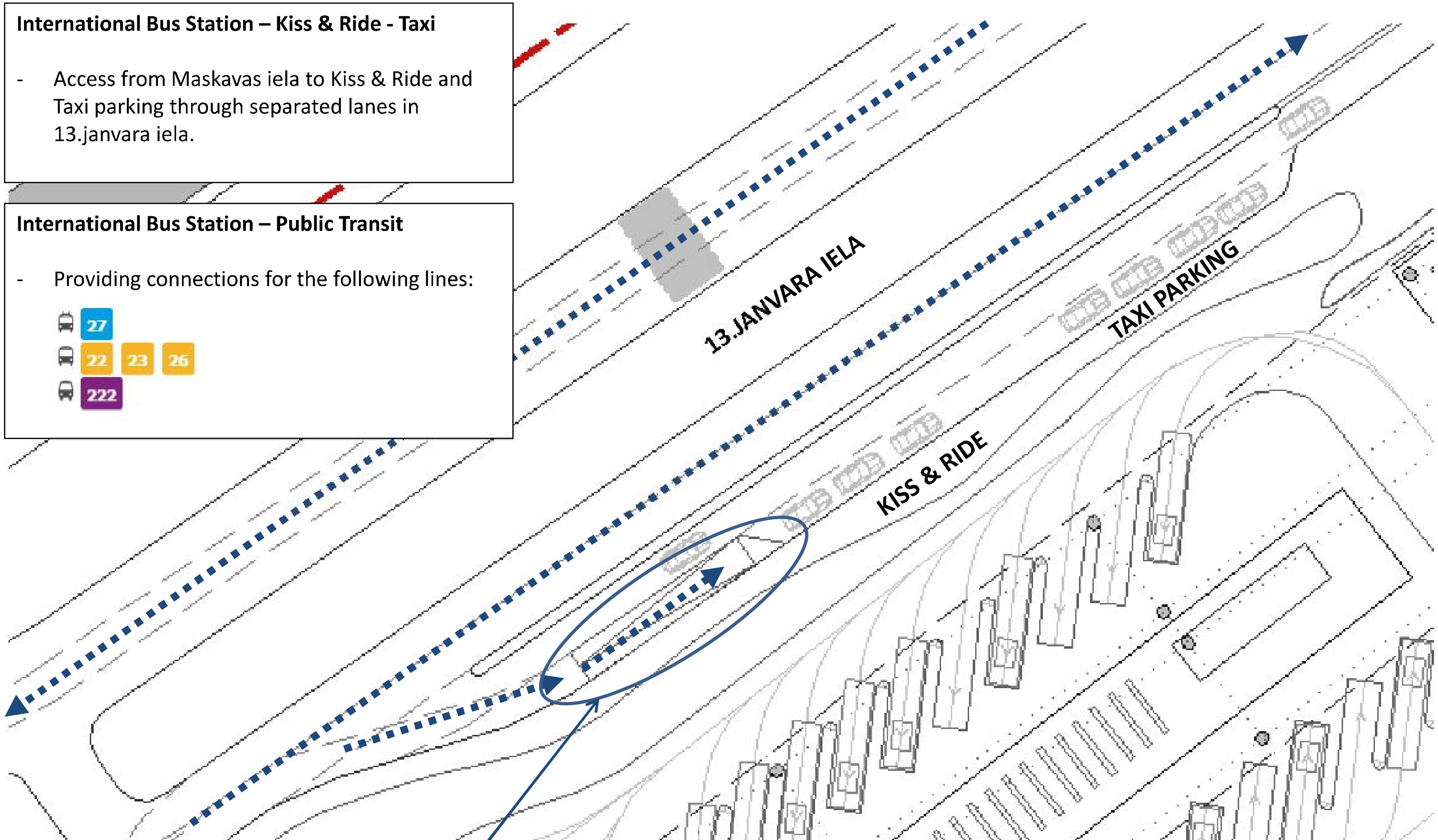
International Bus Station – Kiss & Ride - Taxi

- Access from Maskavas iela to Kiss & Ride and Taxi parking through separated lanes in 13.janvara iela.

International Bus Station – Public Transit

- Providing connections for the following lines:

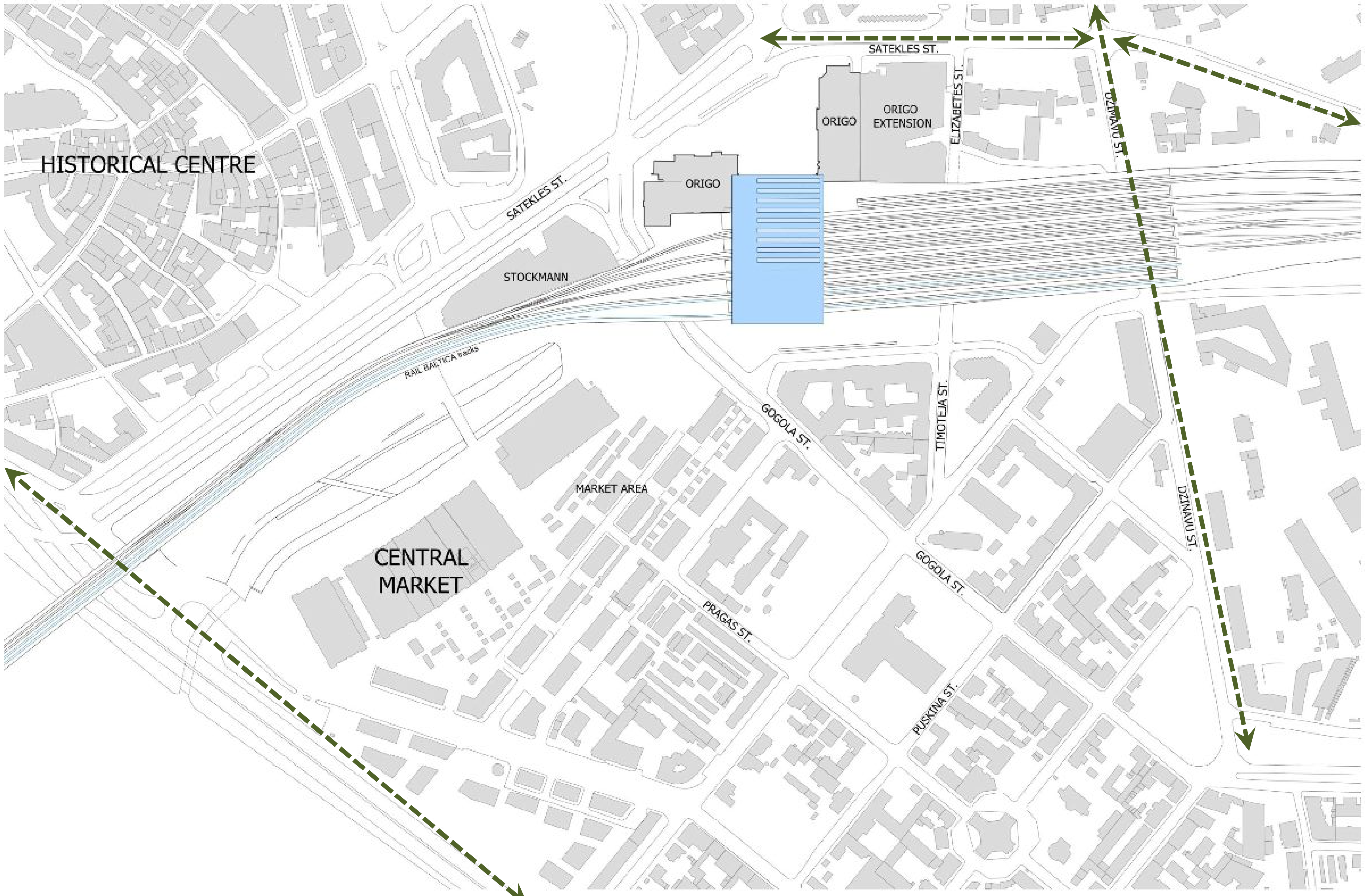
27
22 23 26
222



Access to the underground parking through separated lane in 13.janvara iela.

BICYCLE NETWORK – EXISTING SITUATION

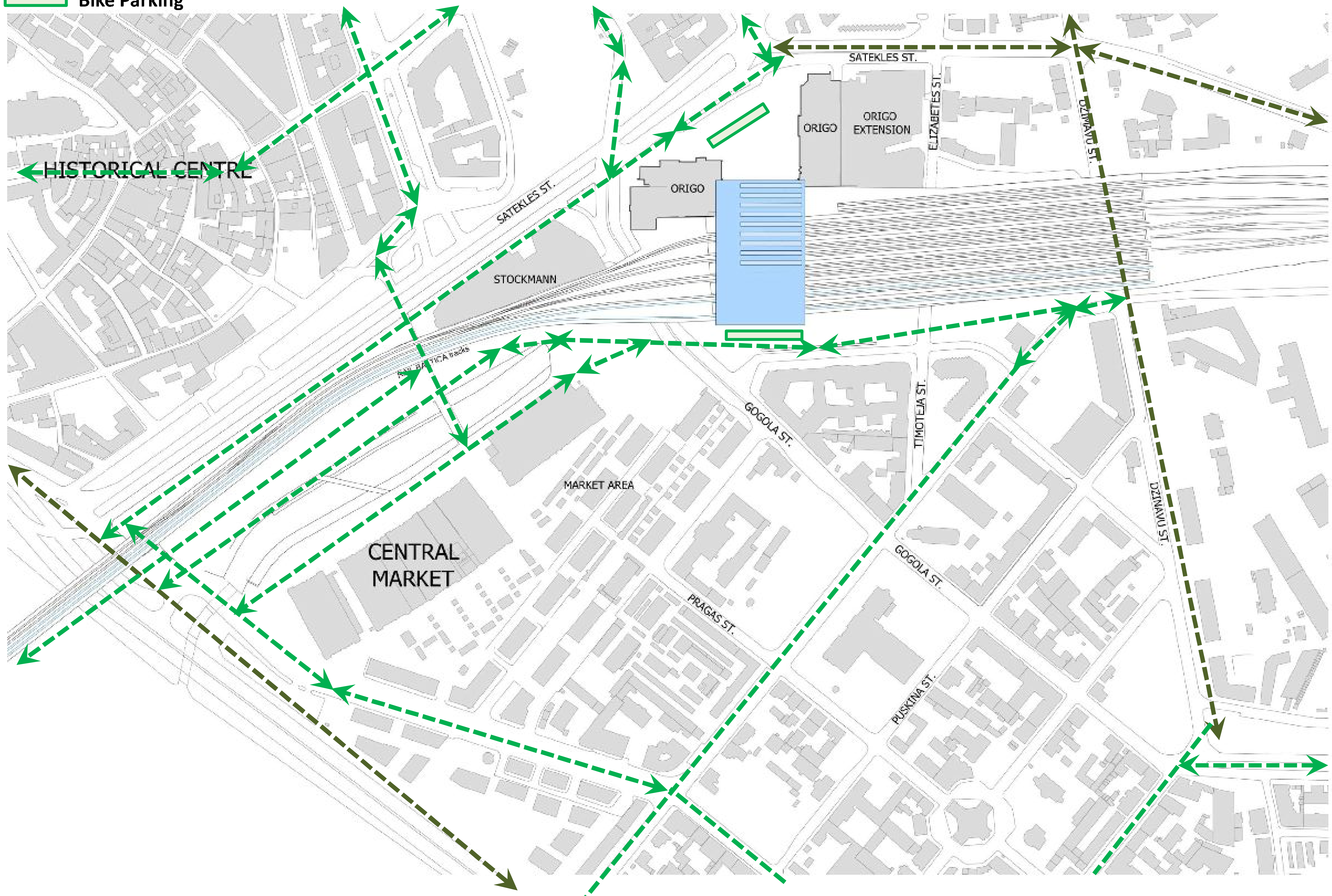
- - - - Existing Bike Lanes



AECOM

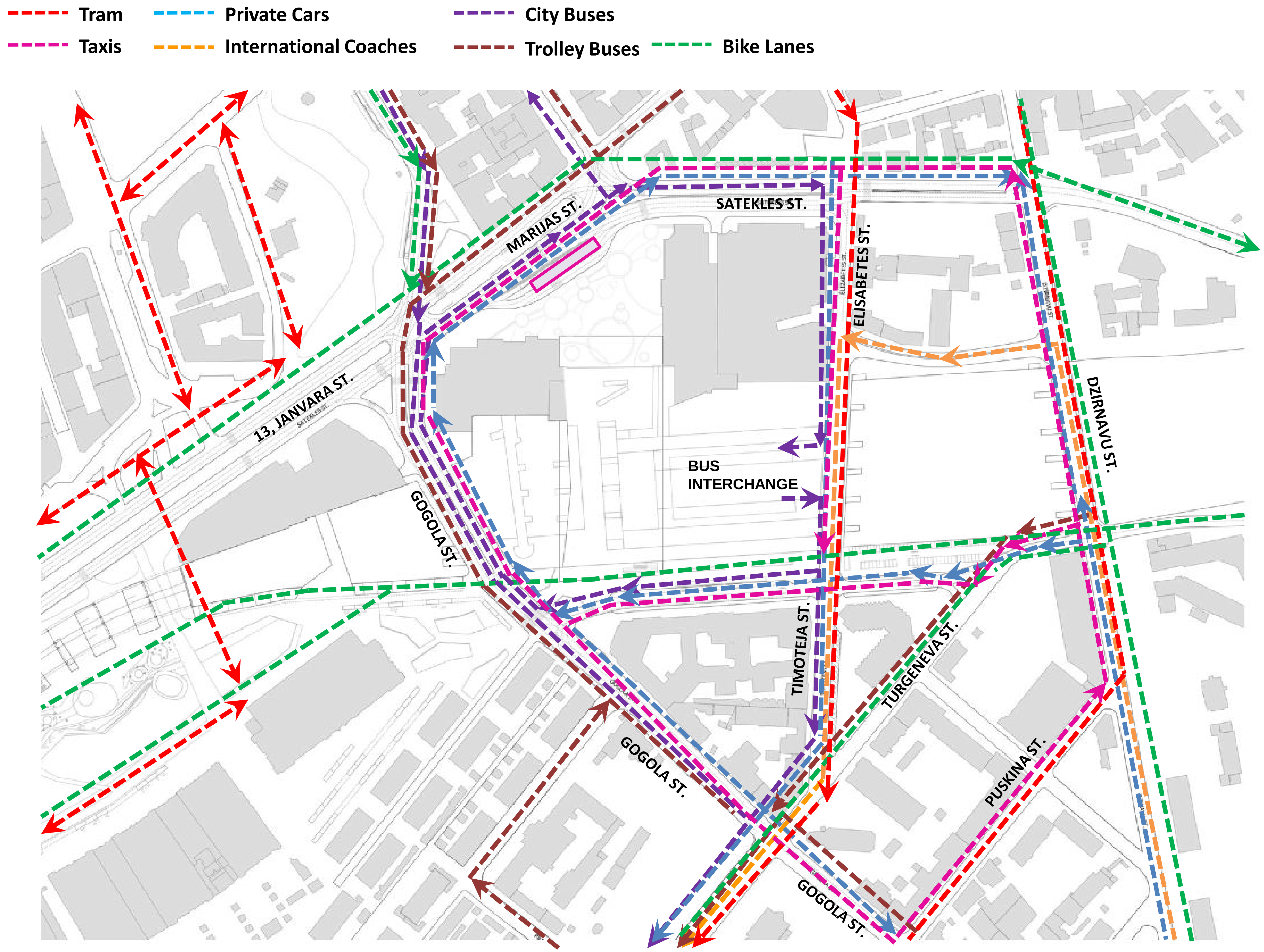
BIKE NETWORK – NEW PROPOSAL

Existing Bike Lanes
Proposed Bike Lanes
Bike Parking



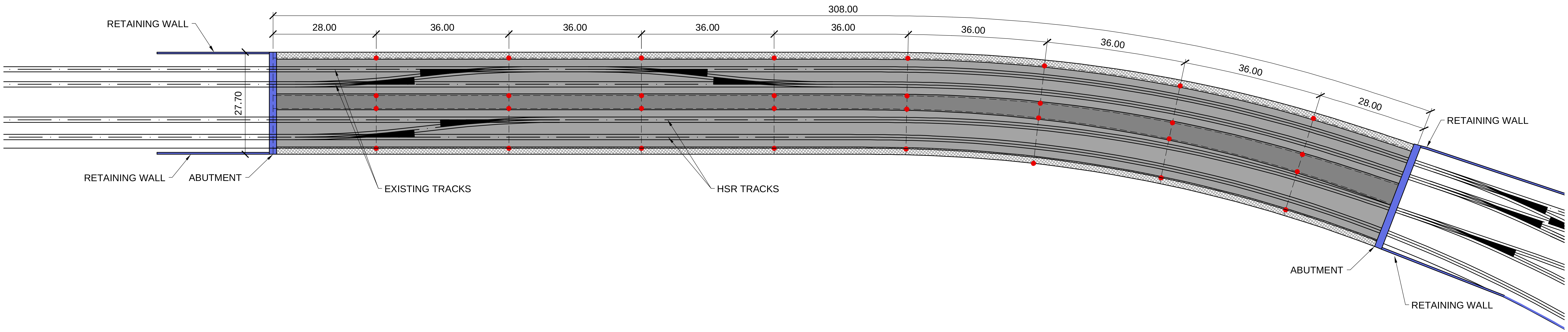
AECOM

TRANSPORTATION NETWORKS – UPDATED FUTURE NETWORK



AECOM

Appendix WP 2.7.5 – Viaduct Structural Drawings



PLAN VIEW

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

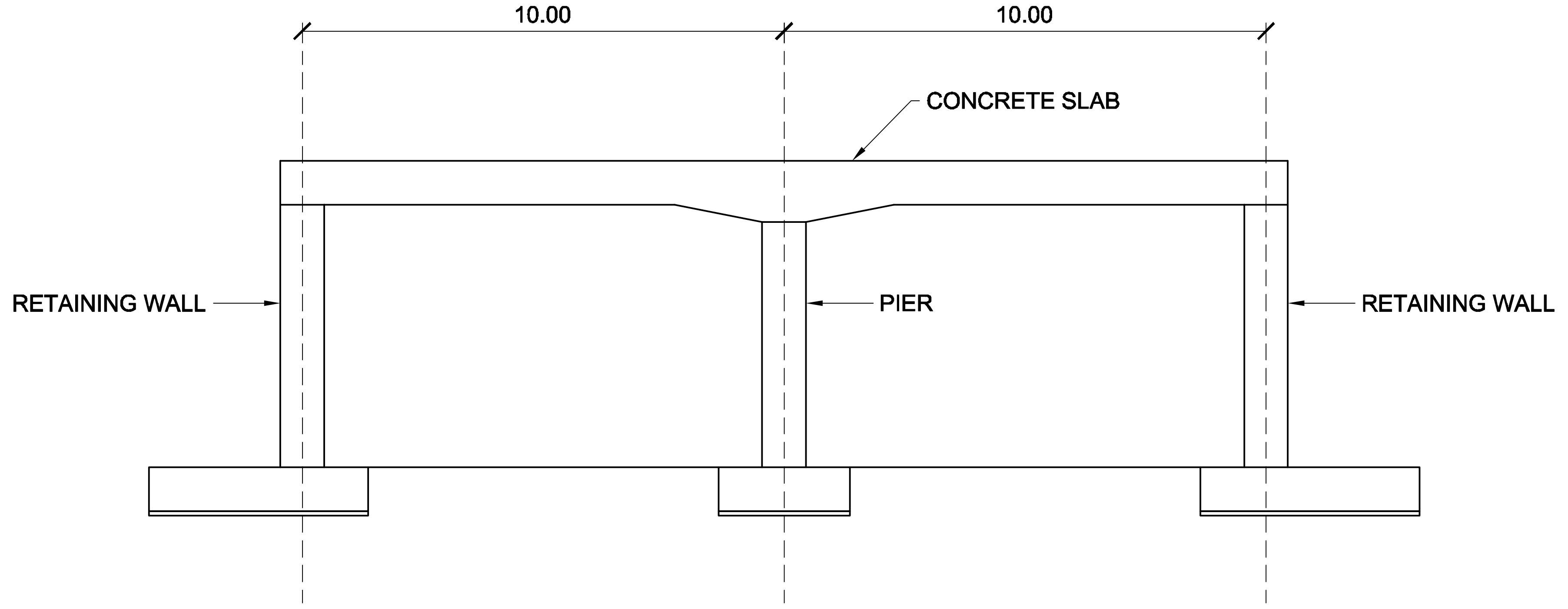
Date	Design/draft	Checked	Approved
12/11/2015	F. Ruiz	P. Benedetto	F. Mesa
Project no.	Scale	Paper size	Rev. Date
60437193	1:750	A2	12/09/2015

Drawing Name. VIADUCT PLAN

Drawing Number. RPTH-VIA-PLA-01

AECOM

PLAN VIEW



TYPICAL SECTION WIDENING UNDERPASS

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

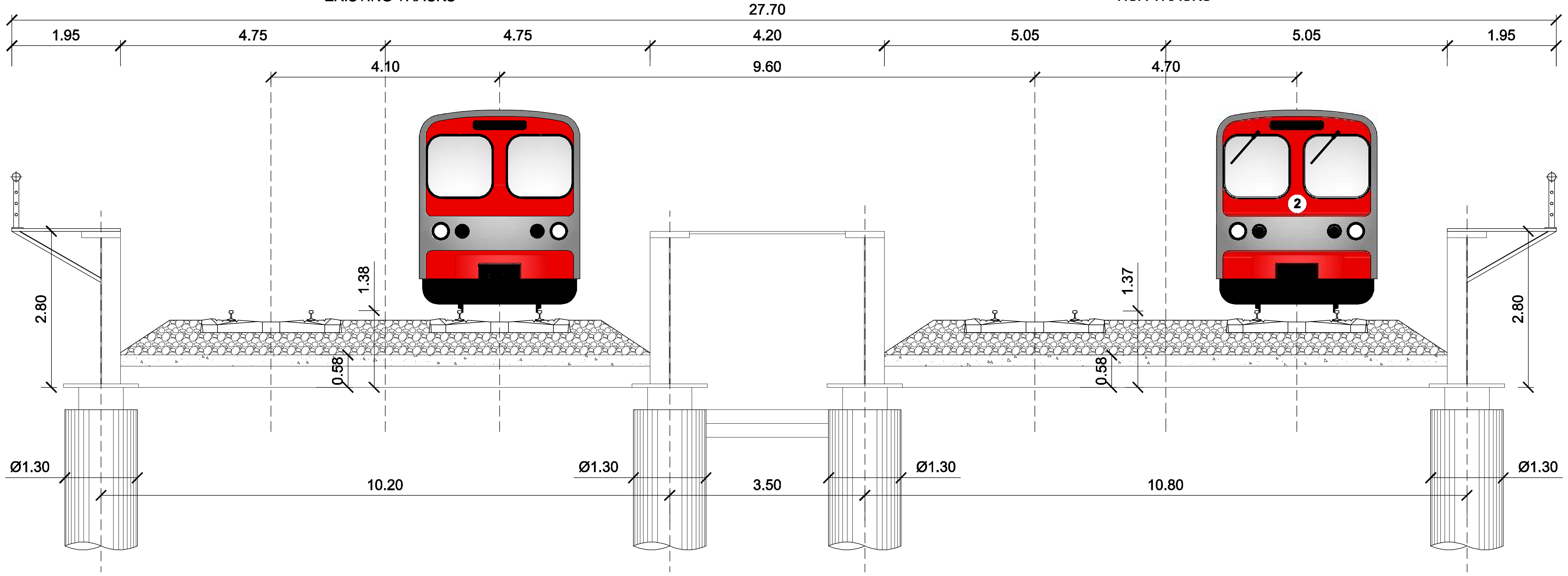
LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

Date	Design/draft	Checked	Approved
12/11/2015	F. Ruiz	P. Benedetto	F. Mesa
Project no.	Scale	Paper size	Rev. Date
60437193	1:750	A2	12/09/2015

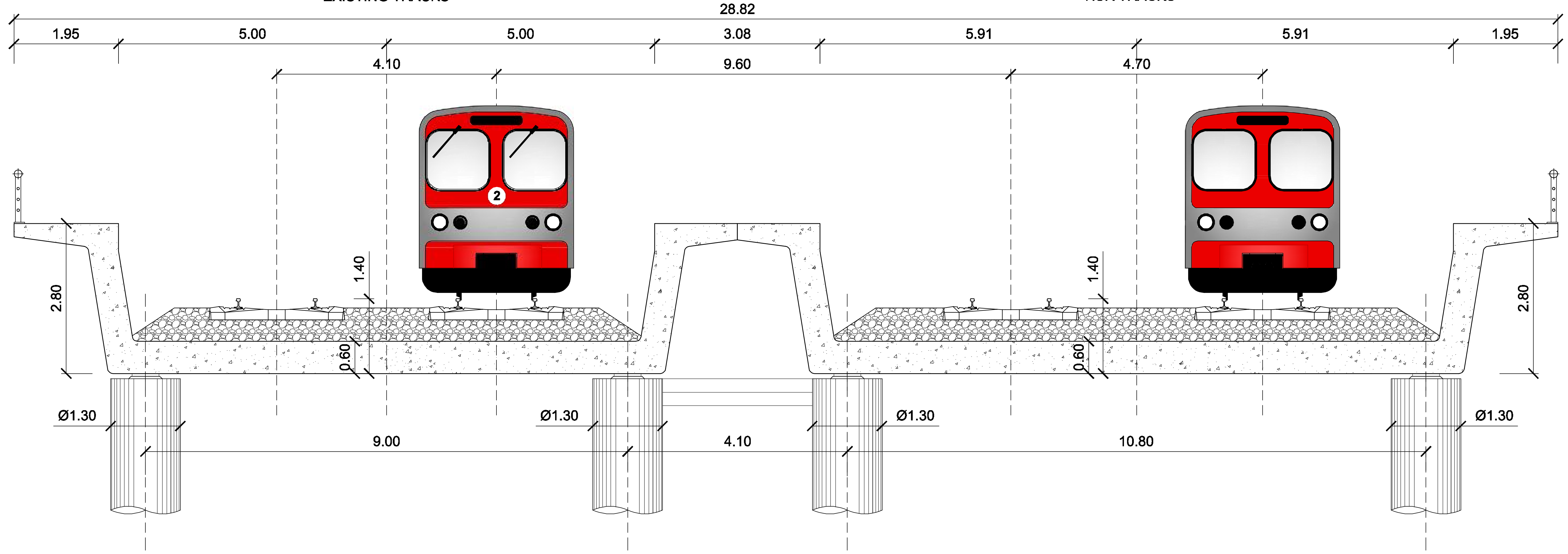
Drawing Name. WIDENING EXISTING UNDERPASS. PLAN VIEW AND SECTIONS

Drawing Number. RPTH-VIA-PLA-02

AECOM



TYPICAL SECTION



ALTERNATIVE SECTION

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

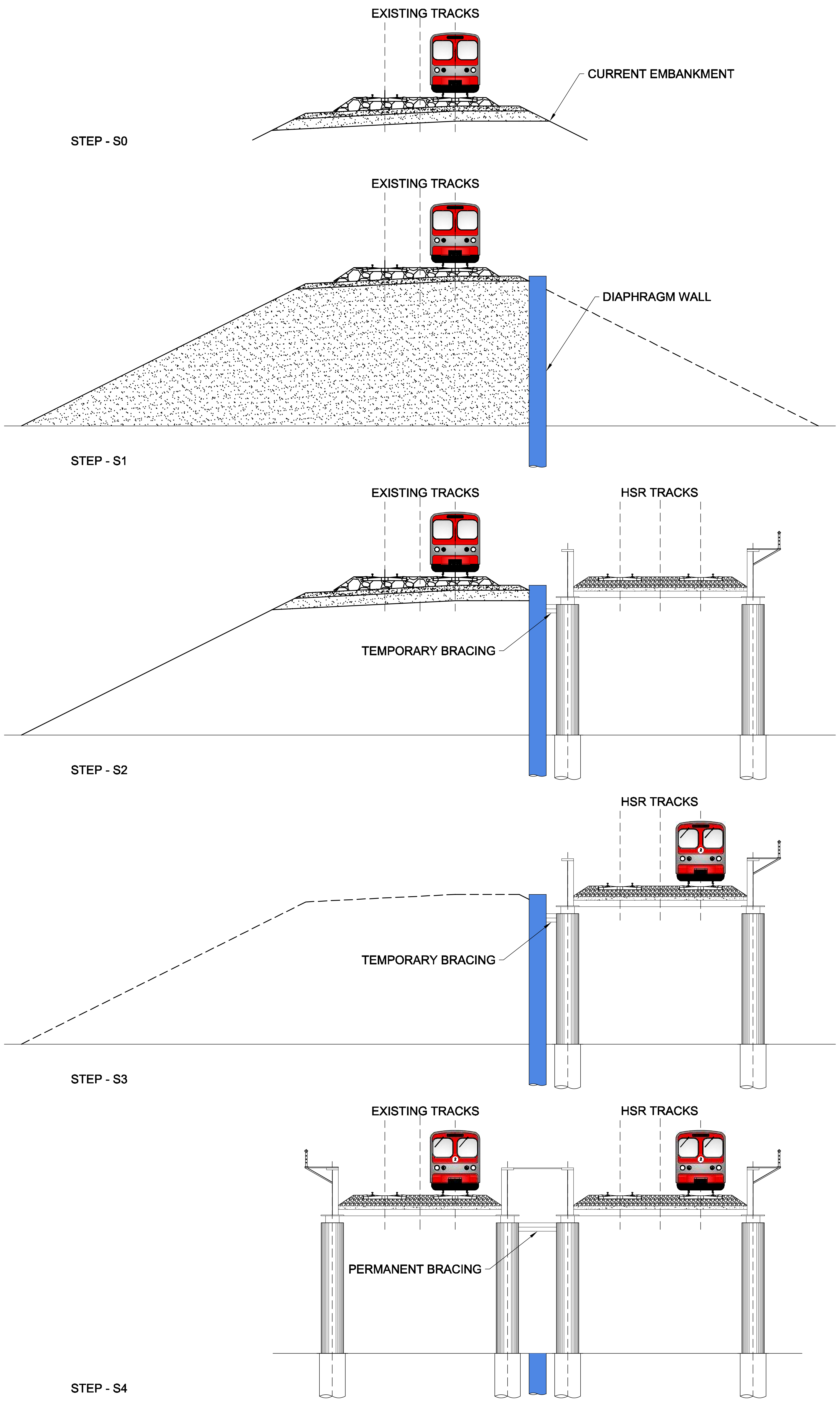
LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

Date 12/11/2015	Design/draft F. Ruiz	Checked P. Benedetto	Approved F. Mesa
Project no. 60437193	Scale 1:75	Paper size A2	Rev. Date 12/09/2015

Drawing Name. VIADUCT CROSS SECTION

Drawing Number. RPTH-VIA-SEC-01

AECOM



STEP - S0

1. EXISTING SITUATION

STEP - S1

1. DIAPHRAGM WALL CONSTRUCTION.
2. REMOVE EXISTING EMBANKMENT.

STEP - S2

1. FOUNDATION, PIERS AND DECK CONSTRUCTION.
2. TEMPORARY BRACING TO CONNECT PIERS AND DIAPHRAGM WALL.
3. TRAFFIC IS DIVERTED BY NEW TRACKS.

STEP - S3

1. REMOVE EXISTING EMBANKMENT.
2. FOUNDATION, PIERS AND DECK CONSTRUCTION.

STEP - S4

1. DIAPHRAGM WALL DEMOLITION.
2. PERMANENT BRACING TO CONNECT PIERS.
3. OPEN TO FULL TRAFFIC.

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
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12/11/2015	F. Ruiz	P. Benedetto	F. Mesa
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60437193	1:200	A2	12/09/2015

Drawing Name. CONSTRUCTION PHASE: VIADUCTS

Drawing Number. RPTH-VIA-PHS-01

AECOM

Appendix WP 2.7.6 – Multimodal Hub Architectural Drawings

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

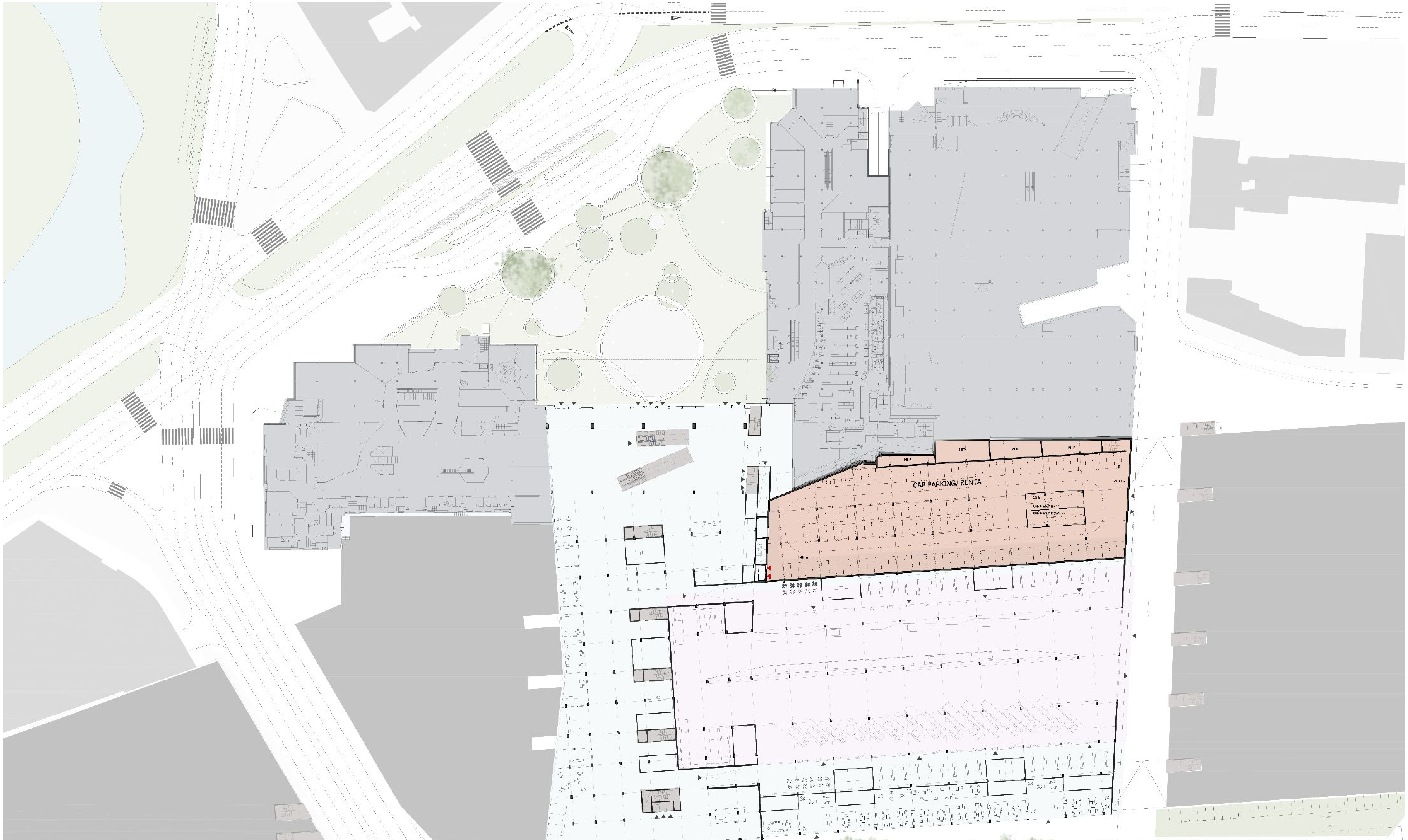
Date	Designed/drawn	Checked	Approved
12/11/2015	A. Castilla	J. Gutiérrez	F. Mesa

Project no	Scale	Paper size	Rev. Date
60437193	1:750	A2	14/01/2016

Drawing Name: MULTIMODAL HUB BUILDING: STREET LEVEL FLOOR PLAN.LEVEL +0.00

Drawing Number: RPTH-ARC-PLA-01-REV1

AECOM



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

Elaboration of the best engineering solution

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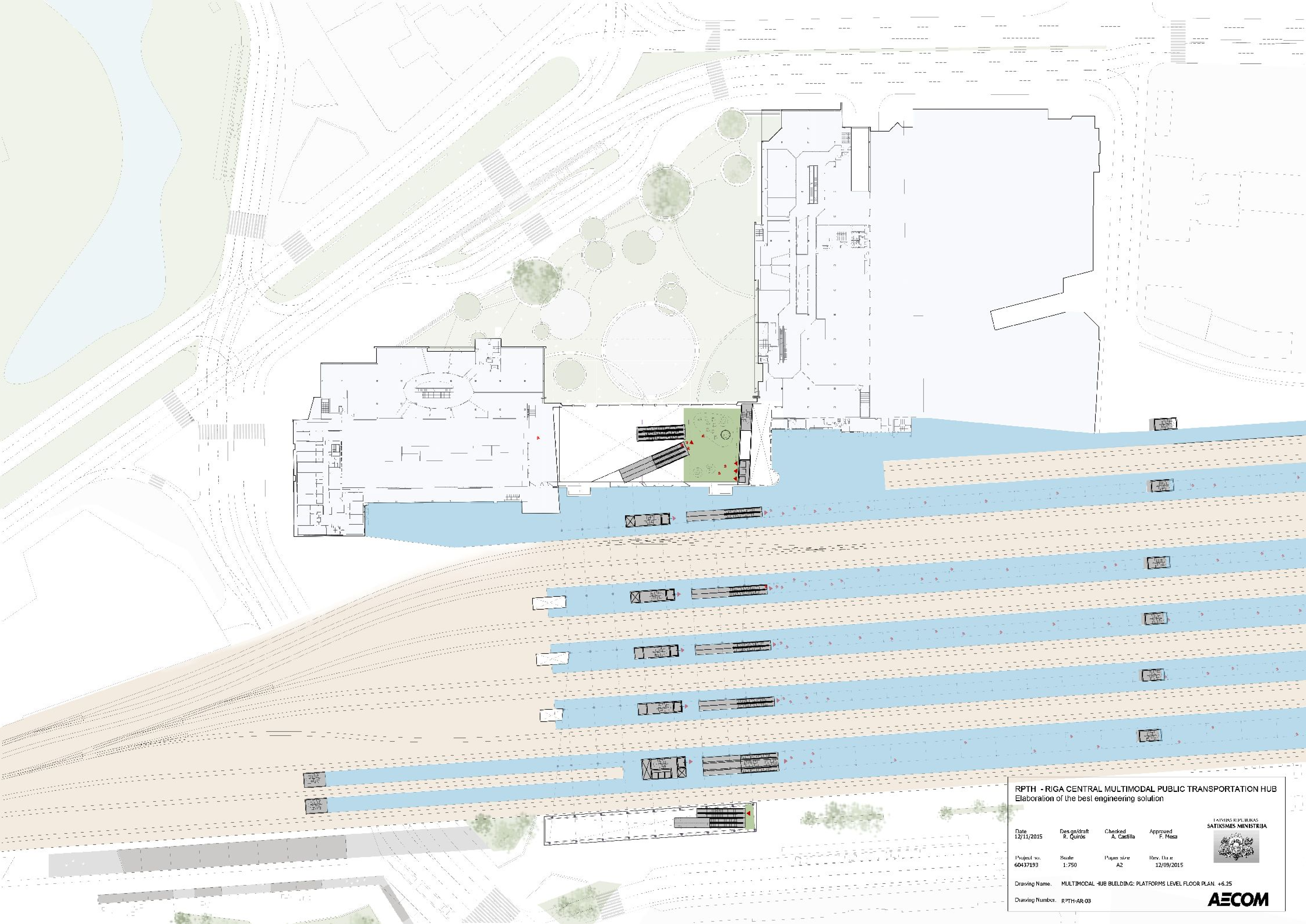
Date	Design/draft	Checked	Approved
12/11/2015	R. Quirós	A. Castilla	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193	1:750	A2	12/09/2015

Drawing Name. MULTIMODAL HUB BUILDING: PARKING LEVEL FLOOR PLANS. LEVEL +1.55

Drawing Number RPTH-ARC-PLA-02



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
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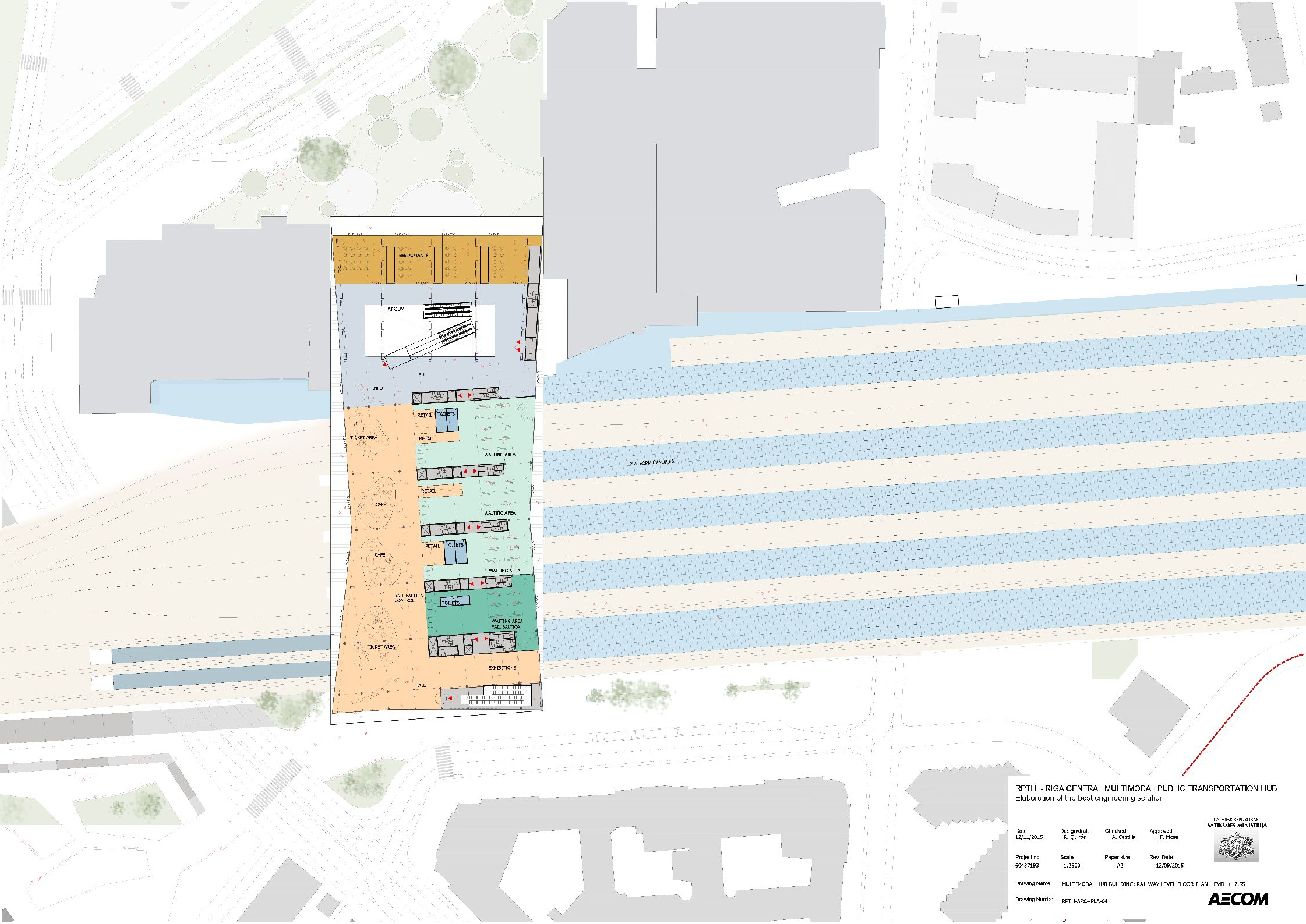
Date	Design/draft	Checked	Approved
12/11/2015	R. Quirós	A. Castilla	F. Mesa

Project no.	Scale	Paper size	Rev. Date
60437193	1:750	A2	12/09/2015

Drawing Name. MULTIMODAL HUB BUILDING: PLATFORMS LEVEL FLOOR PLAN. +6.25

Drawing Number. RPTH-AR-03

AECOM



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
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Date	Design/draft	Checked	Approved
12/11/2015	R. Quirós	A. Castilla	F. Mesa
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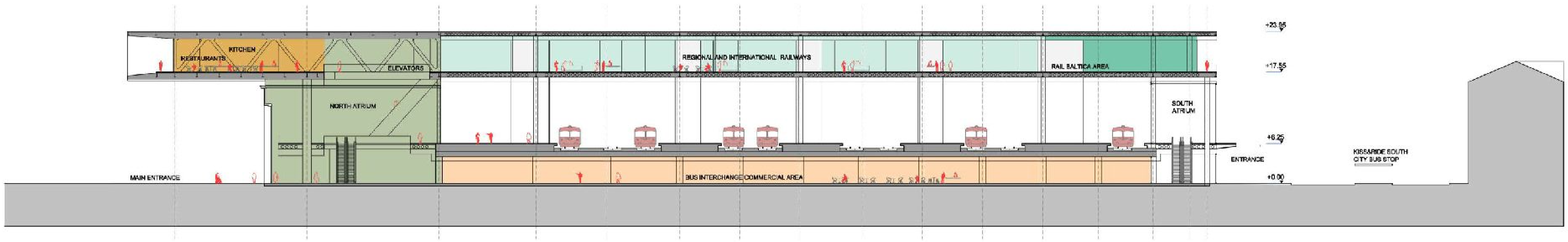
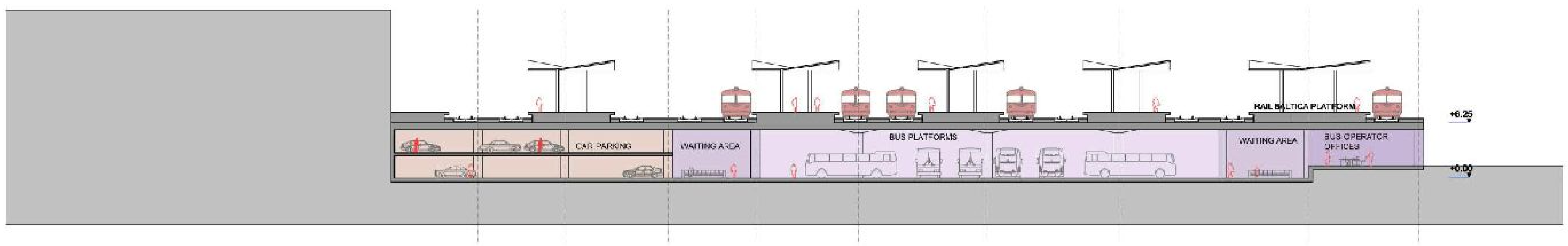
60437193	1:2500	A2	12/09/2015

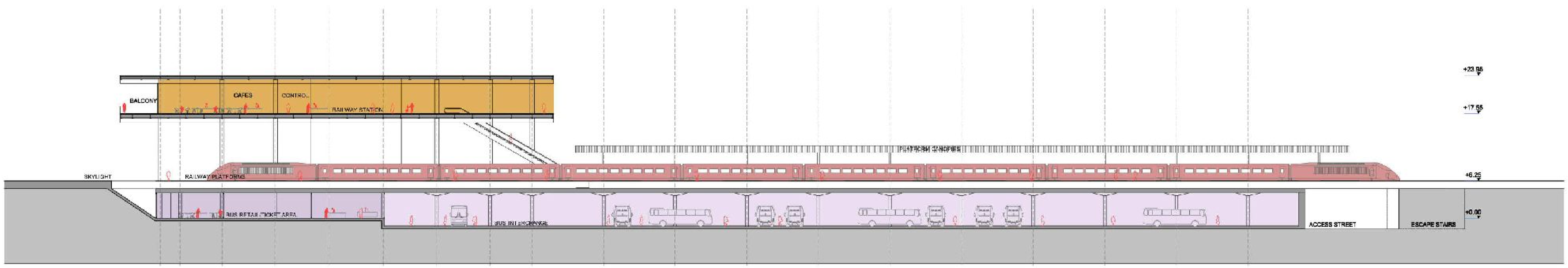
Drawing Name: MULTIMODAL HUB BUILDING: RAILWAY LEVEL FLOOR PLAN. LEVEL +17.55

Drawing Number: RPTH-ARC--PLA-04

AECOM







RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

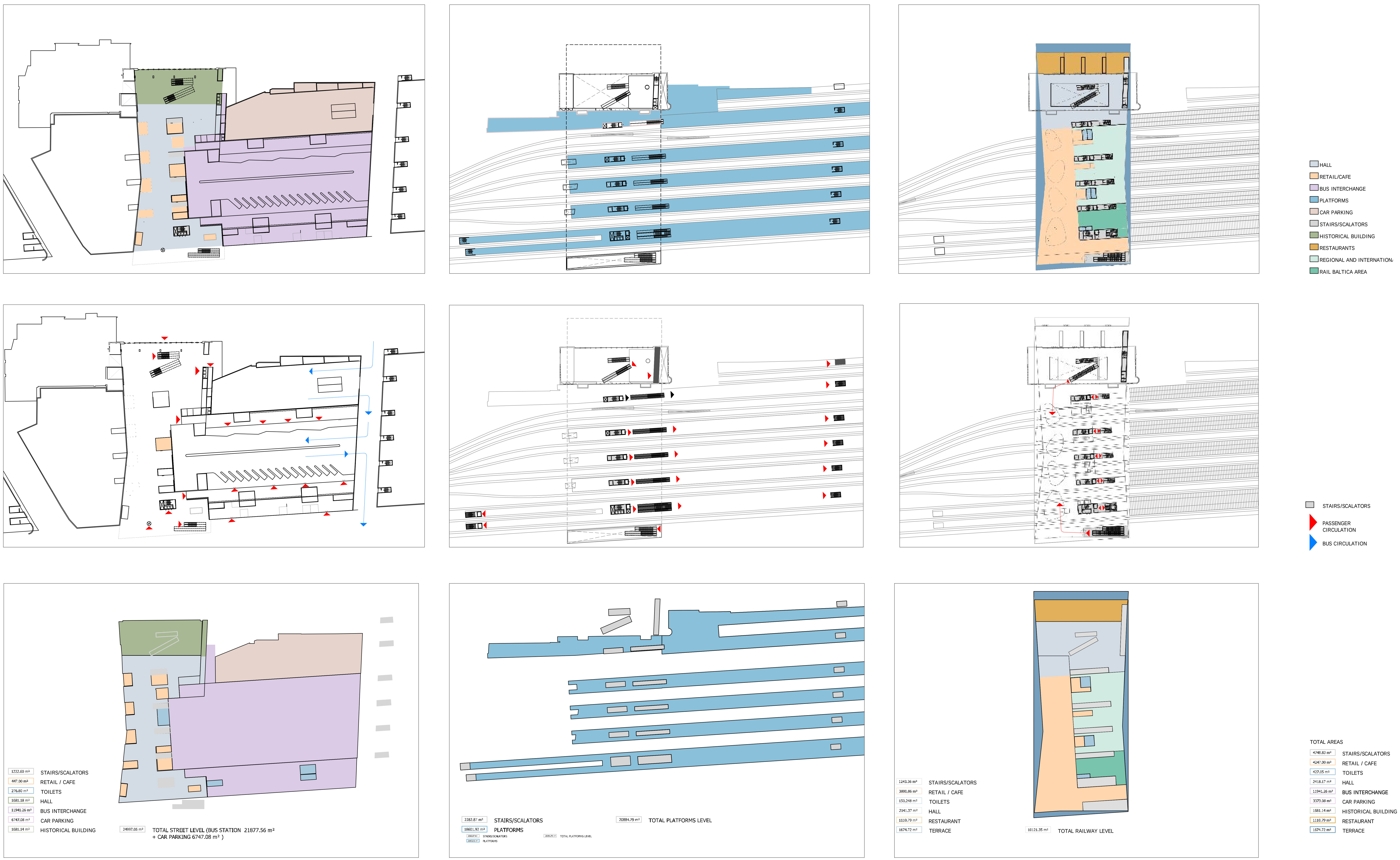
LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

Date 12/11/2015	Design/draft R. Quirós	Checked A. Castilla	Approved F. Mesa
Project no. 60437193	Scale 1:1000	Paper size A2	Rev. Date 12/09/2015

Drawing Name. MULTIMODAL HUB BUILDING: SECTIONS

Drawing Number. RPTH-AR-SEC-01

AECOM



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

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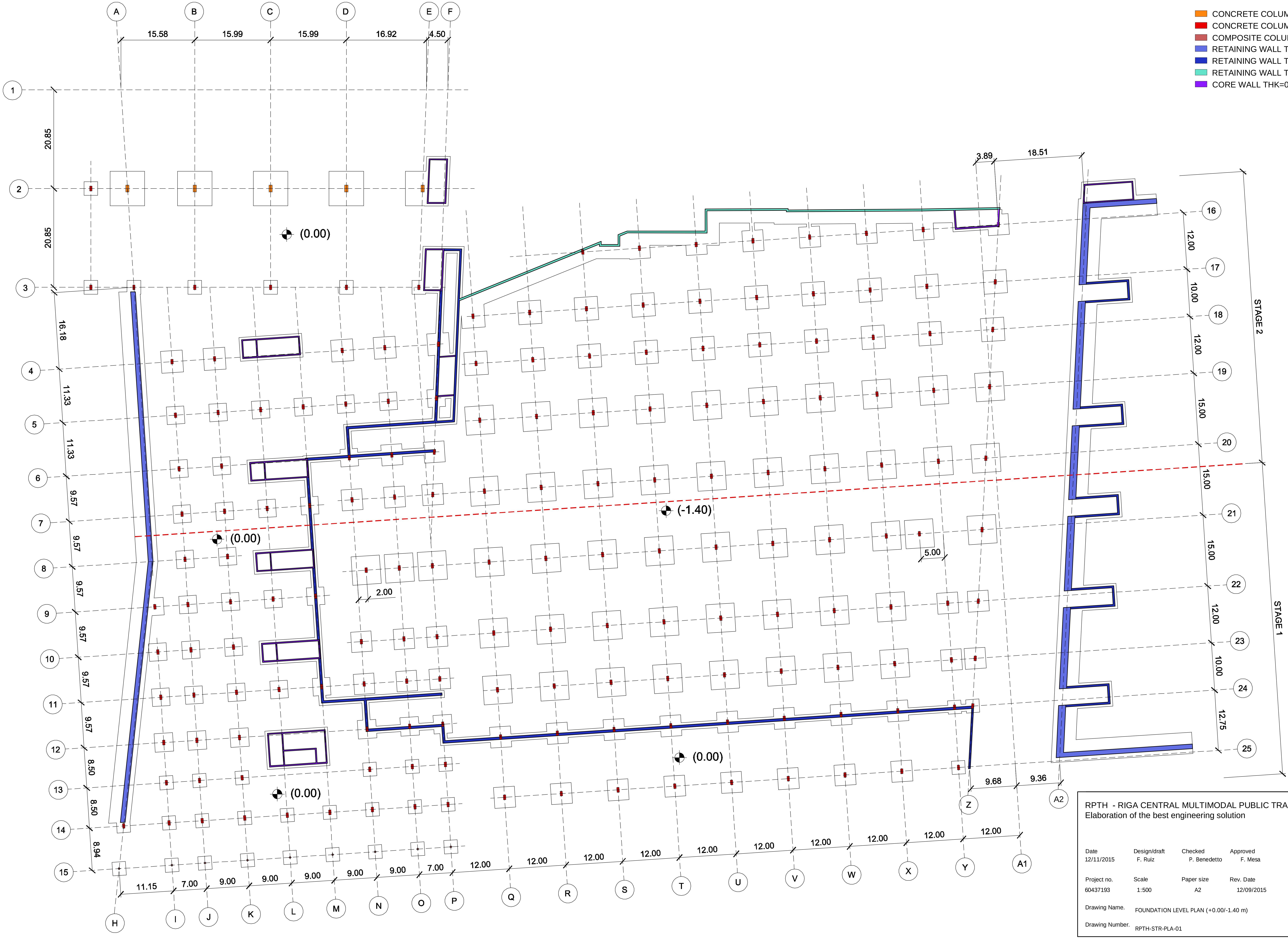
Date	Design/draft	Checked	Approved
12/11/2015	R. Quirós	A. Castilla	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193		A2	12/09/2015

Drawing Name. MULTIMODAL HUB BUILDING: SCHEMES PROGRAM, ACCESS AND AREAS

Drawing Number. RPTH-AR-DIA-01

AECOM

Appendix WP 2.7.7 – Multimodal Hub Structural Drawings



LEGEND

- CONCRETE COLUMN 1.40 x 0.70 m
- CONCRETE COLUMN 1.00 x 0.50 m
- COMPOSITE COLUMN Ø0.40 m
- RETAINING WALL THK=1.00 & 1.50 m
- RETAINING WALL THK=0.50 m
- RETAINING WALL THK=0.40 m
- CORE WALL THK=0.30 m

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

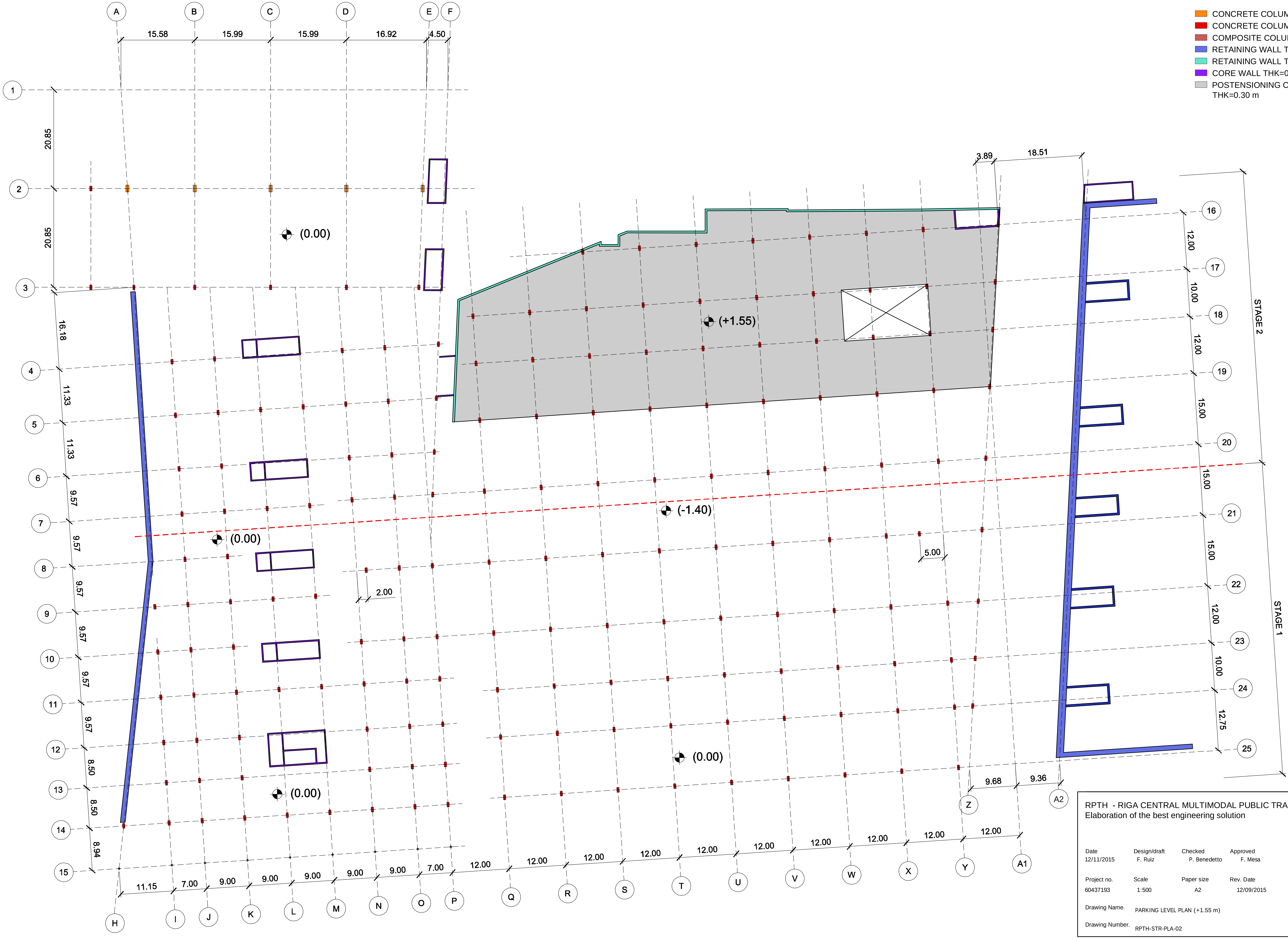
LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

Date	Design/draft	Checked	Approved
12/11/2015	F. Ruiz	P. Benedetto	F. Mesa
Project no.	Scale	Paper size	Rev. Date
60437193	1:500	A2	12/09/2015

Drawing Name. FOUNDATION LEVEL PLAN (+0.00/-1.40 m)

Drawing Number. RPTH-STR-PLA-01

AECOM



LEGEND

- CONCRETE COLUMN 1.40 x 0.70 m
- CONCRETE COLUMN 1.00 x 0.50 m
- COMPOSITE COLUMN Ø0.40 m
- RETAINING WALL THK=1.00 & 1.50 m
- RETAINING WALL THK=0.40 m
- CORE WALL THK=0.30 m
- POSTENSIONING CONCRETE SLAB THK=0.30 m

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

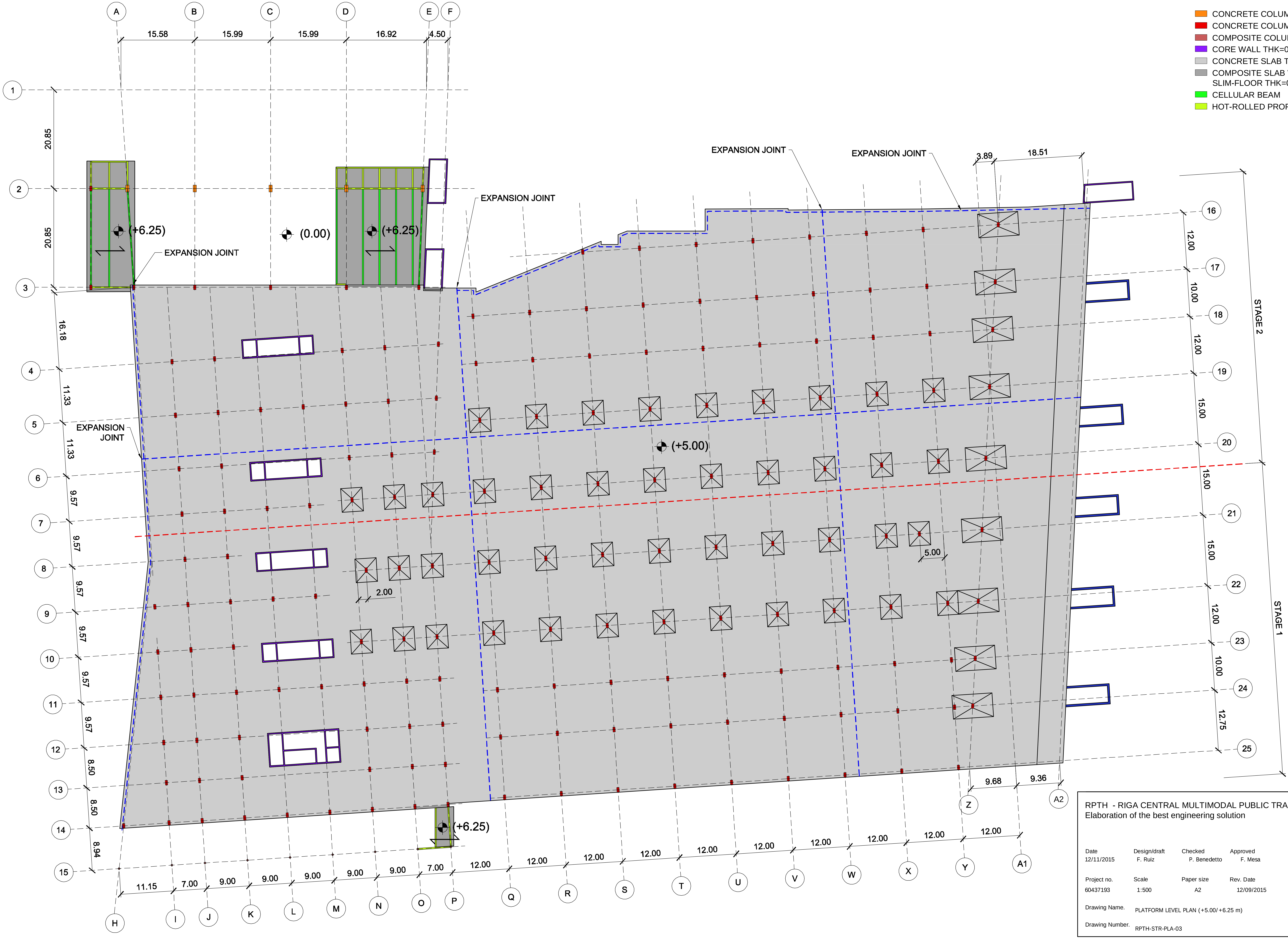
Date	Design/draft	Checked	Approved
12/11/2015	F. Ruiz	P. Benedetto	F. Mesa

Project no.	Scale	Paper size	Rev. Date
60437193	1:500	A2	12/09/2015

Drawing Name. PARKING LEVEL PLAN (+1.55 m)

Drawing Number. RPTH-STR-PLA-02

AECOM



LEGEND

- CONCRETE COLUMN 1.40 x 0.70 m
- CONCRETE COLUMN 1.00 x 0.50 m
- COMPOSITE COLUMN Ø0.40 m
- CORE WALL THK=0.30 m
- CONCRETE SLAB THK=0.75 m
- COMPOSITE SLAB WITH SLIM-FLOOR THK=0.14 m
- CELLULAR BEAM
- HOT-ROLLED PROFILE BEAM

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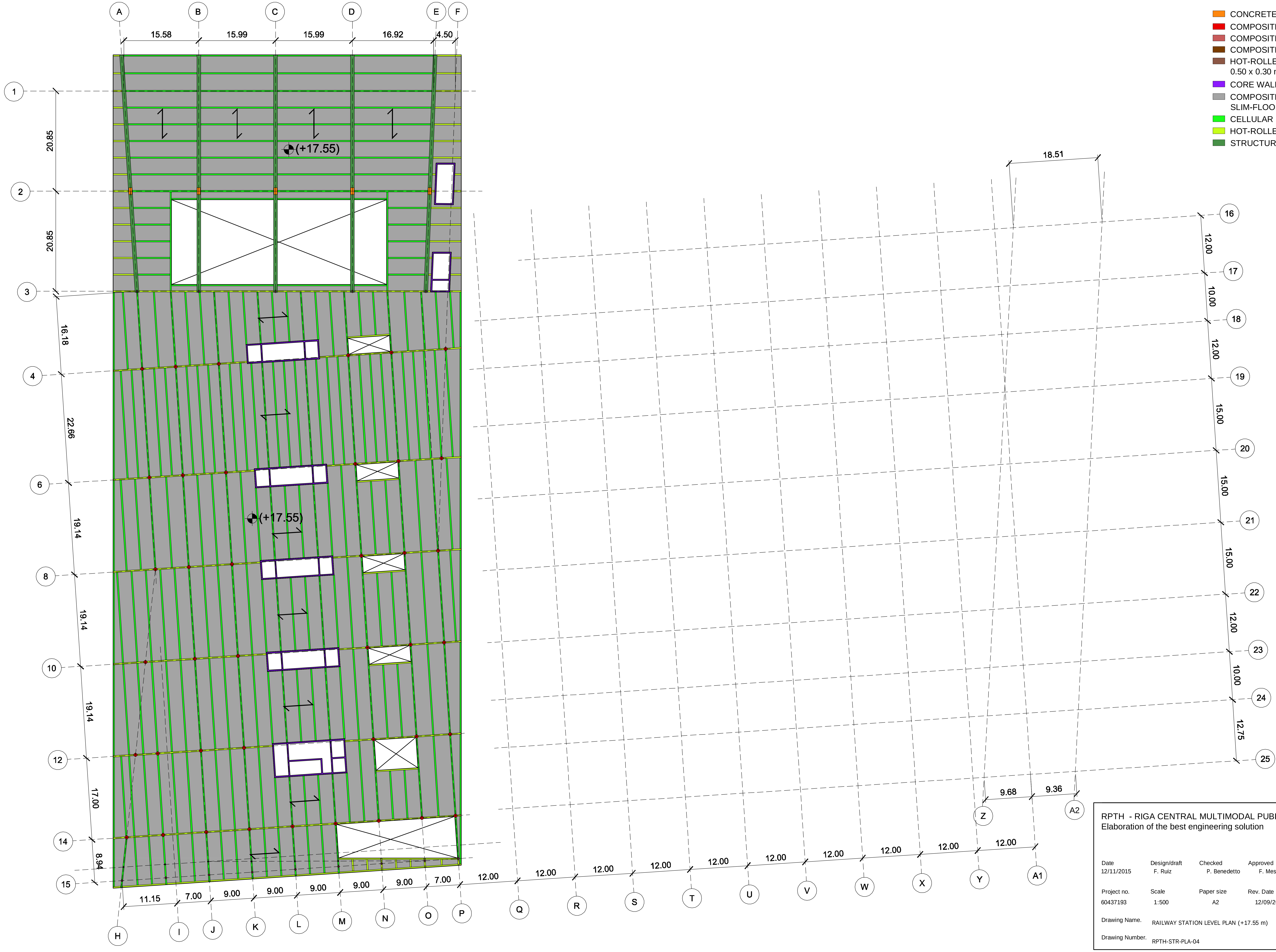
12/11/2015	F. Ruiz	P. Benedetto	F. Mesa

Project no.	Scale	Paper size	Rev. Date
60437193	1:500	A2	12/09/2015

Drawing Name. PLATFORM LEVEL PLAN (+5.00/+6.25 m)

Drawing Number. RPTH-STR-PLA-03

AECOM



LEGEND

- CONCRETE COLUMN 1.40 x 0.70 m
- COMPOSITE COLUMN Ø0.70 m
- COMPOSITE COLUMN Ø0.40 m
- COMPOSITE COLUMN Ø0.25 m
- HOT-ROLLED PROFILE COLUMN 0.50 x 0.30 m
- CORE WALL THK=0.30 m
- COMPOSITE SLAB WITH SLIM-FLOOR THK=0.14 m
- CELLULAR BEAM
- HOT-ROLLED PROFILE BEAM
- STRUCTURAL FRAME TYPE WARREN

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

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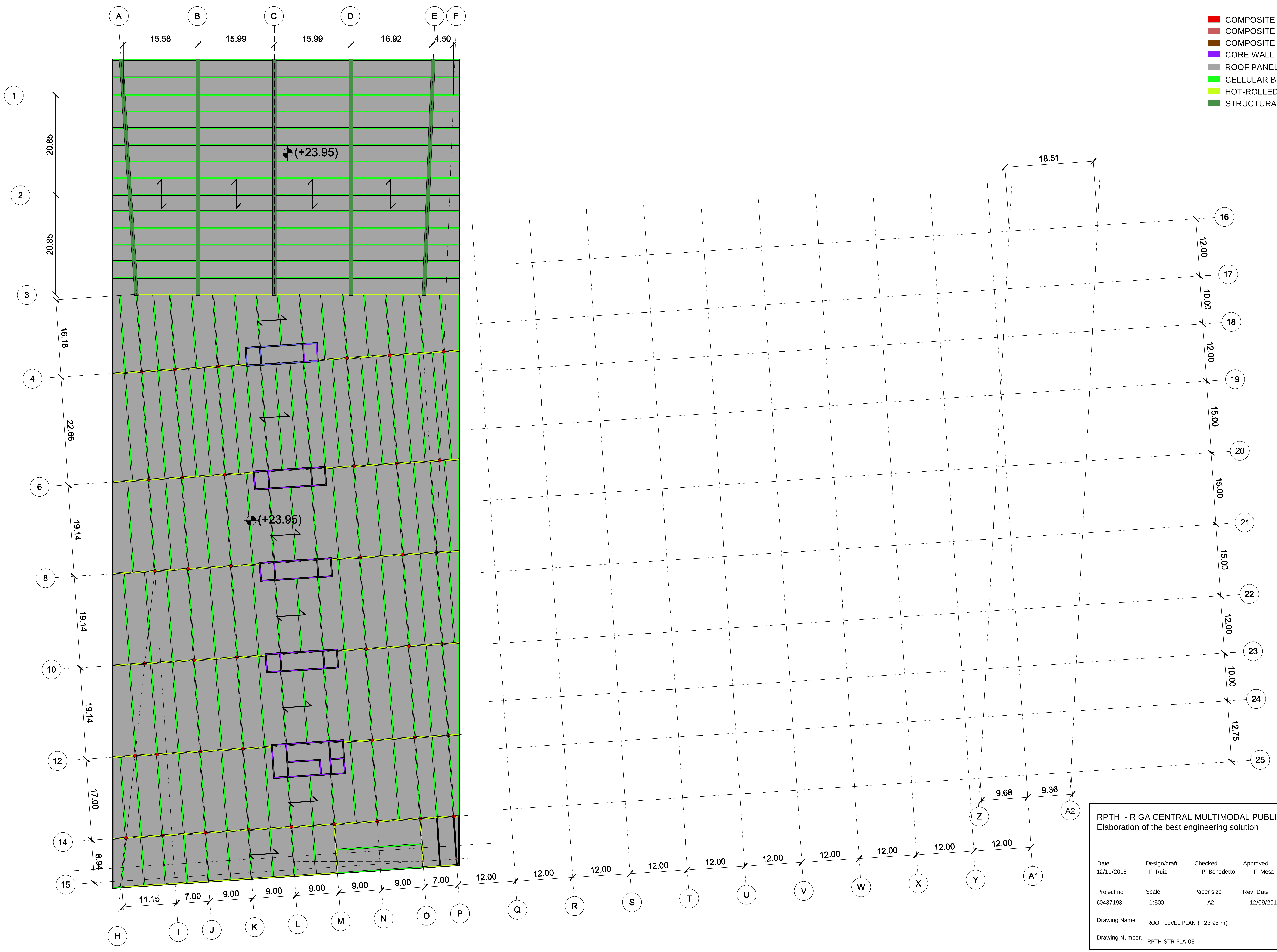
Date	Design/draft	Checked	Approved
12/11/2015	F. Ruiz	P. Benedetto	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193	1:500	A2	12/09/2015

Drawing Name. RAILWAY STATION LEVEL PLAN (+17.55 m)

Drawing Number. RPTH-STR-PLA-04

AECOM



LEGEND

- COMPOSITE COLUMN Ø0.70 m
- COMPOSITE COLUMN Ø0.40 m
- COMPOSITE COLUMN Ø0.25 m
- CORE WALL THK=0.30 m
- ROOF PANEL THK=0.15 m
- CELLULAR BEAM
- HOT-ROLLED PROFILE BEAM
- STRUCTURAL FRAME TYPE WARREN

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
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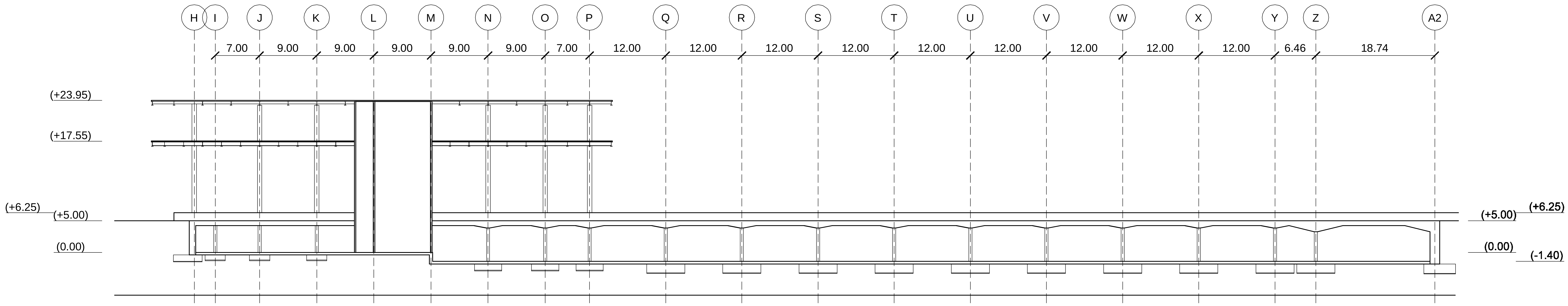
Project no.	Scale	Paper size	Rev. Date
60437193	1:500	A2	12/09/2015

Drawing Name. ROOF LEVEL PLAN (+23.95 m)

Drawing Number. RPTH-STR-PLA-05

AECOM



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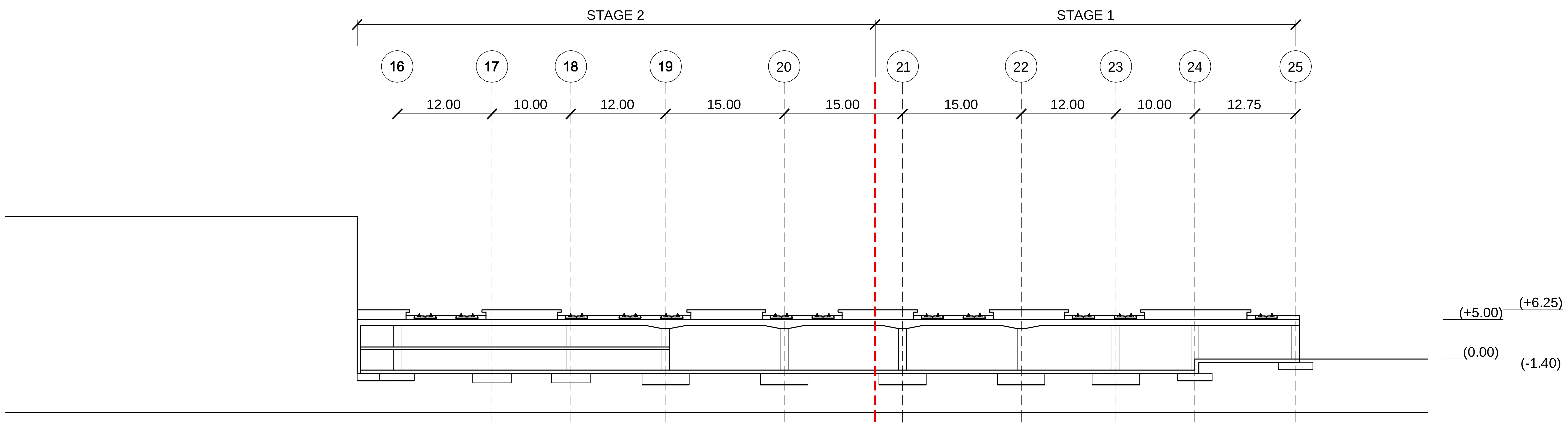

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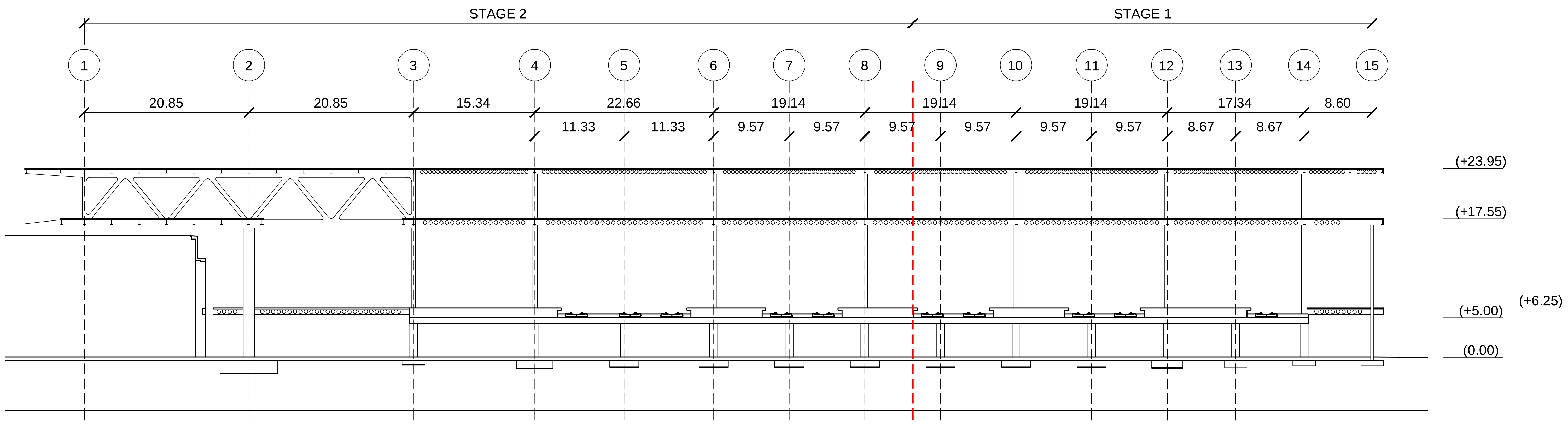

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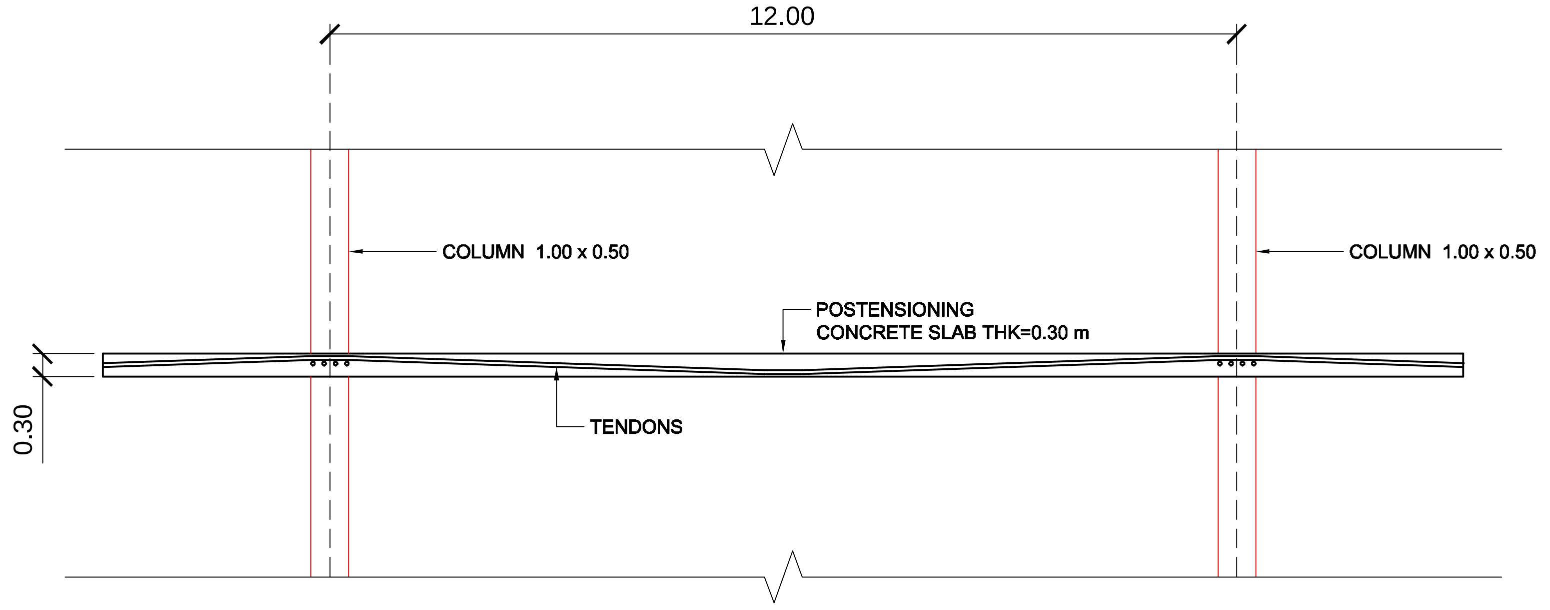
12/11/2015	F. Ruiz	P. Benedetto	F. Mesa
Project no.	Scale	Paper size	Rev. Date
60437193	1:500	A2	12/09/2015

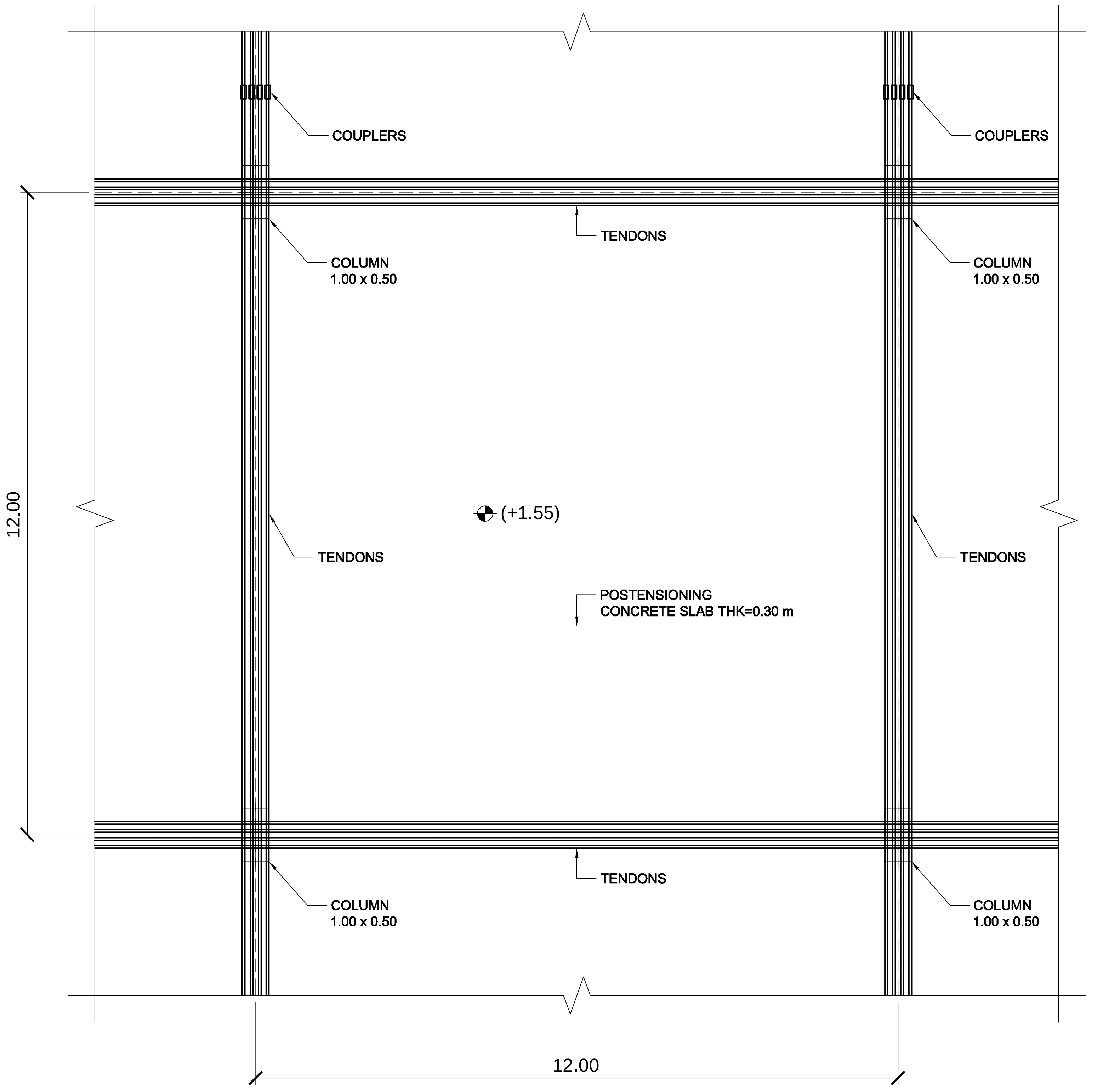
Drawing Name. CROSS SECTION: LONGITUDINAL AND TRANSVERSE

Drawing Number. RPTH-STR-SEC-01

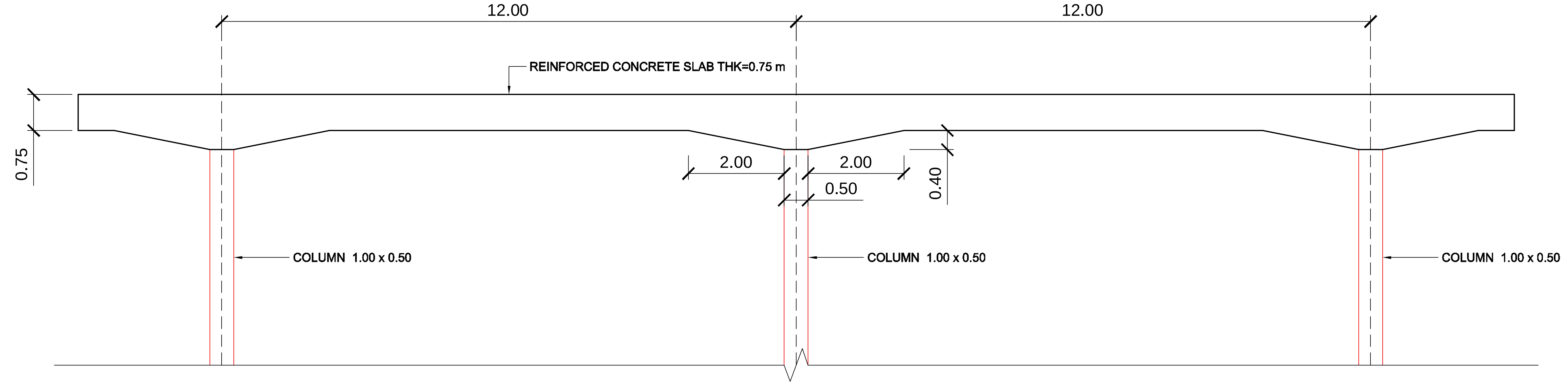
AECOM



SECTION. POSTENSIONING CONCRETE SLAB THK=0.30 m



PLAN. POSTENSIONING CONCRETE SLAB THK=0.30 m



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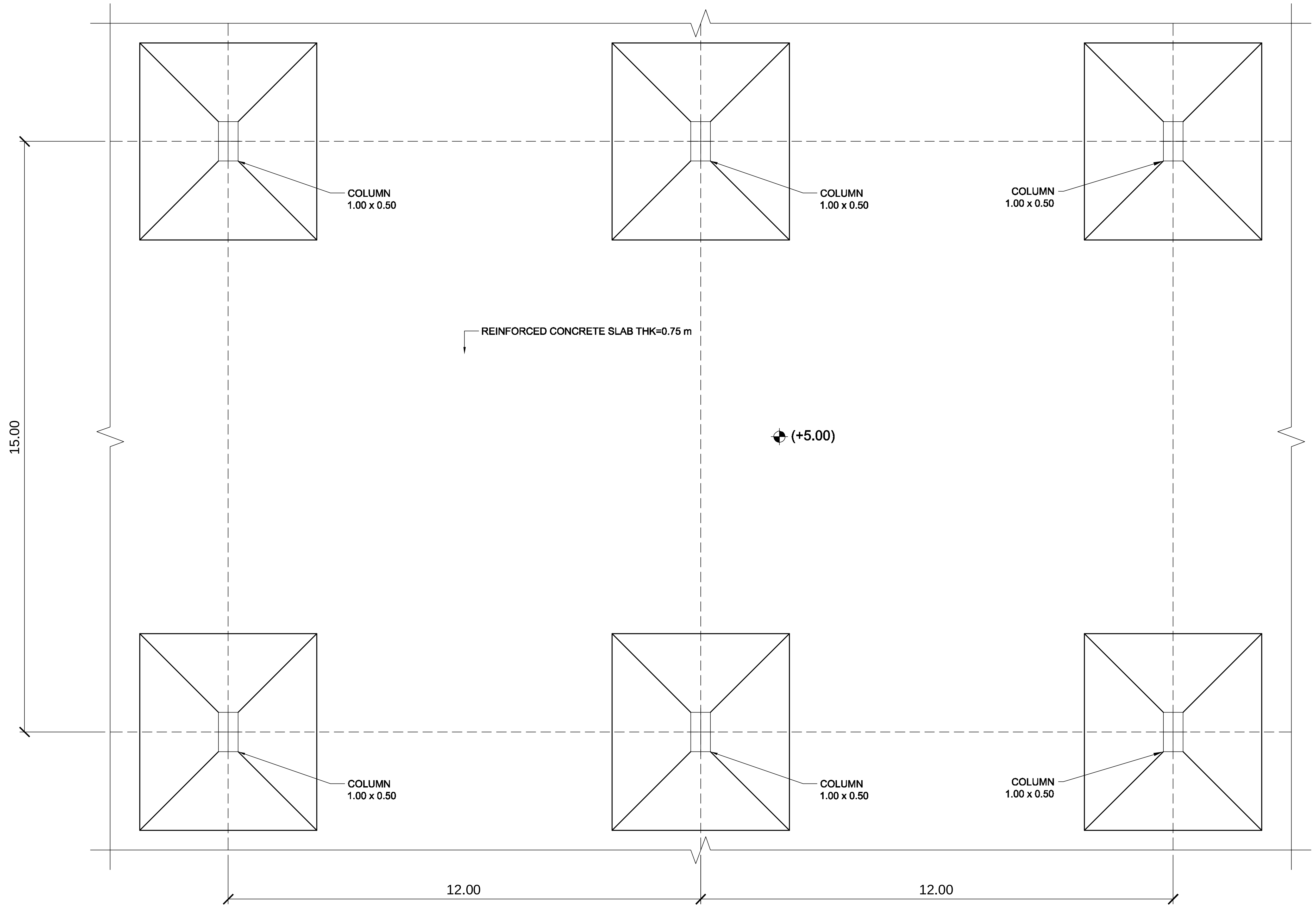

PLAN. CONCRETE SLAB THK=0.75 m

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60437193	1:100	A2	12/09/2015

Drawing Name. DETAILS (I)

Drawing Number. RPTH-STR-DET-01

LATVIJAS REPUBLIKAS
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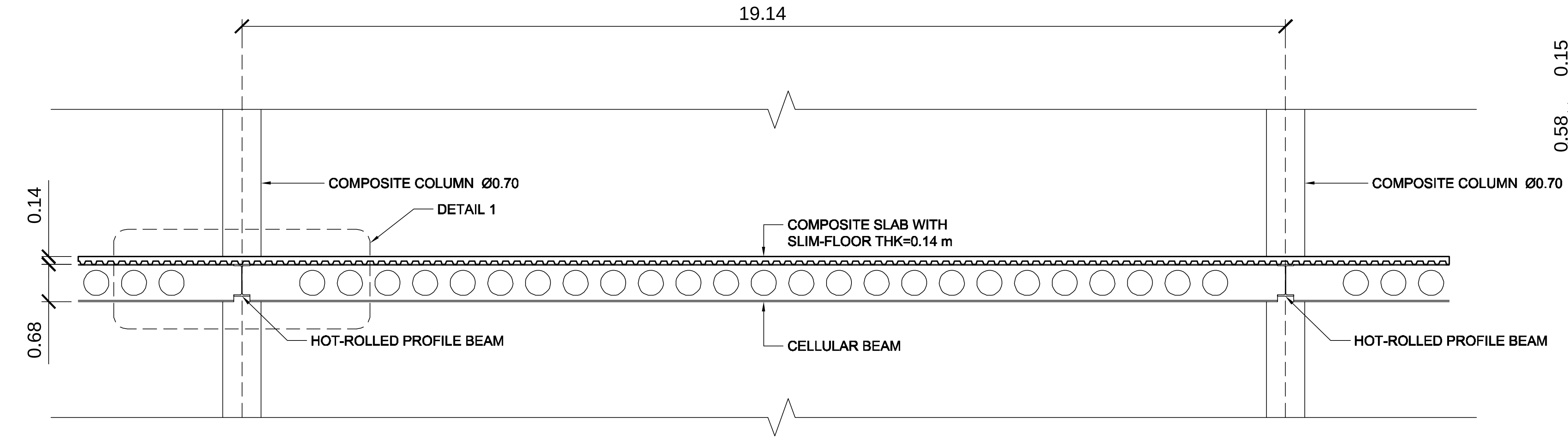
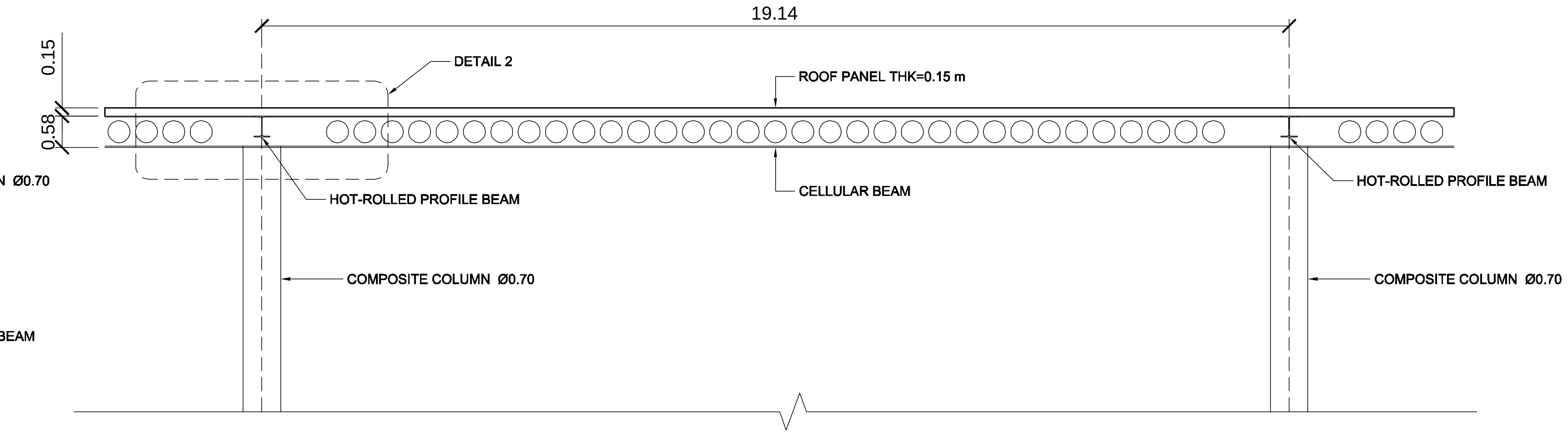
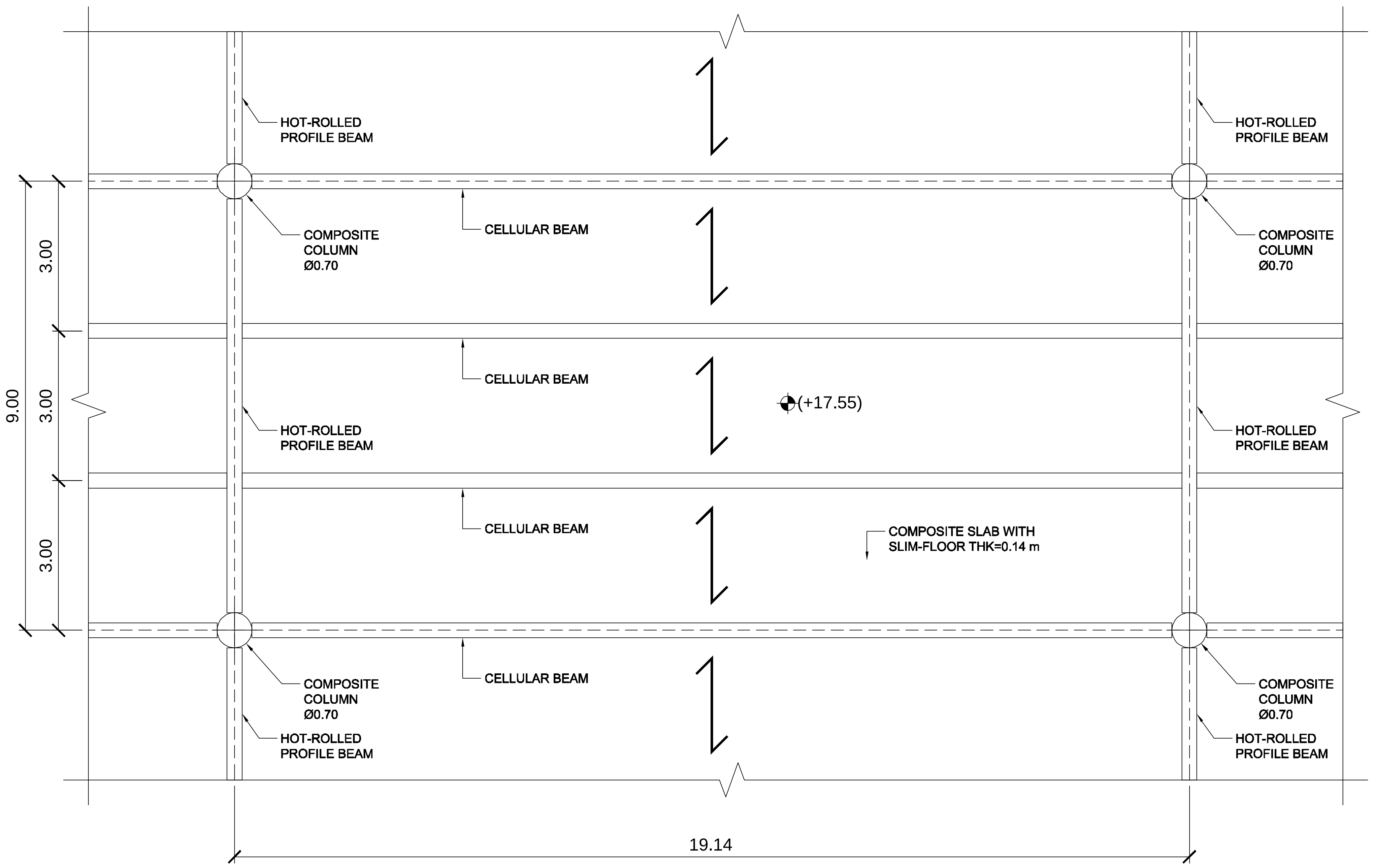


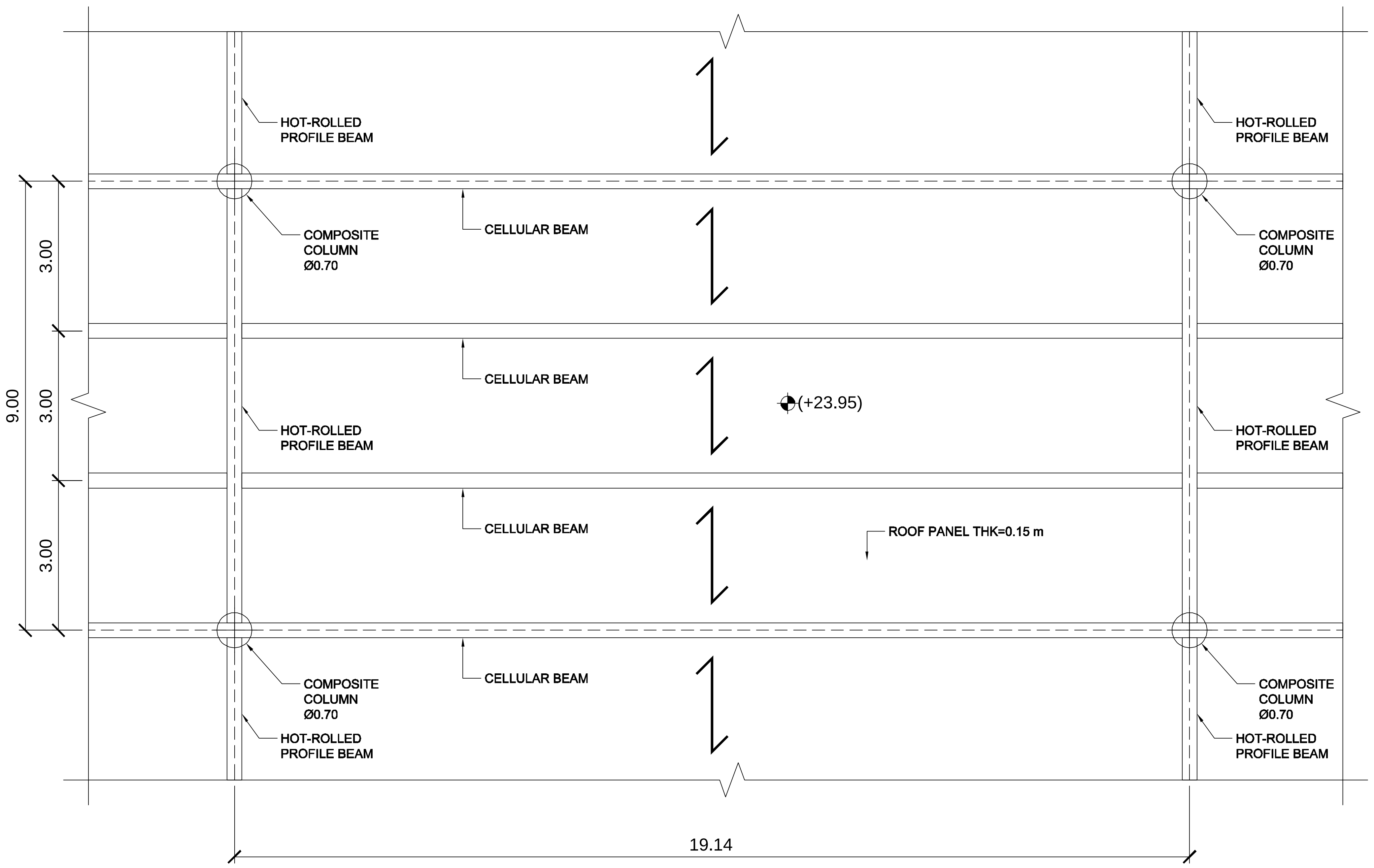
SECTION. COMPOSITE SLAB WITH SLIM-FLOOR THK=0.14 m



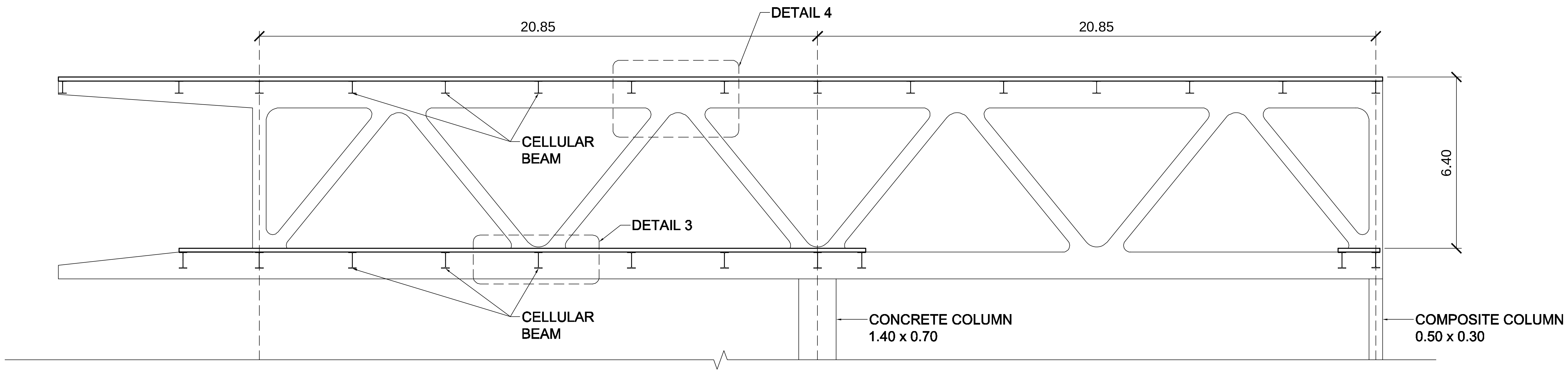
SECTION. ROOF PANEL THK=0.15 m



PLAN. COMPOSITE SLAB WITH SLIM-FLOOR THK=0.14 m



PLAN. ROOF PANEL THK=0.15 m



SECTION. STRUCTURAL FRAME TYPE WARREN

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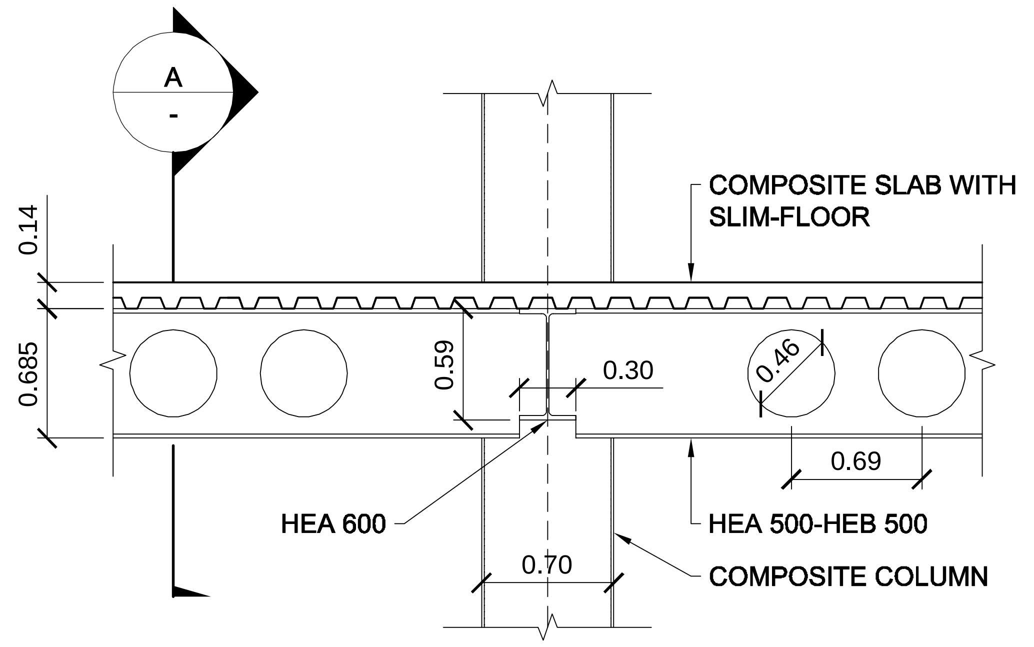
12/11/2015	F. Ruiz	P. Benedetto	F. Mesa
Project no.	Scale	Paper size	Rev. Date
60437193	1:100	A2	12/09/2015

Drawing Name. DETAILS (II)
Drawing Number. RPTH-STR-DET-02

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

AECOM



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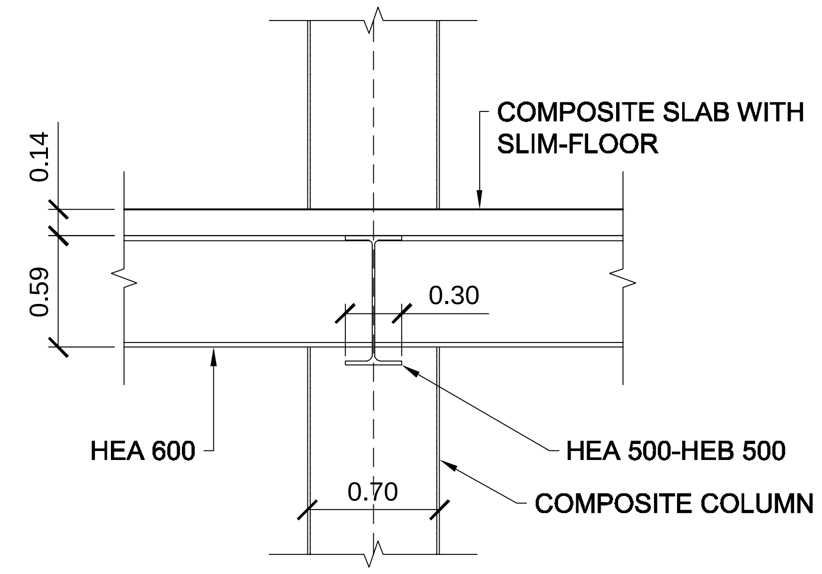

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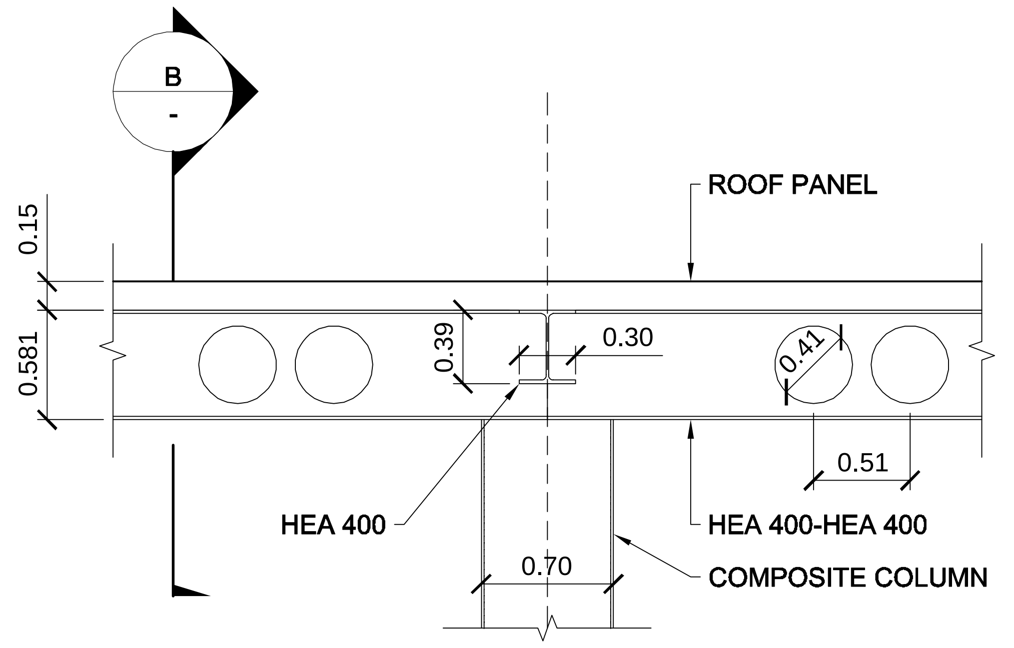

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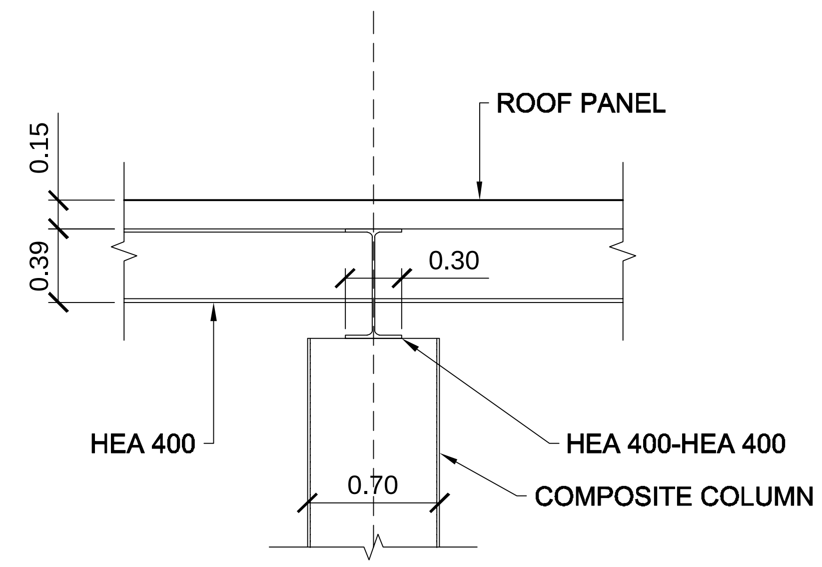

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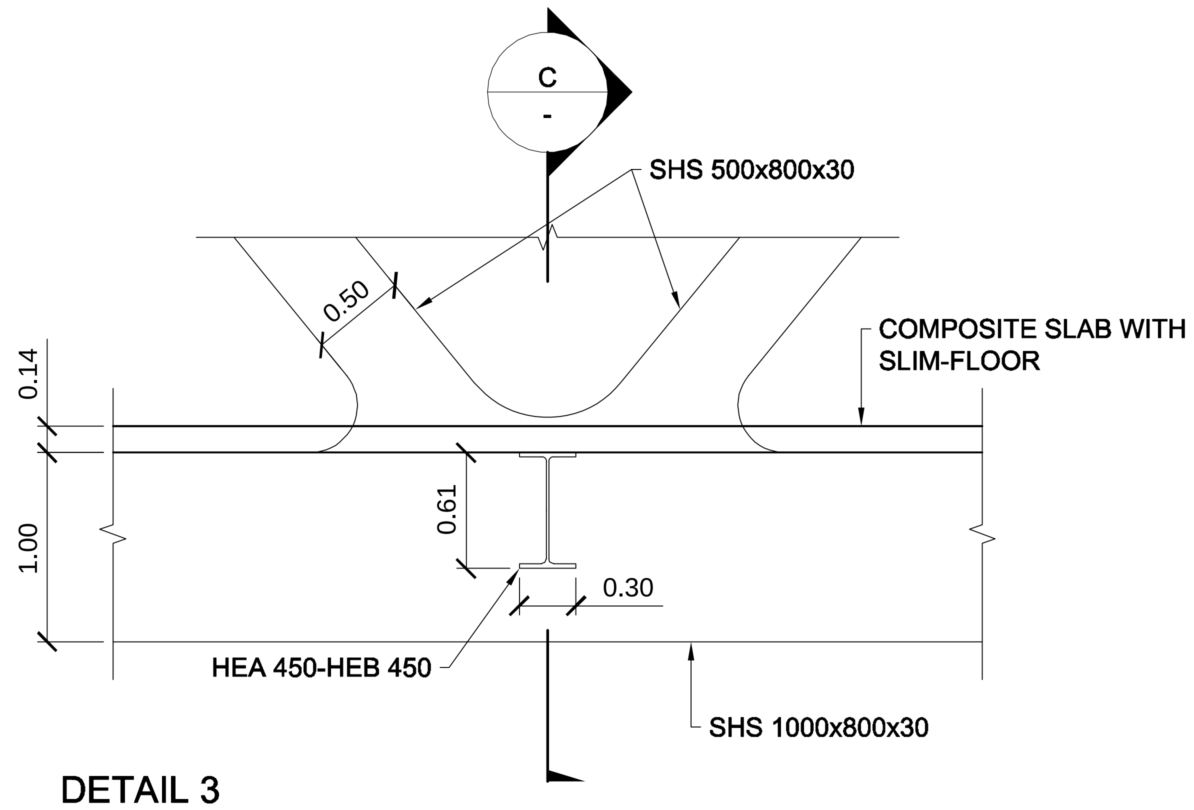

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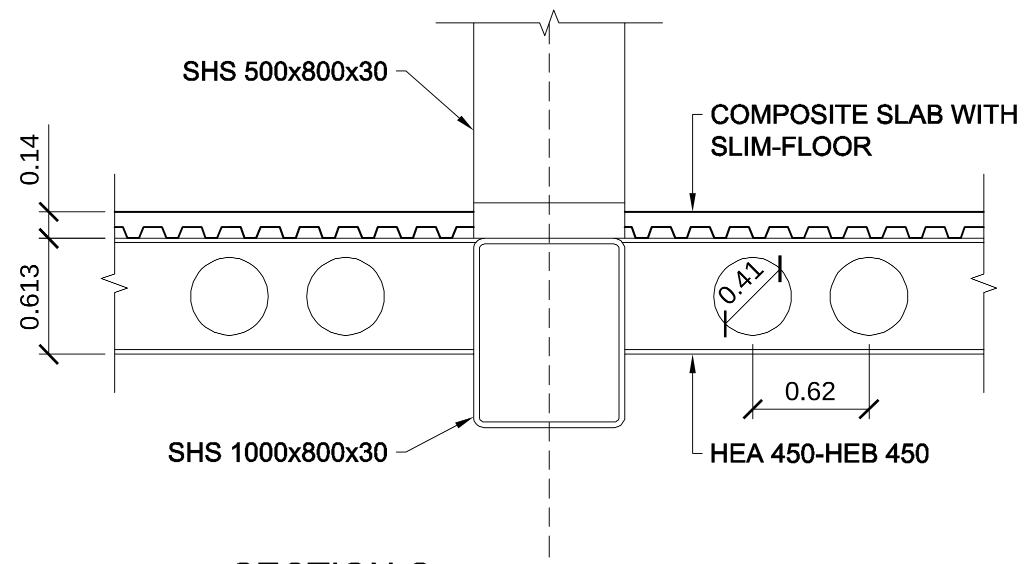

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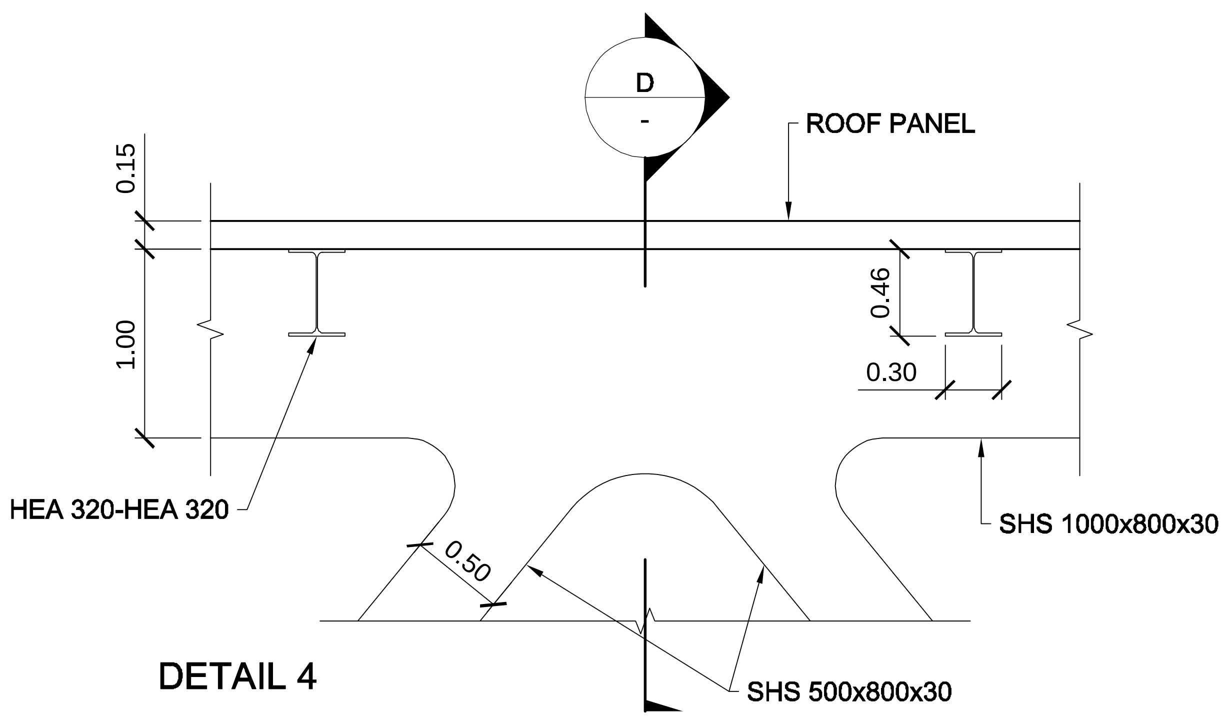

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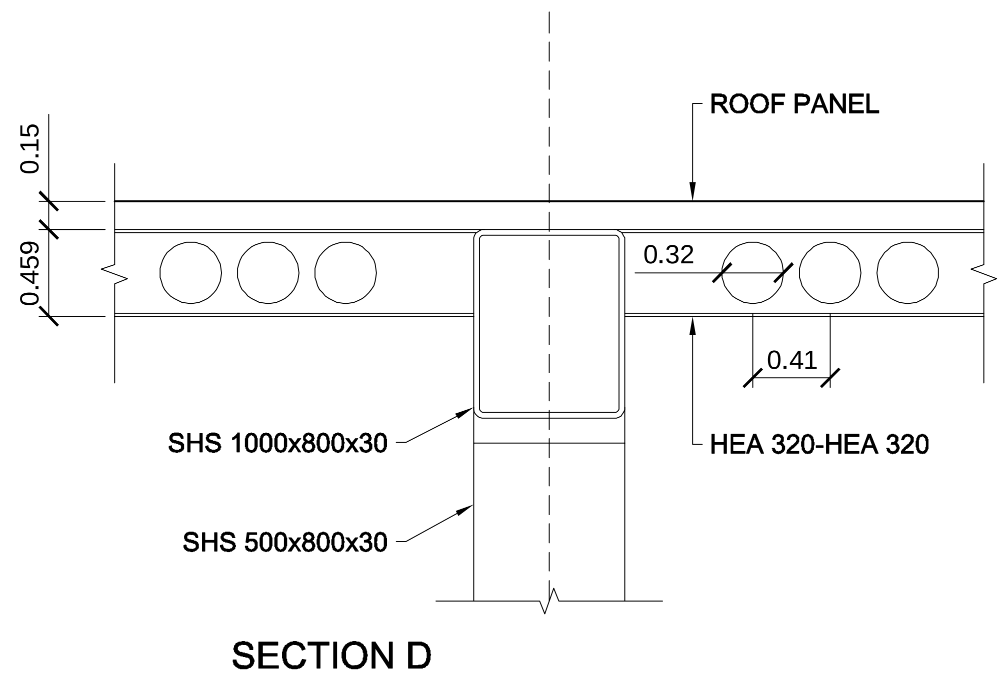

SECTION D

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

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12/11/2015	F. Ruiz	P. Benedetto	F. Mesa
Project no.	Scale	Paper size	Rev. Date
60437193	1:100	A2	12/09/2015

Drawing Name. DETAILS (III)

Drawing Number. RPTH-STR-DET-03

AECOM

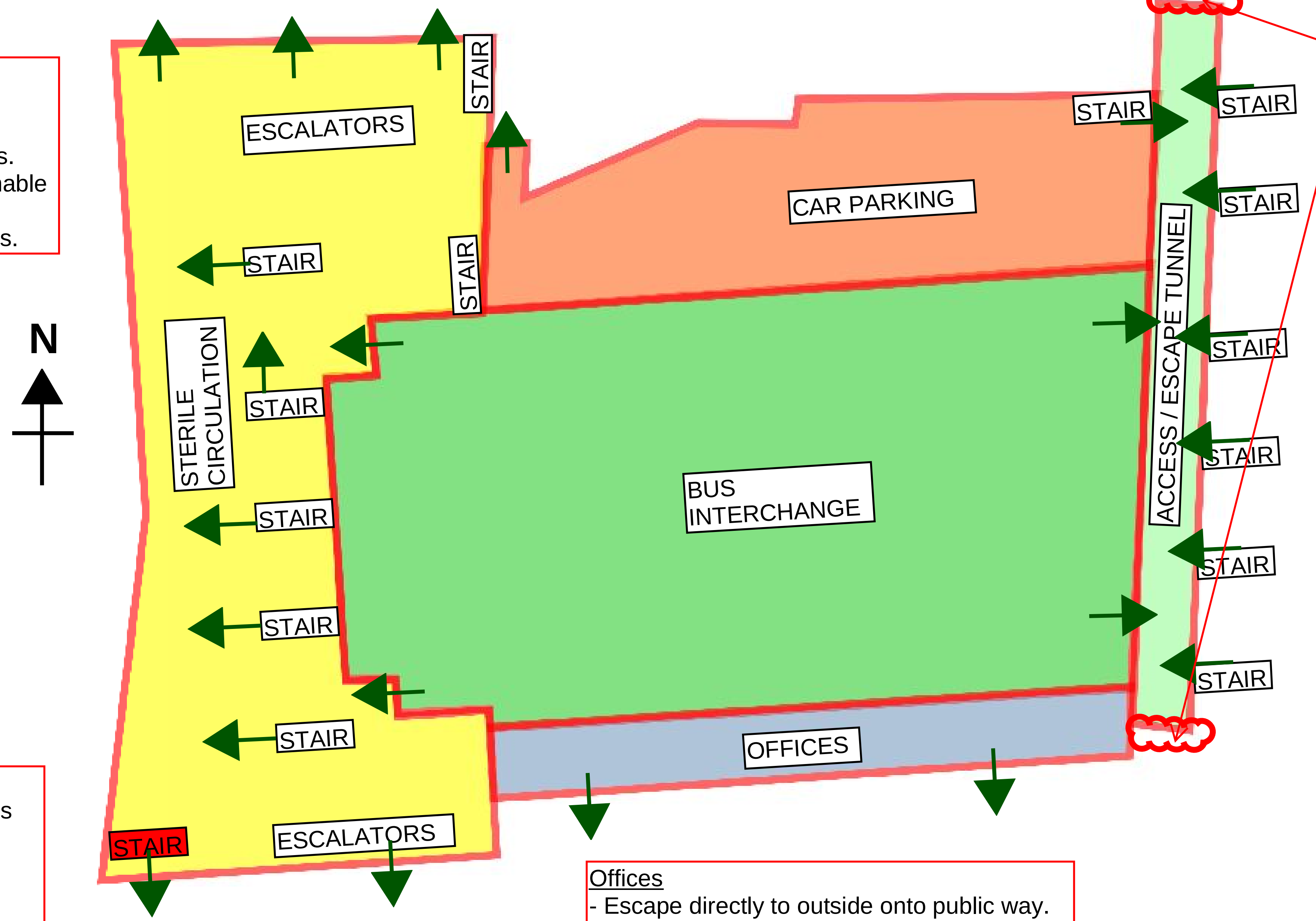
Appendix WP 2.7.8 – Multimodal Hub Fire Protection Diagrams

General
- Progressive evacuation from demise to adjacent demise.
- Share ownership to be adopted to enable progressive evacuation.
- Demise divided by fire resisting construction.

Car Park
- From ground floor escape into existing Mall building and into Access / Escape Tunnel.
- From first floor escape via single stair. A second stair proposed. Alternatively, a ramp access between ground and first Car Park levels can be adopted as a second means of egress, given appropriate provisions, e.g. ramp sidewalks, smoke management system.
- Smoke management proposal to use jet fans. Finished floor level to ceiling heights to consider sufficient clearance.
- Slab to be protected against 8MW car fire (possible additional protection).

Sterile Circulation
- Escape directly to outside.
- "Fire load island" strategy to be adopted.
- Sprinkler controlled transient fire scenarios.
- Smoke management utilised to control tenable conditions.
- Fire separation from adjoining occupancies.

Access / Escape Tunnel
- Day to day use for vehicle access; Tunnel smoke management required.
- Vehicle management security controls in the event of a fire.
- Shared escape tunnel for use by car, bus and Train Platform occupants.
- Protected against a fire in adjoining demises.
- Ownership of the tunnel to be confirmed as common across all demises.



Bus Interchange
- Escape into the Sterile Circulation and into Access / Escape Tunnel.
- Combination of environmental and smoke extract system.
- Slab to be protected against 20MW bus fire (possible additional protection).
- Use of bus repair space to be clarified.

Fire Department Access
- Access to be defined using existing routes where possible, utilising delivery routes.
- Facilities to include:
  - standpipes.
  - fire hydrants.
  - single fire command centre for all demises.

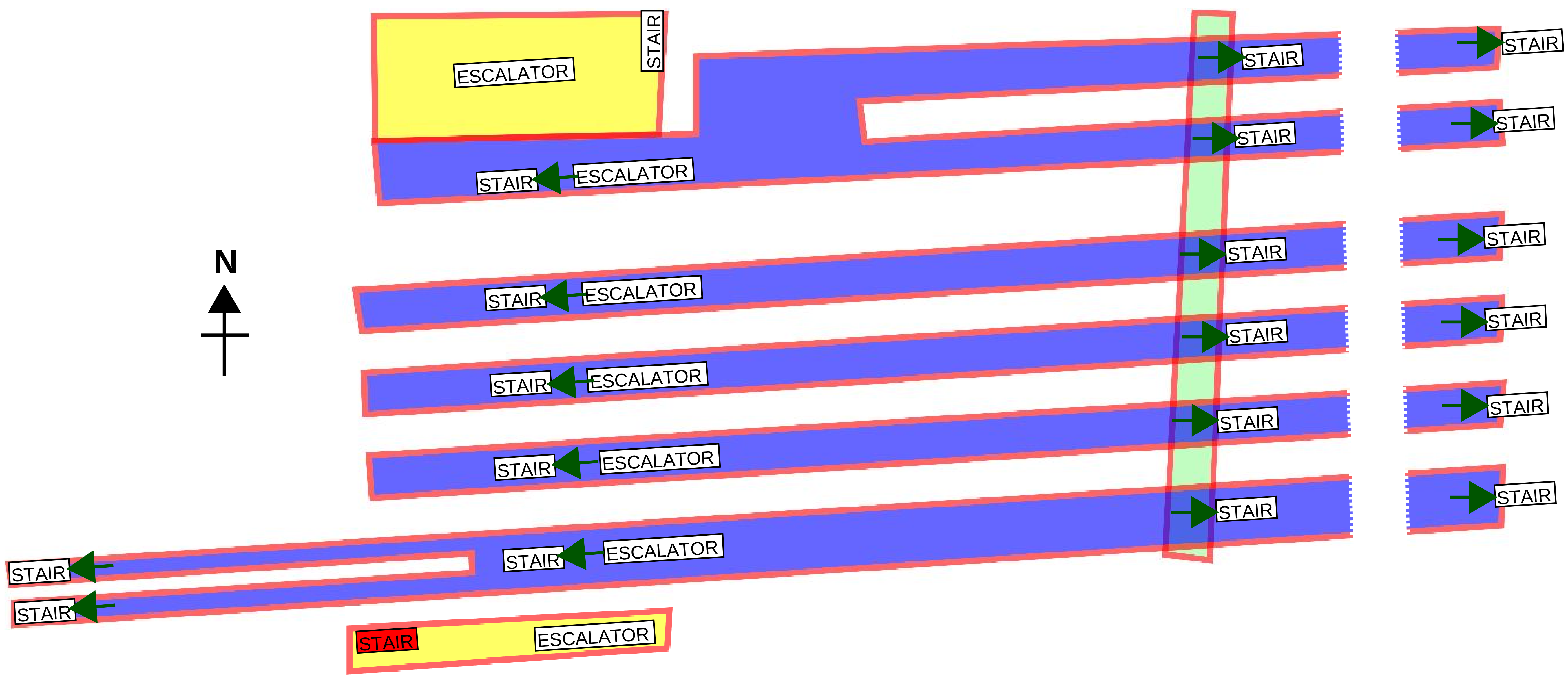
Offices
- Escape directly to outside onto public way.

GRADE LEVEL

General
- Mobility impaired people evacuation to use either staff assisted or self evacuation via elevators strategy.
- Line ridership figures are required.
- Train population figures are required.

Sterile Circulation
- Separated from Train Platform:
  - atrium is separated.
  - escalator is separated.

Train Platform
- Escape via stairs down to the Sterile Circulation and additional set of stairs down to Access / Escape Tunnel.
- Escape down and away from the fire risk.
- Dead-end portions will require additional stairs.
- North-East stair might be combined with the proposed stair for the Car Park, providing shared means of egress for both levels.
- Open platform, hence no smoke management required.
- Ceiling slab, i.e. floor slab of the Ticket Hall level, protection against train fire.
- Ceiling slab structure to allow smoke to dissipate.

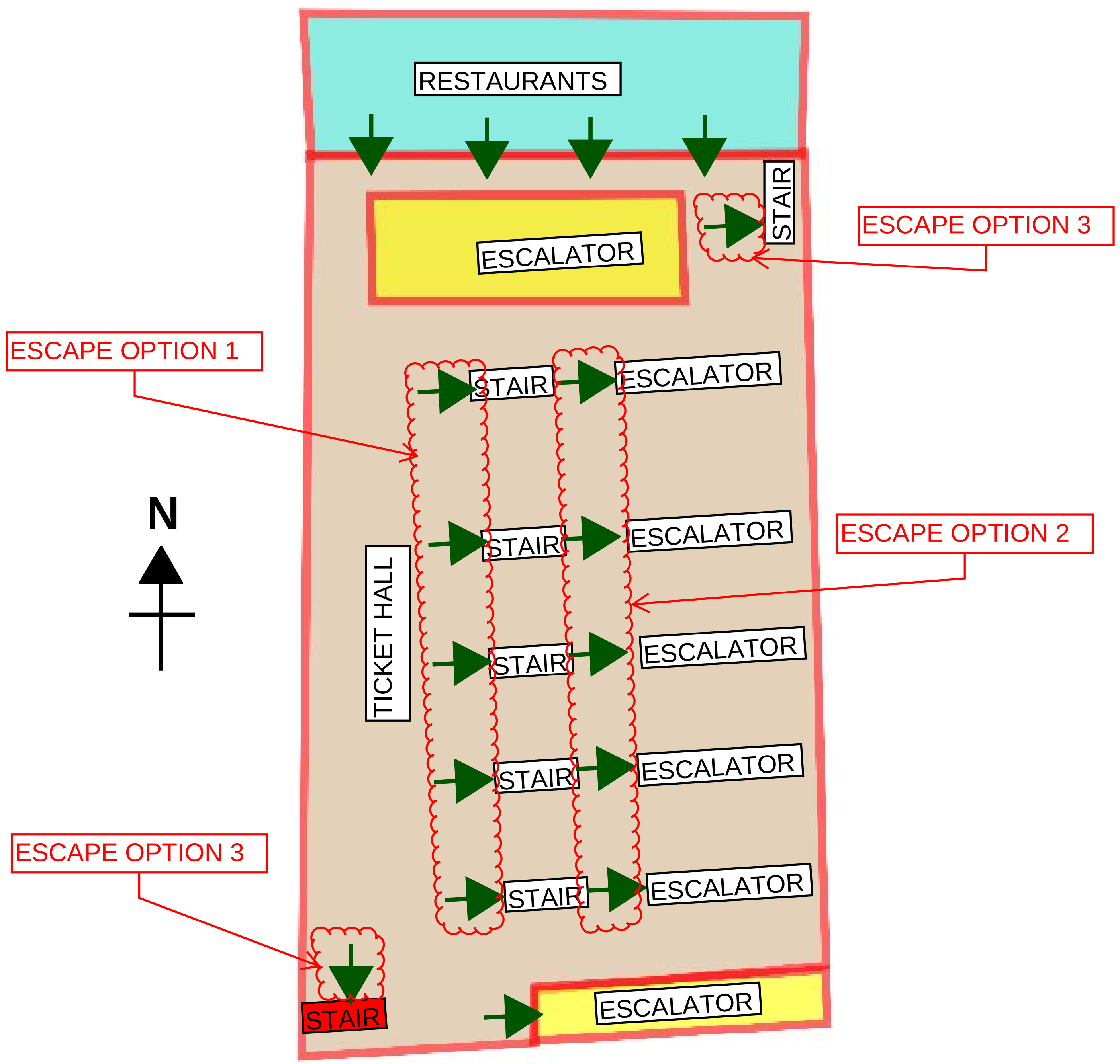


TRAIN PLATFORM LEVEL

<u>General</u>
- Stairs to be considered pressurised.

<u>Atrium</u>
- Separated from Ticket Hall by smoke curtains.
- Smoke management used with reservoir to control smoke.
- Sprinkler controlled fire on Sterile Circulation floor.
- Fire load controlled fire beneath atrium.

<u>Restaurants</u>
- Food and Beverage ratio required (front of house and back of house).
- Populations consider permanent in egress capacity.



<u>Escape</u>
- Option 1:
The stairs can be used as means of egress discharging internally, given that sufficient fire protection and systems provisions are adopted to keep Sterile Circulation under tenable conditions at all time during the evacuation.

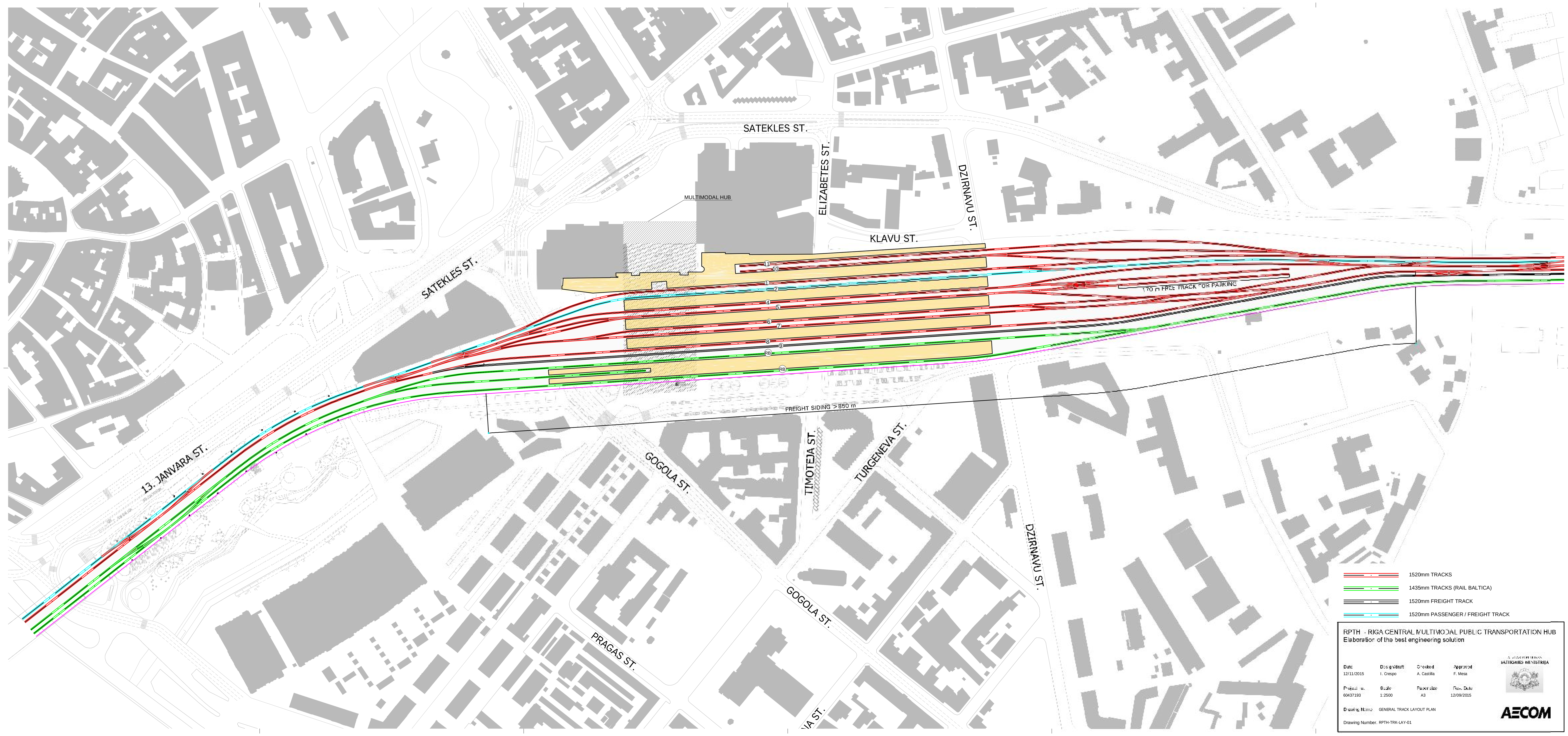
- Option 2:
Should the provision of the fire protection and systems be not feasible, the occupancy of the Ticket Hall floor are proposed to evacuate down the escalators to the Train Platform level and from there escape to the ground level using numerous available stairs. The Authority Having Jurisdiction should be consulted at the early stage of the design development to agree on escalators usage for evacuation purposes.

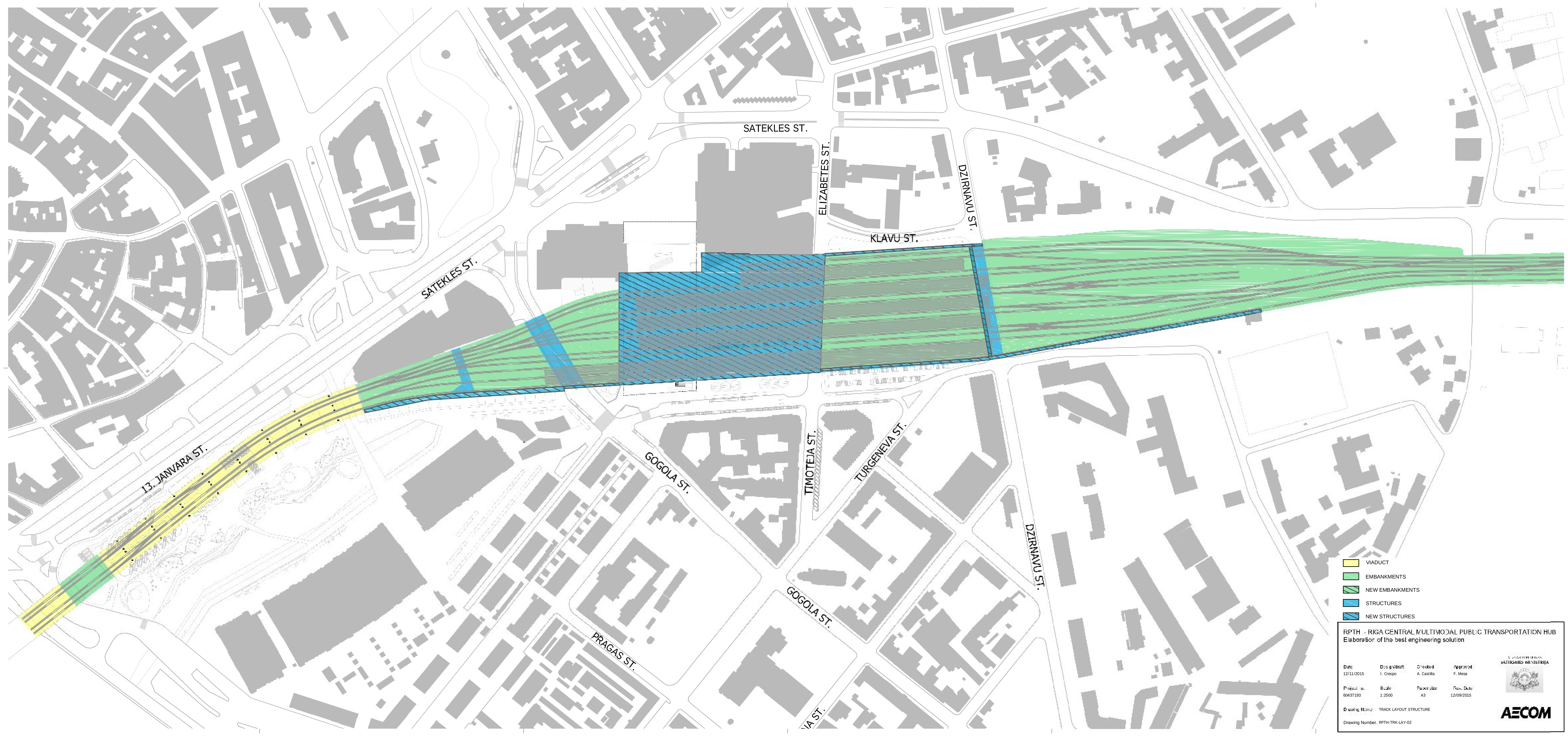
- Option 3:
An alternative option is to provide a second stair in the South – West corner of the Ticket Hall which would discharge at the ground level directly to outside. The stairs will have to be sized accordingly to the estimated occupancy of the Ticket Hall level.

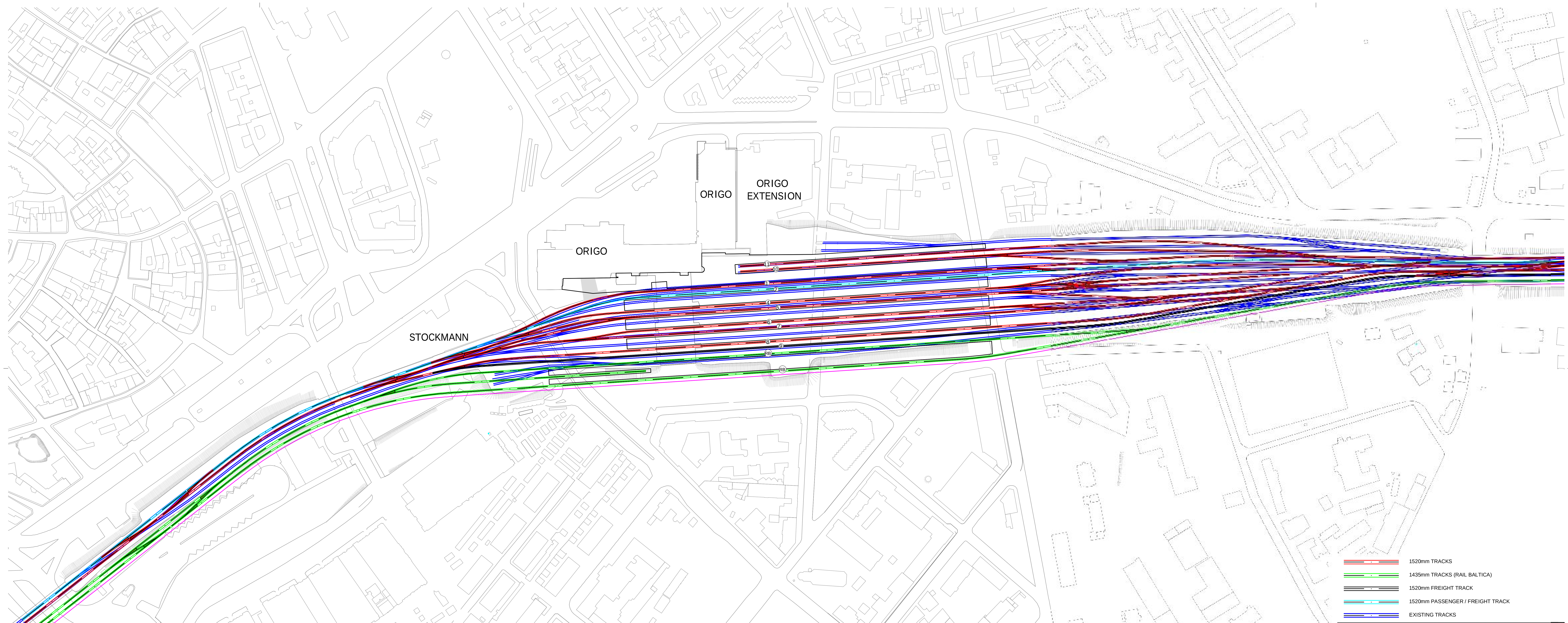
<u>Escalators</u>
- To be confirmed whether elements can be used during evacuation.
- Escalators will not be considered when estimating capacity of the means of egress until their usage during evacuation is confirmed.
- Facade adjacent to external escalator to be protected.

TICKET HALL LEVEL

Appendix WP 2.7.9 – Track Layout


SATEKLES ST.
ELIZABETES ST.
DZIRNAVU ST.
MULTIMODAL HUB
KLAVU ST.
170 m FREE TRACK FOR PARKING
SATEKLES ST.
FREIGHT SIDING > 850 m
13. JANVARA ST.
GOGOLA ST.
TIMOTEJA ST.
TURGENEVA ST.
DZIRNAVU ST.
GOGOLA ST.
PRAGAS ST.
1520mm TRACKS
1435mm TRACKS (RAIL BALTICA)
1520mm FREIGHT TRACK
1520mm PASSENGER / FREIGHT TRACK
RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution
Date 12/11/2015
Design/draft I. Crespo
Checked A. Castilla
Approved F. Mesa
Project no. 60437193
Scale 1:2500
Paper size A3
Rev. Date 12/09/2015
SATIKSMES MINISTRIJA
Drawing Name GENERAL TRACK LAYOUT PLAN
Drawing Number. RPTH-TRK-LAY-01
AECOM


SATEKLES ST.
ELIZABETES ST.
DZIRNAVU ST.
KLAVU ST.
SATEKLES ST.
13. JANVARA ST.
GOGOLA ST.
TIMOTEJA ST.
TURGENEVA ST.
DZIRNAVU ST.
GOGOLA ST.
PRAGAS ST.
VIADUCT
EMBANKMENTS
NEW EMBANKMENTS
STRUCTURES
NEW STRUCTURES
RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution
Date 12/11/2015
Design/draft I. Crespo
Checked A. Castilla
Approved F. Mesa
Project no. 60437193
Scale 1:2500
Paper size A3
Rev. Date 12/09/2015
SATIKSMES MINISTRIJA
Drawing Name TRACK LAYOUT STRUCTURE
Drawing Number. RPTH-TRK-LAY-02
AECOM



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

Date	Design/draft	Checked	Approved
12/11/2015	I. Crespo	A. Castilla	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193	1:2500	A3	12/09/2015

SATIKSMES MINISTRIJA

Drawing Name: EXISTING AND NEW TRACKS

Drawing Number. RPTH-TRK-LAY-03

AECOM

1520mm TRACKS

1435mm TRACKS (RAIL BALTICA)

1520mm FREIGHT TRACK

1520mm PASSENGER / FREIGHT TRACK

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

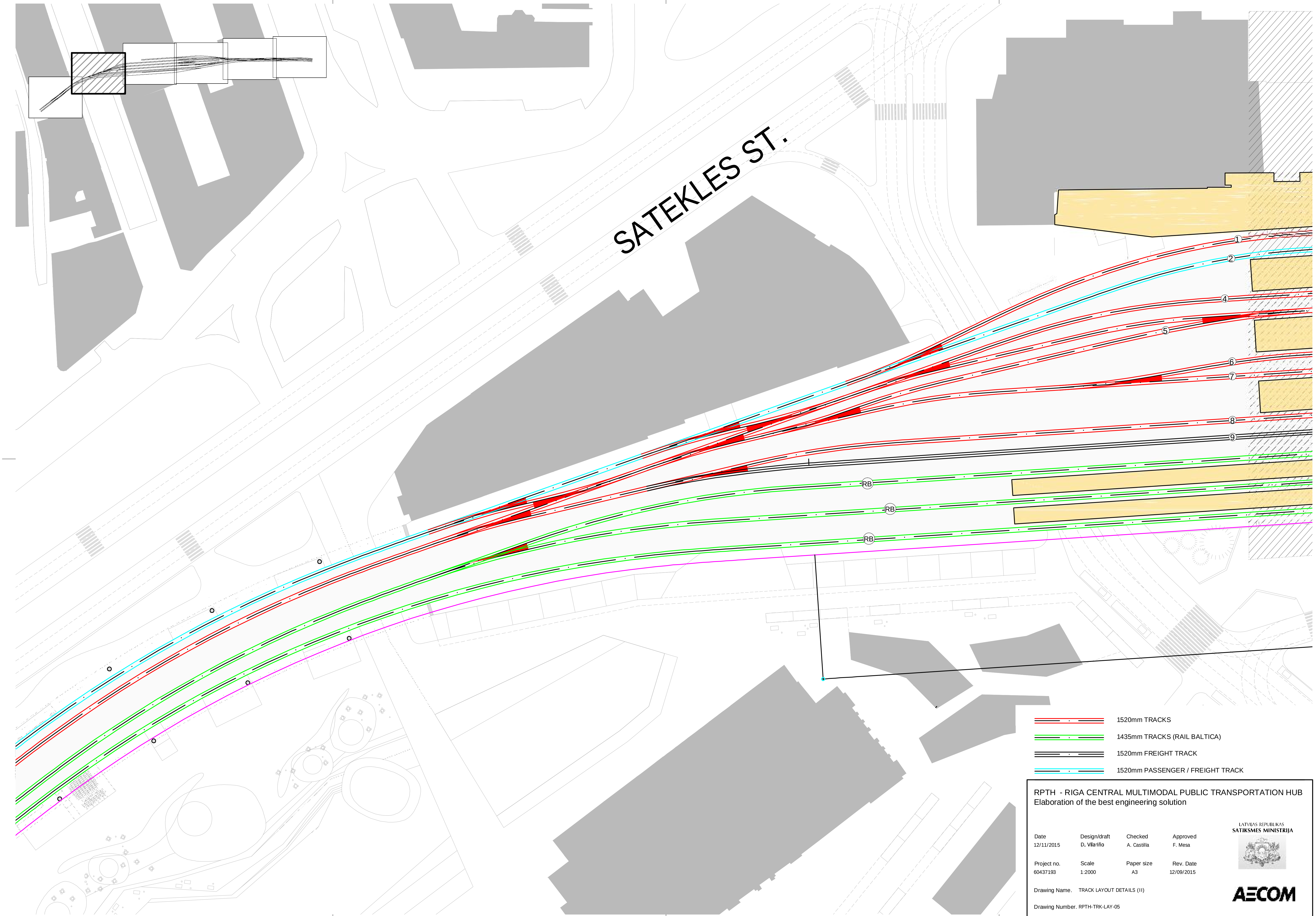
LATVIJAS REPUBLIKAS
SATIKSMES MINISTRIJA

Date	Design/draft	Checked	Approved
12/11/2015	D. Villariño	A. Castilla	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193	1:2000	A3	12/09/2015

Drawing Name. TRACK LAYOUT DETAILS (I)

Drawing Number. RPTH-TRK-LAY-04

AECOM



1520mm TRACKS
1435mm TRACKS (RAIL BALTICA)
1520mm FREIGHT TRACK
1520mm PASSENGER / FREIGHT TRACK

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

Date	Design/draft	Checked	Approved
12/11/2015	D. Villariño	A. Castilla	F. Mesa
Project no.	Scale	Paper size	Rev. Date
60437193	1:2000	A3	12/09/2015

Drawing Name. TRACK LAYOUT DETAILS (II)

Drawing Number. RPTH-TRK-LAY-05

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

AECOM

1520mm TRACKS
1435mm TRACKS (RAIL BALTICA)
1520mm FREIGHT TRACK
1520mm PASSENGER / FREIGHT TRACK

RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

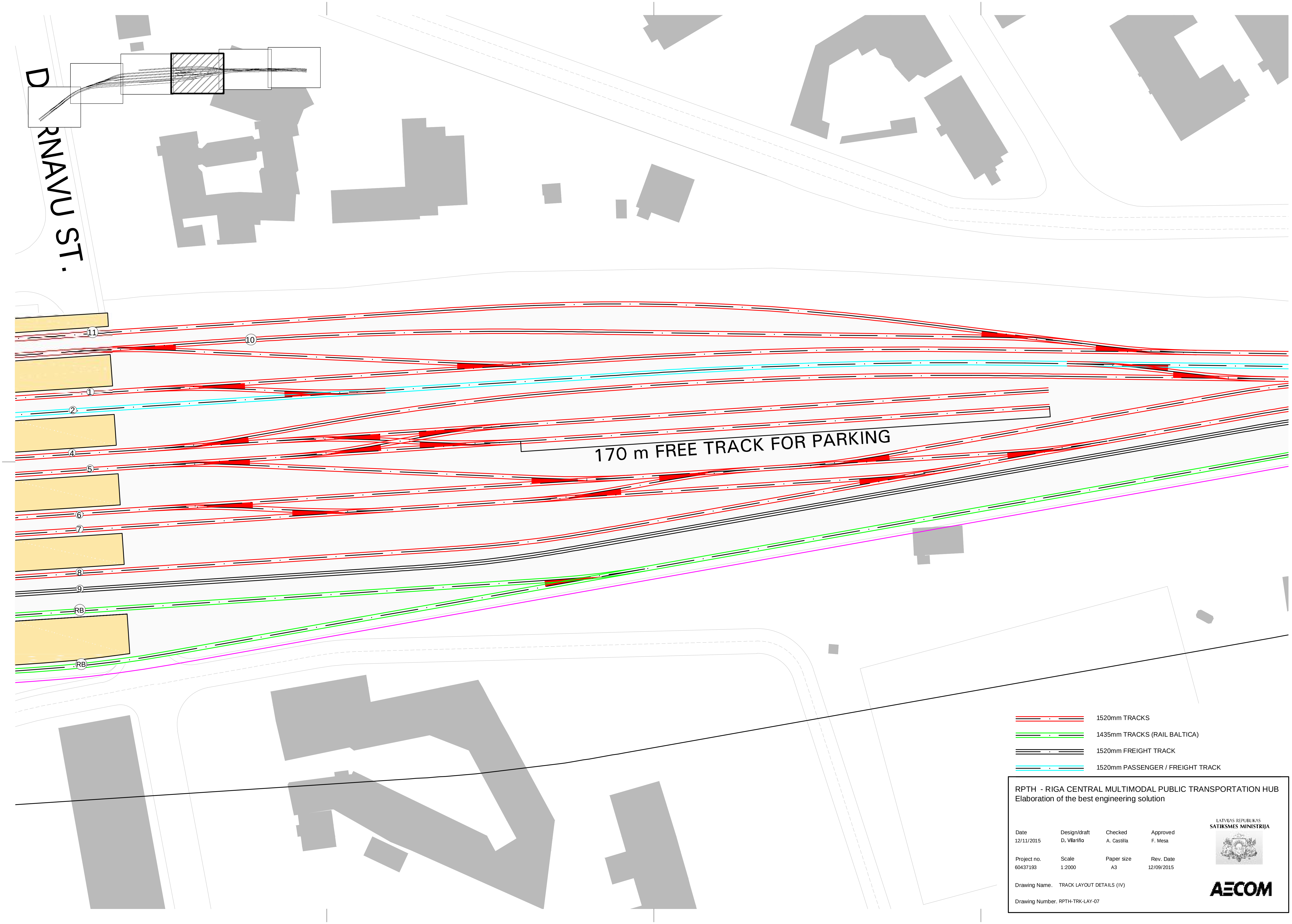
Date	Design/draft	Checked	Approved
12/11/2015	D. Villariño	A. Castilla	F. Mesa
Project no.	Scale	Paper size	Rev. Date
60437193	1:2000	A3	12/09/2015

Drawing Name. TRACK LAYOUT DETAILS (III)

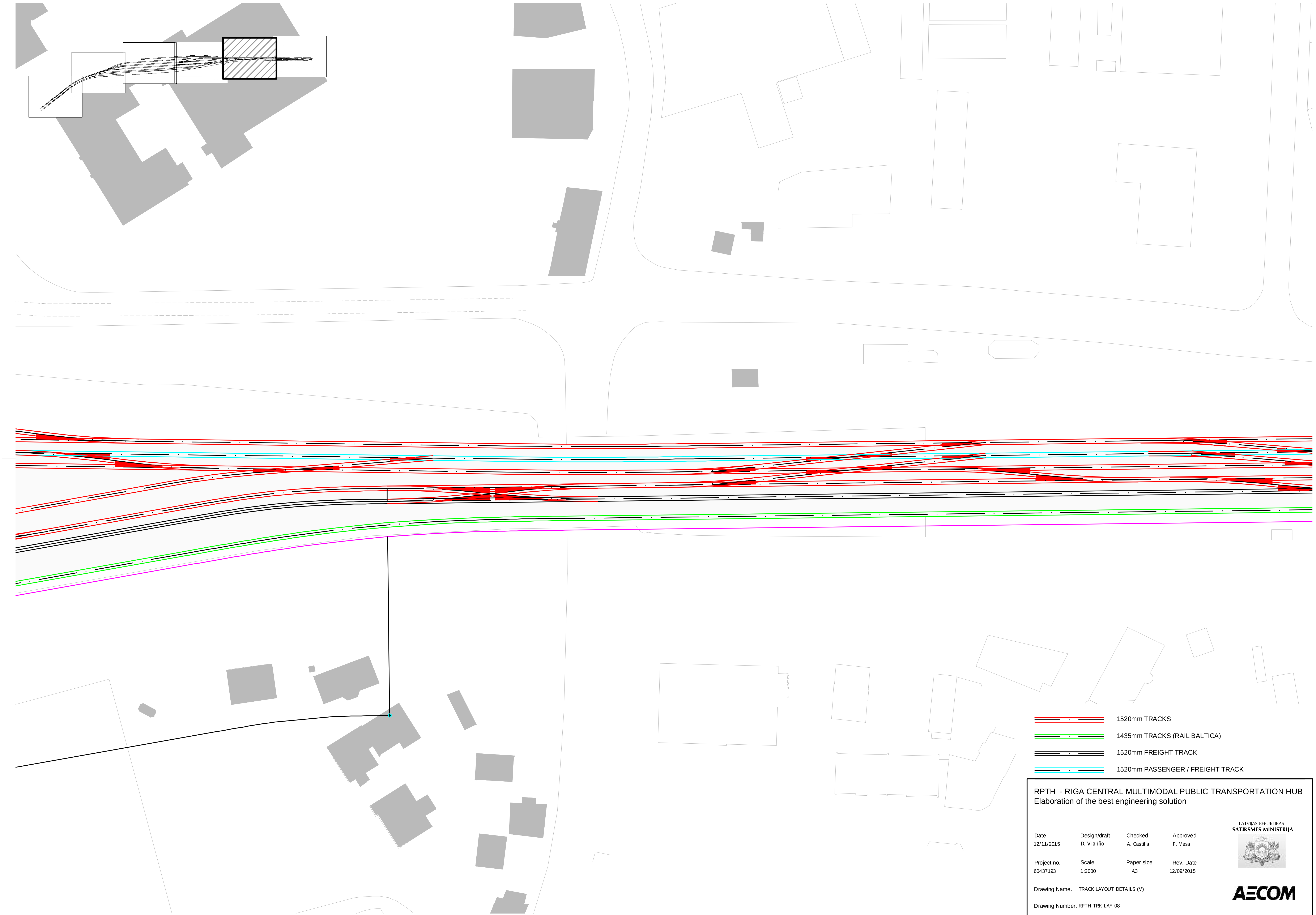
Drawing Number. RPTH-TRK-LAY-06

LATVIJAS REPUBLIKAS
SATIKSMES MINISTRIJA

AECOM



DZIRNAVU ST.
170 m FREE TRACK FOR PARKING
11
10
1
2
4
5
6
7
8
9
RB
RB
1520mm TRACKS
1435mm TRACKS (RAIL BALTICA)
1520mm FREIGHT TRACK
1520mm PASSENGER / FREIGHT TRACK
RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution
Date 12/11/2015
Design/draft D. Villariño
Checked A. Castilla
Approved F. Mesa
Project no. 60437193
Scale 1:2000
Paper size A3
Rev. Date 12/09/2015
Drawing Name. TRACK LAYOUT DETAILS (IV)
Drawing Number. RPTH-TRK-LAY-07
LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA
AECOM



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

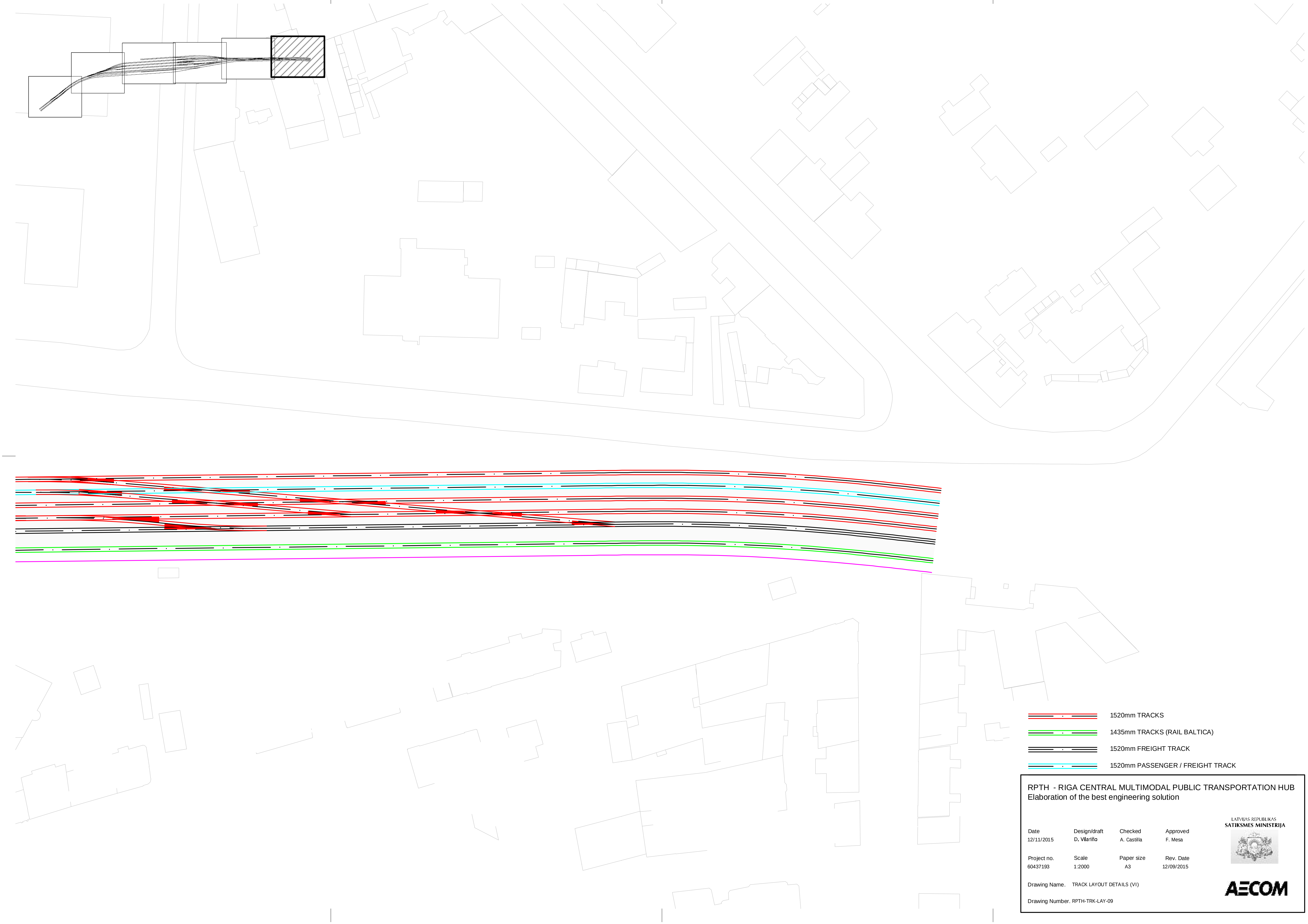
Date	Design/draft	Checked	Approved
12/11/2015	D. Villariño	A. Castilla	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193	1:2000	A3	12/09/2015

Drawing Name. TRACK LAYOUT DETAILS (V)

Drawing Number. RPTH-TRK-LAY-08

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

AECOM



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB
Elaboration of the best engineering solution

Date	Design/draft	Checked	Approved
12/11/2015	D. Villariño	A. Castilla	F. Mesa
Project no.	**Scale**	**Paper size**	**Rev. Date**
60437193	1:2000	A3	12/09/2015

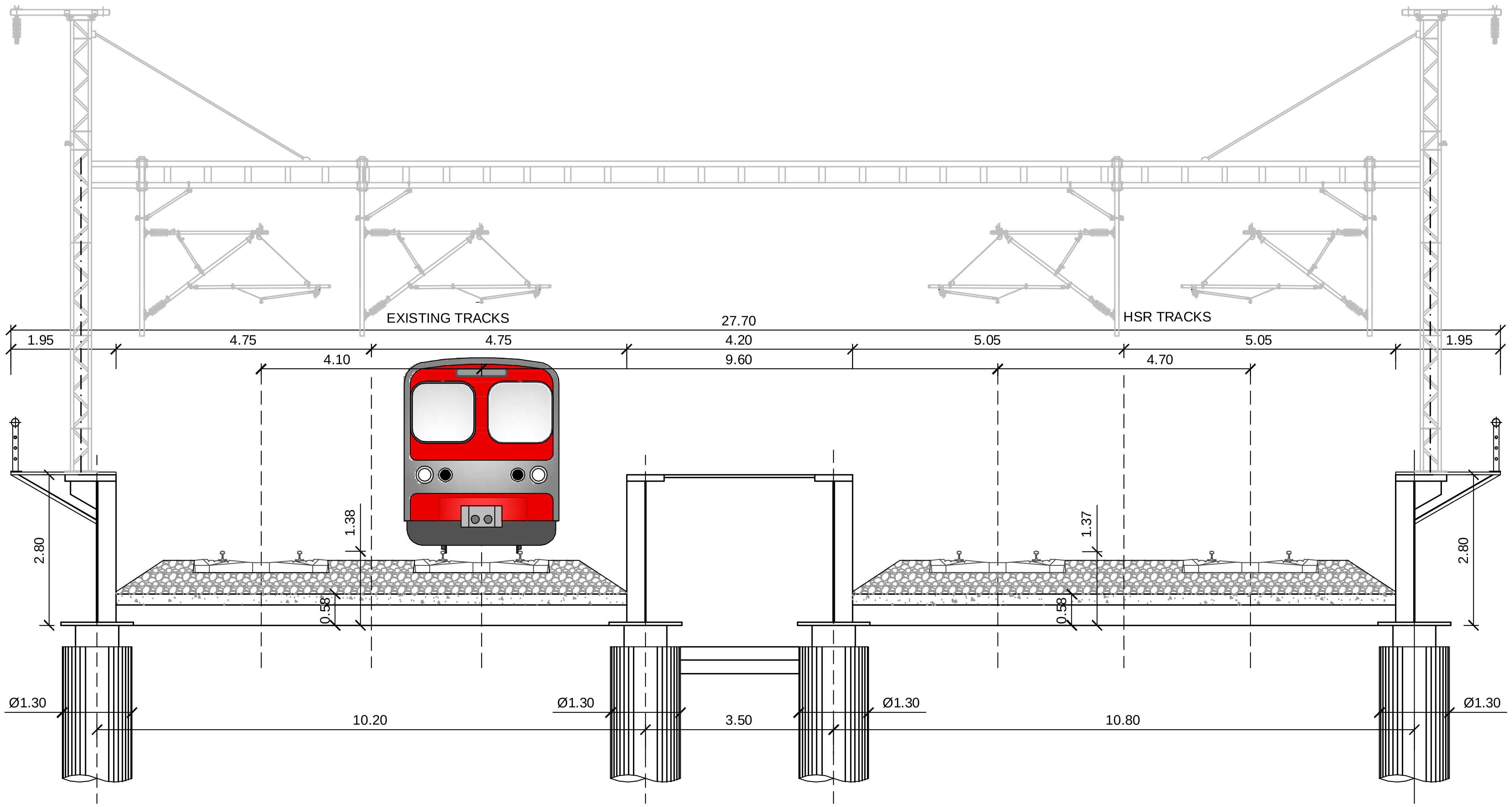
Drawing Name. TRACK LAYOUT DETAILS (VI)

Drawing Number. RPTH-TRK-LAY-09

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

AECOM

CROSS SECTION EMBANKMENT



RPTH - RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB Elaboration of the best engineering solution			
Date 12/11/2015	Design/draft I. Crespo	Checked A. Castilla	Approved F. Mesa
Project no. 60437193	Scale 1:100	Paper size A3	Rev. Date 12/09/2015
Drawing Name.	TRACK LAYOUT TYPICAL SECTION		
Drawing Number.	RPTH-TRK-SEC-01		

LATVIJAS REPUBLIKAS SATIKSMES MINISTRIJA

AECOM

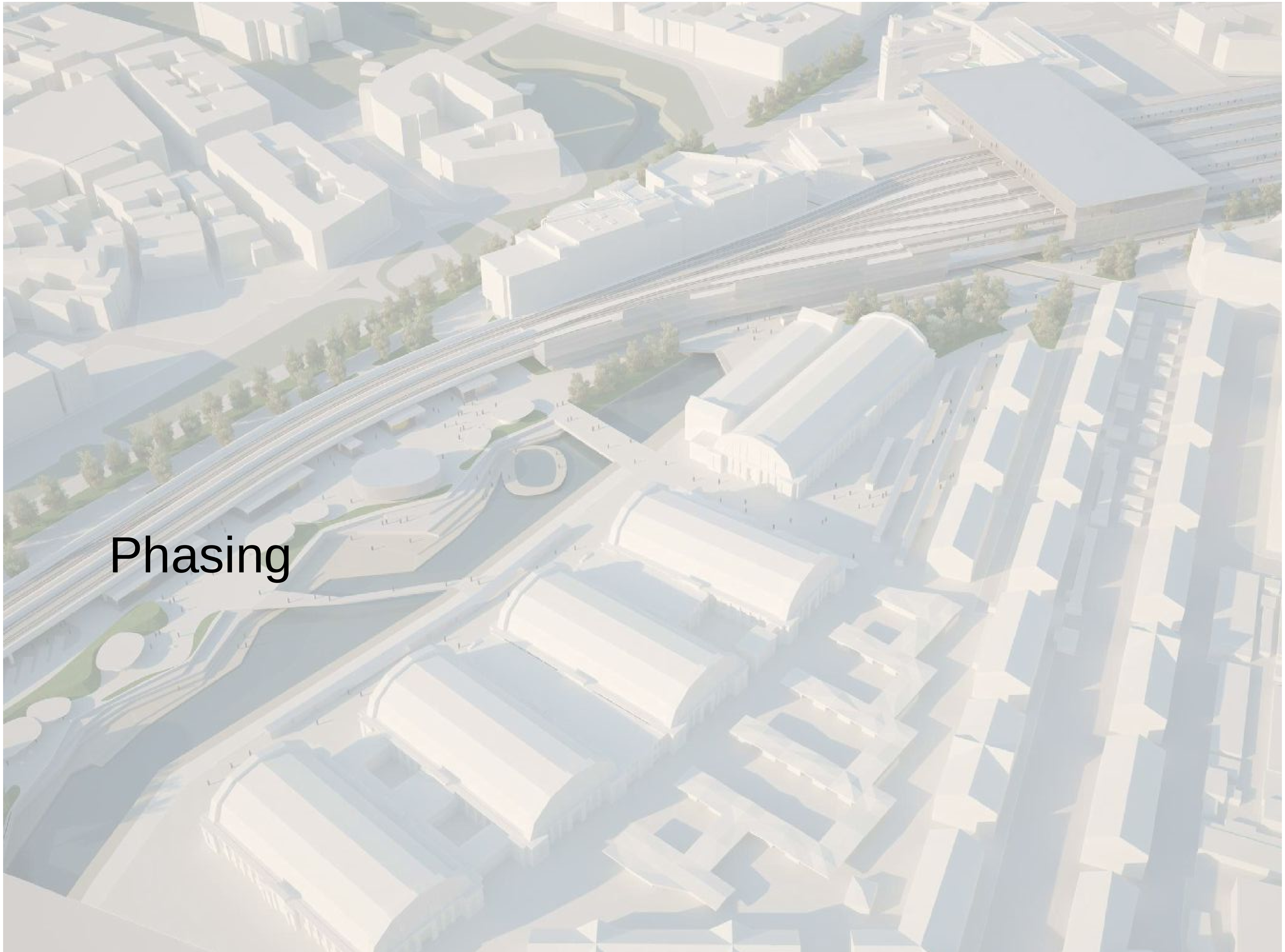
Appendix WP 3.1.1 – Phasing & Programme of Works

RPTH RIGA CENTRAL MULTIMODAL PUBLIC TRANSPORTATION HUB

- PHASING
- COST AND PROGRAMME OF WORKS OF THE EMBANKMENT ALTERNATIVES

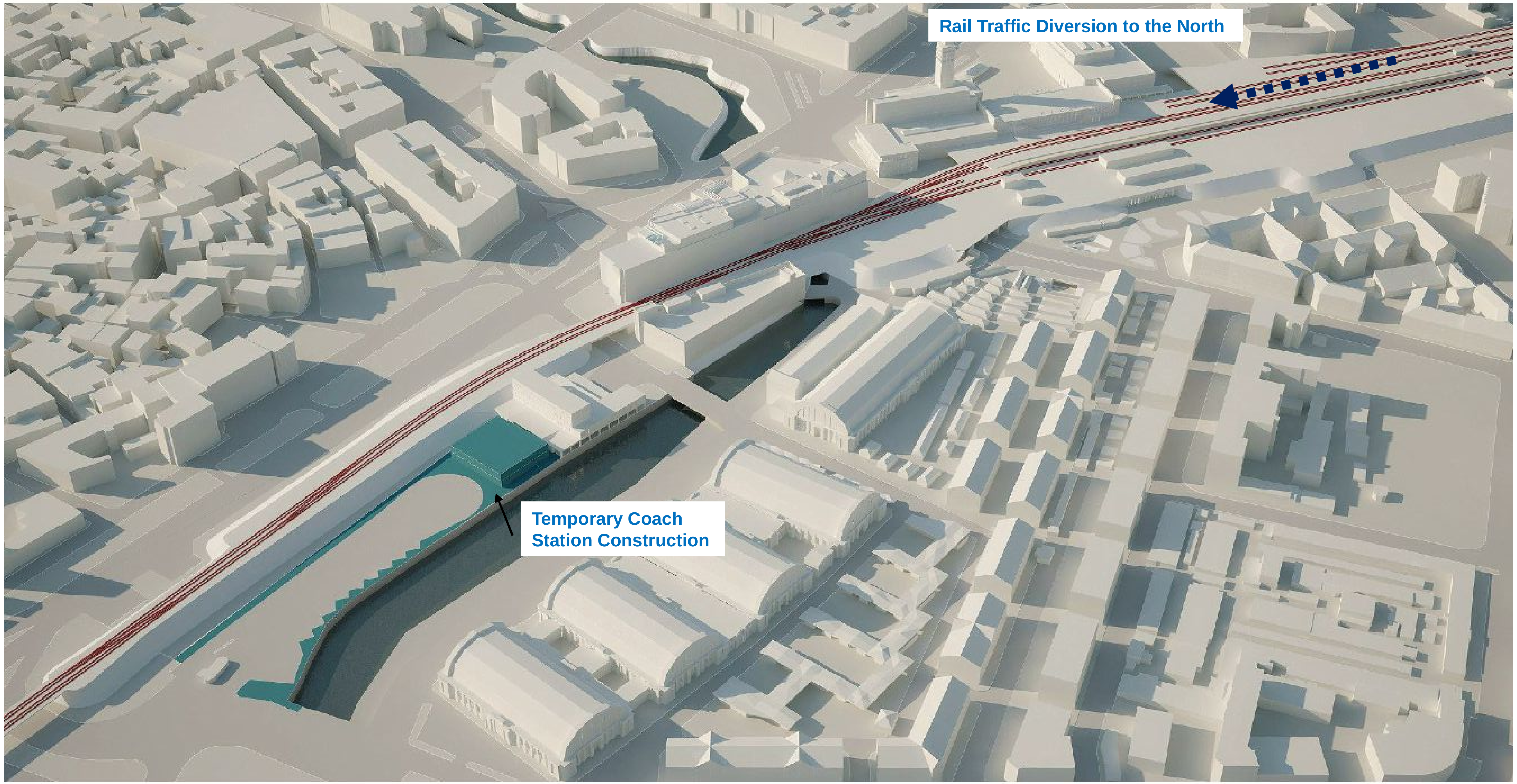
AECOM

Phasing



PHASE A: **Construction of the Station at Street Level, Viaduct and the new tracks. BY STAGES A.1 and A.2.**

STAGE A.1: SOUTH HALF UNDER CONSTRUCTION (part 1)

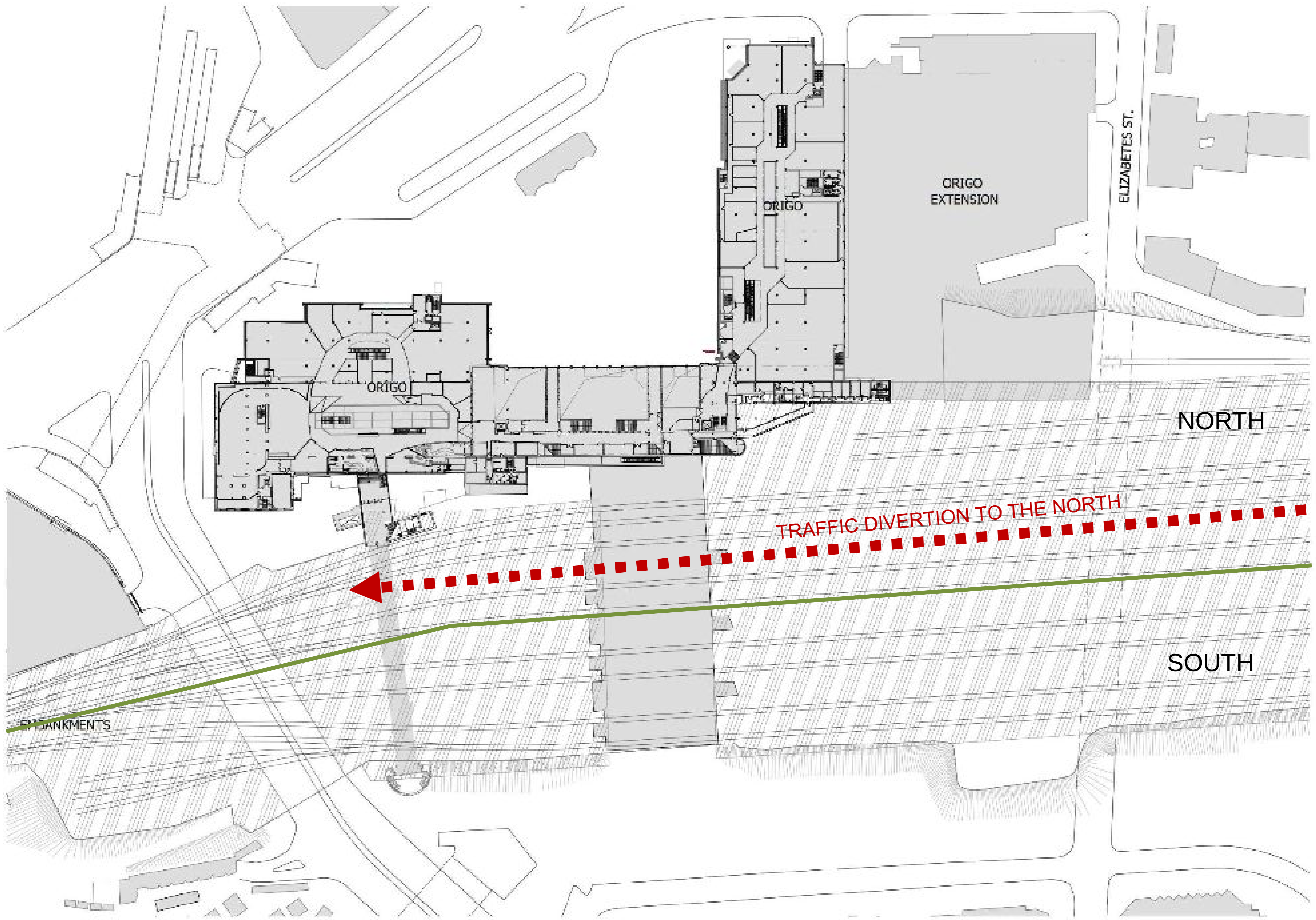


AECOM

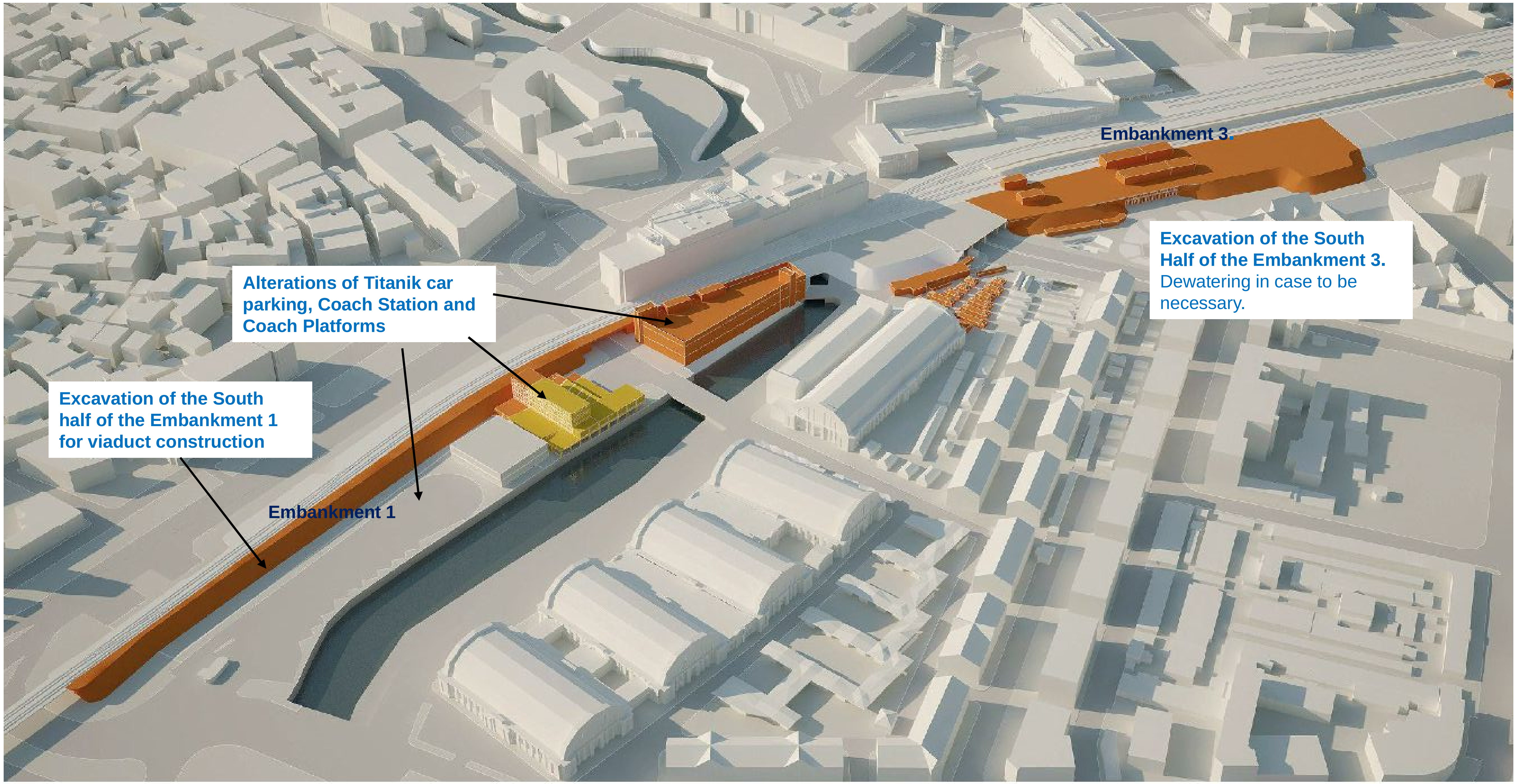
STAGE A.1: SOUTH HALF UNDER CONSTRUCTION

A.1.1. Rail Traffic Divertion to the North

- Change the switches
- New Signalling
- Build the new Railway signalling building



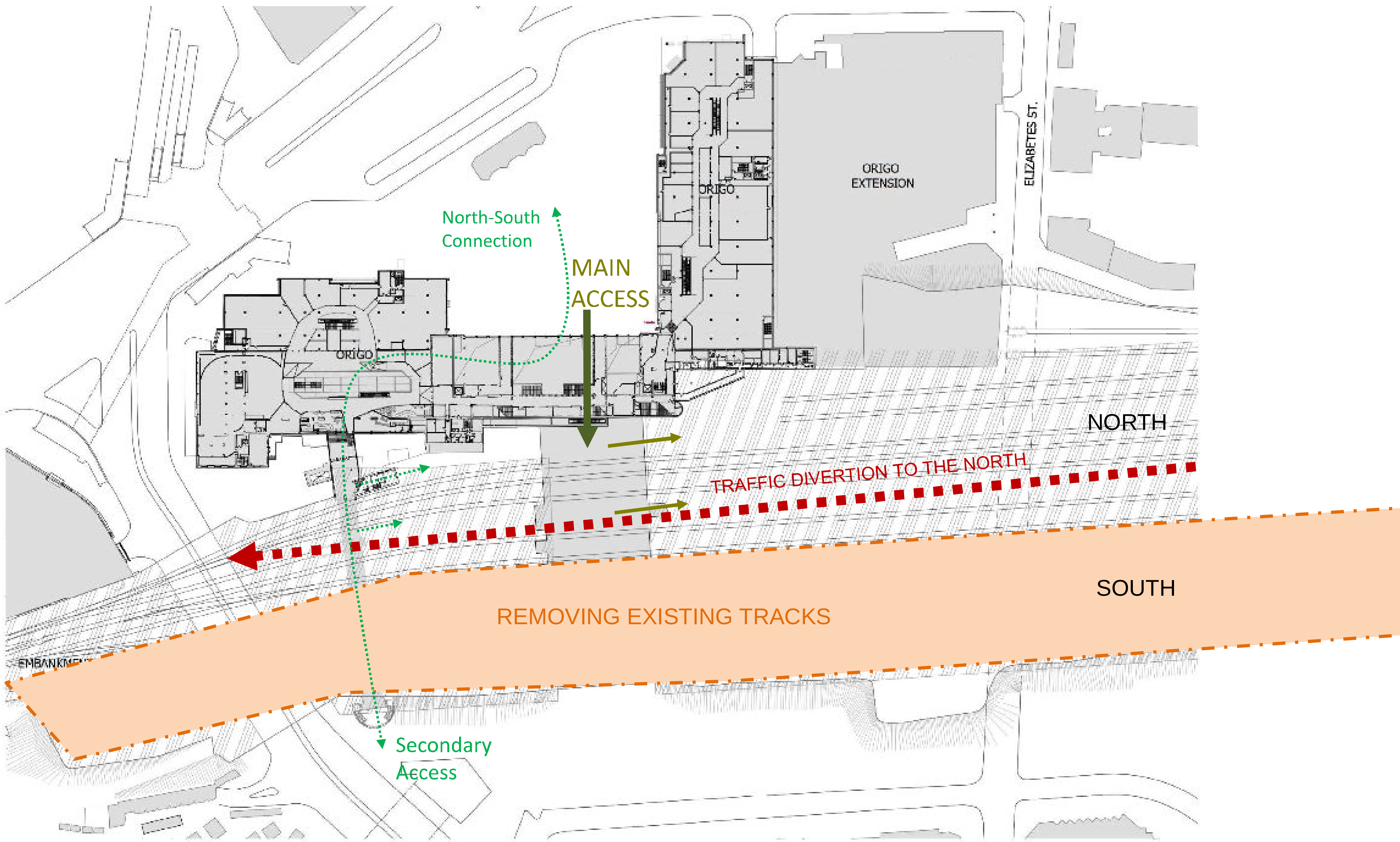
STAGE A.1: SOUTH HALF UNDER CONSTRUCTION (part 2)



STAGE A.1: SOUTH HALF UNDER CONSTRUCTION

A.1.1. Rail Traffic Divertion to the North

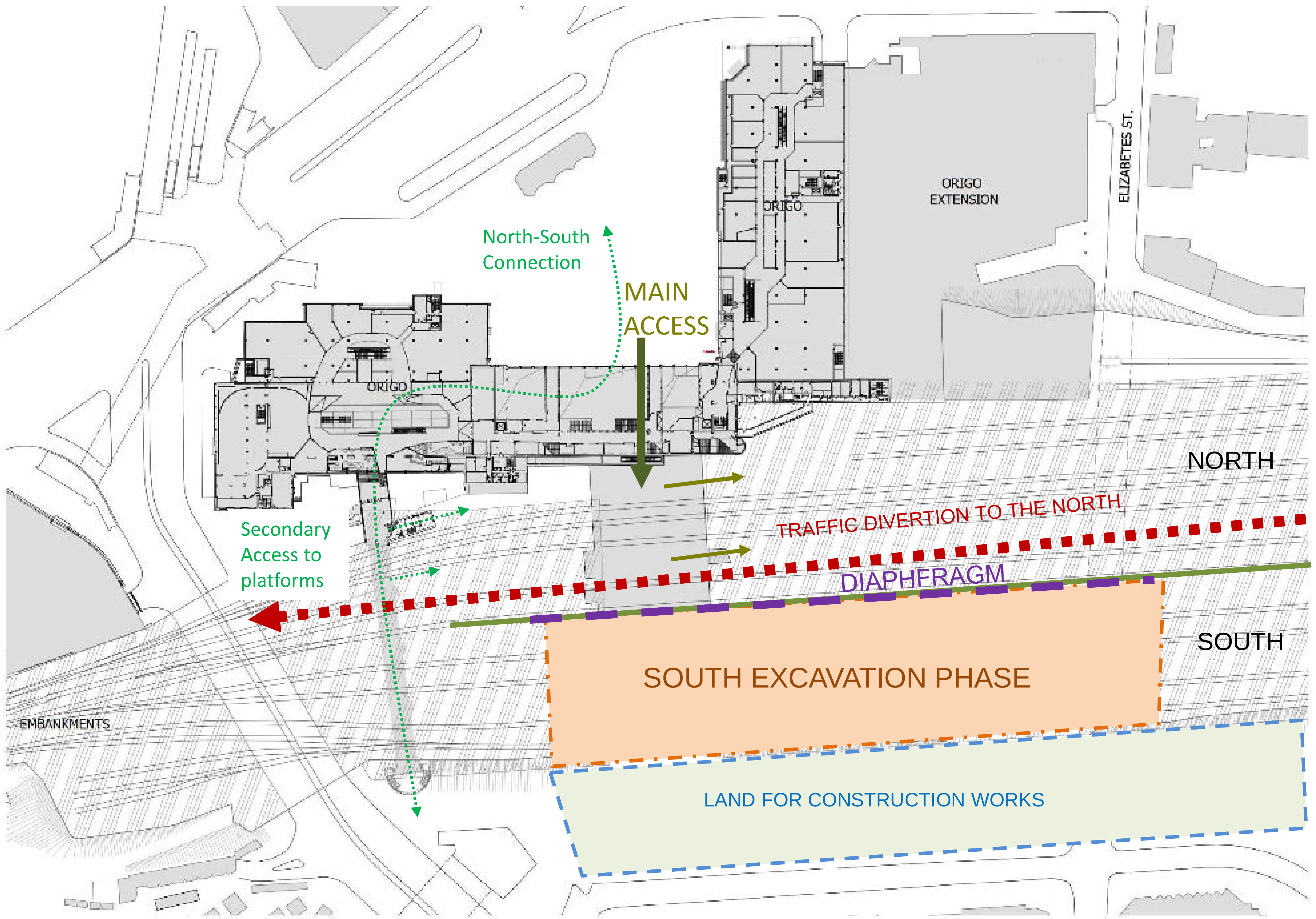
A.1.2. Removing the existing tracks



AECOM

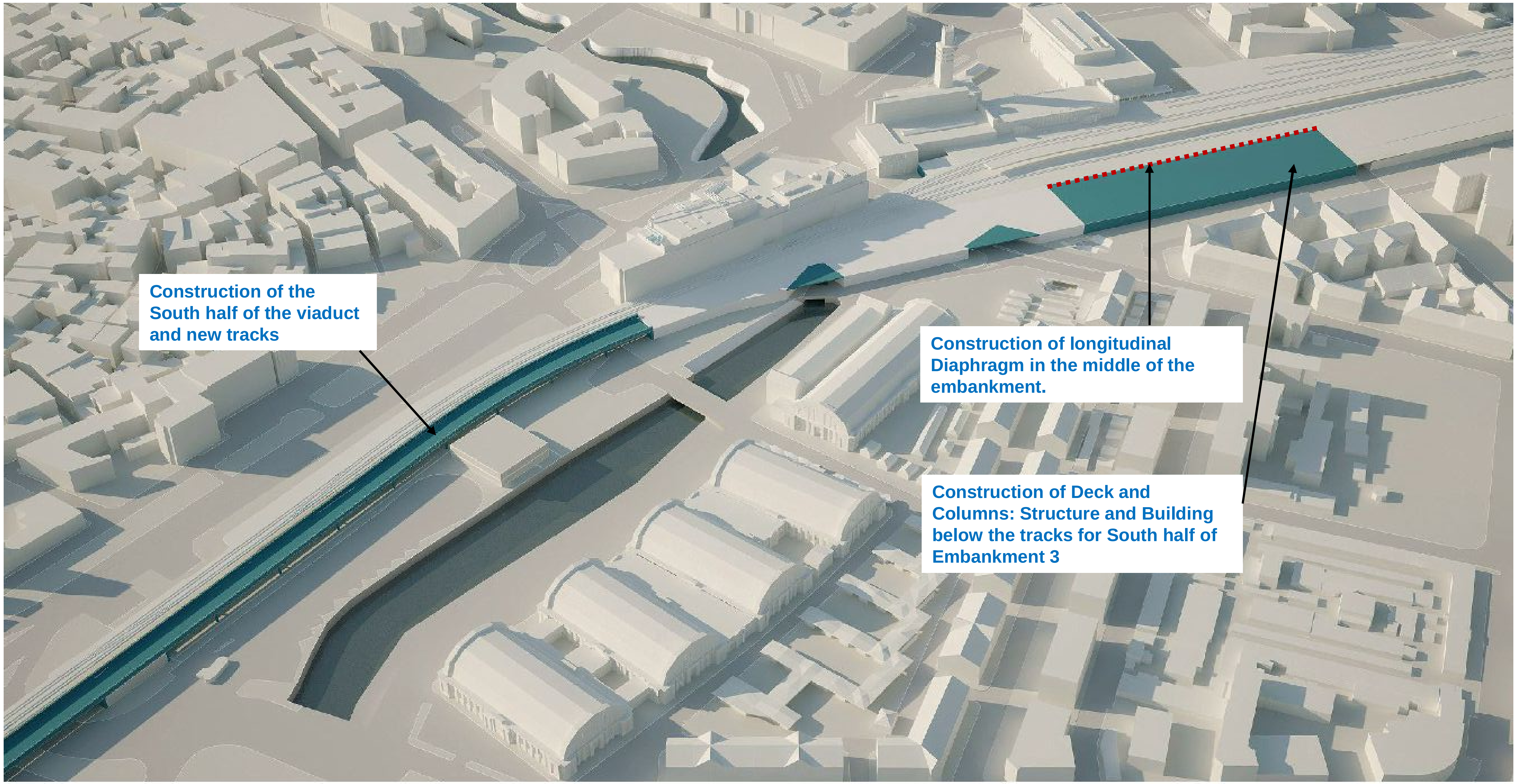
STAGE A.1: SOUTH HALF UNDER CONSTRUCTION

A.1.1. Rail Traffic Divertion to the North
A.1.2. Removing the existing tracks
A.1.3. Excavation of the South Half of the Embankment 3. Dewatering in case to be necessary.

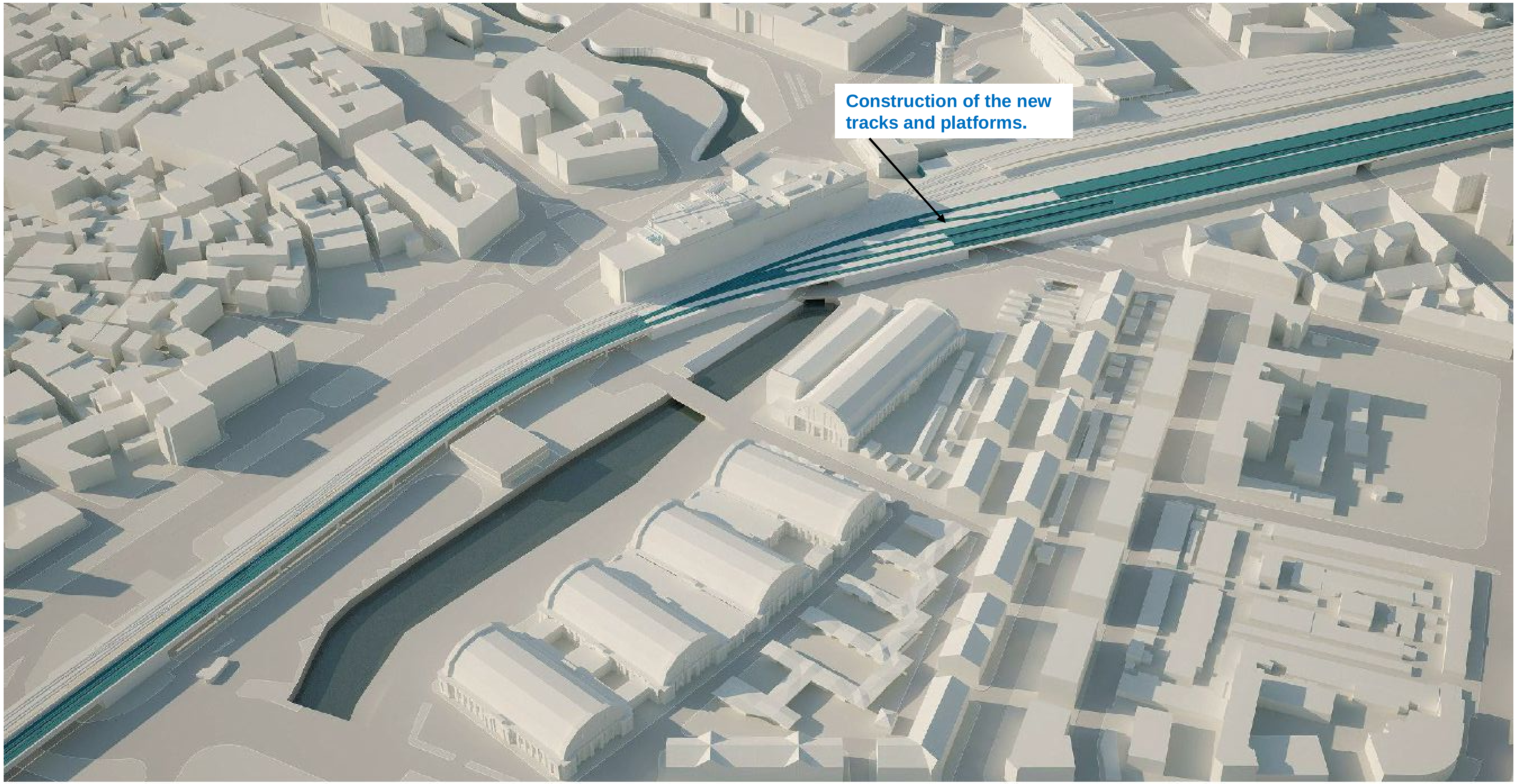


AECOM

STAGE A.1: SOUTH HALF UNDER CONSTRUCTION (part 3)

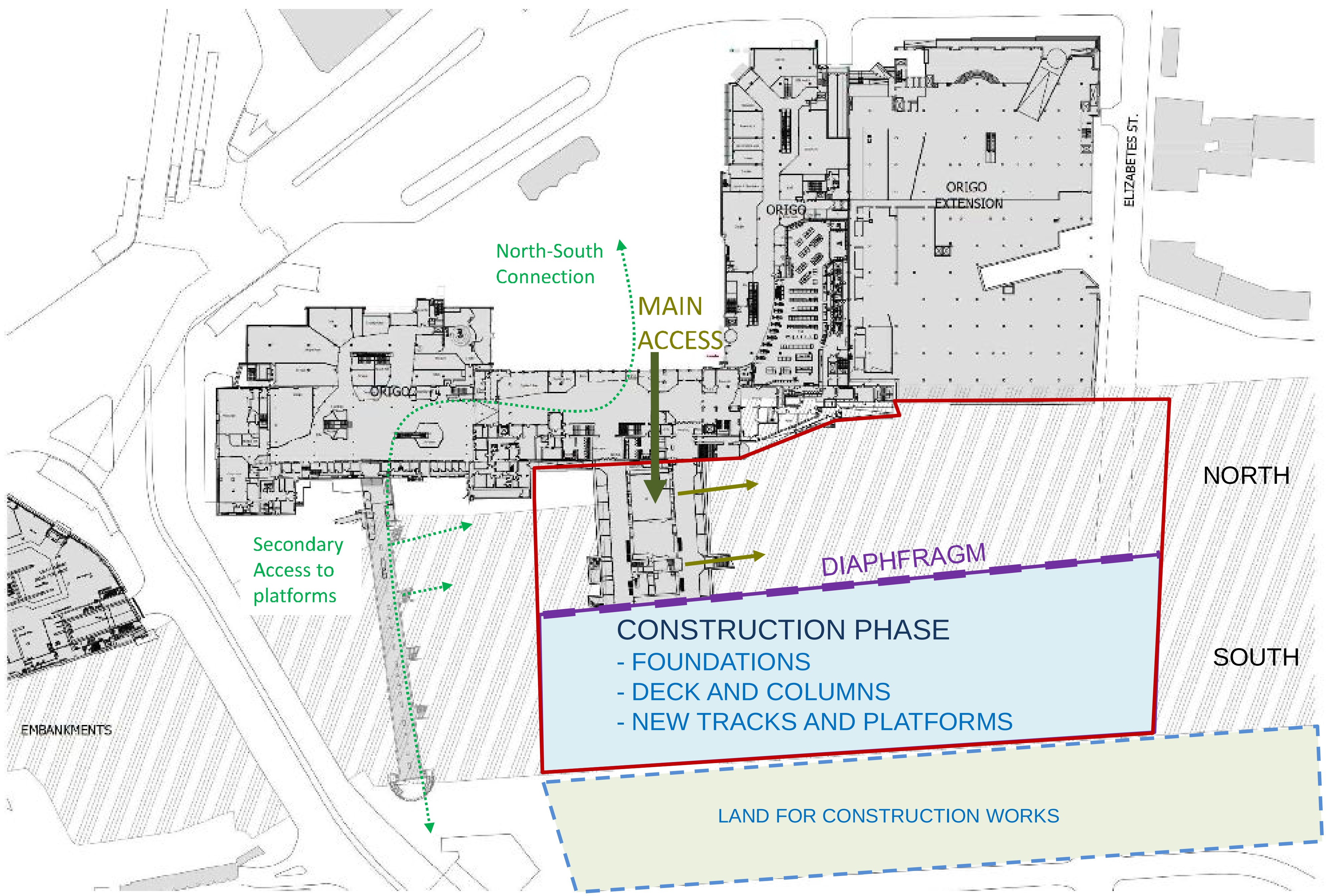


STAGE A.1: SOUTH HALF UNDER CONSTRUCTION (part 4)



STAGE A.1: SOUTH HALF UNDER CONSTRUCTION

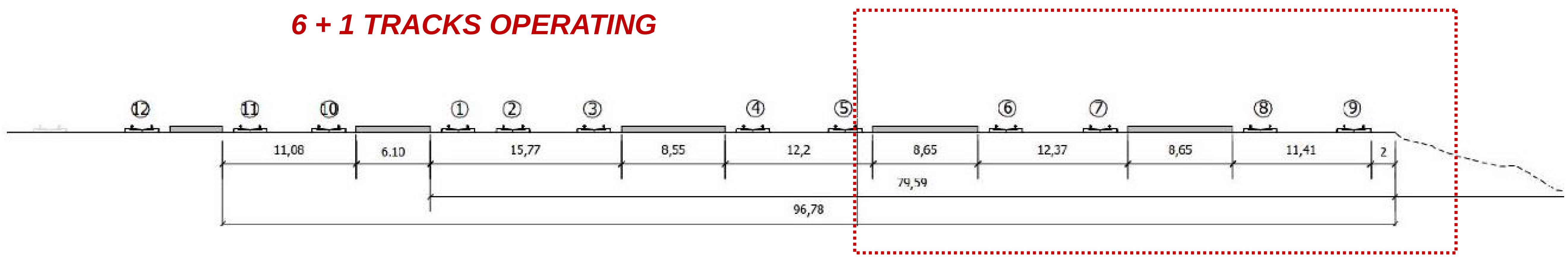
A.1.1. Rail Traffic Diversion to the North
A.1.2. Removing the existing tracks
A.1.3. Excavation of the South Half of the Embankment 3. Dewatering in case to be necessary
A.1.4. Construction of longitudinal Diaphragm in the middle of the embankment
A.1.5. Construction of Deck and Columns: Structure and Building below the tracks for South half of Embankment 3
A.1.6. Construction of the new tracks and platforms.



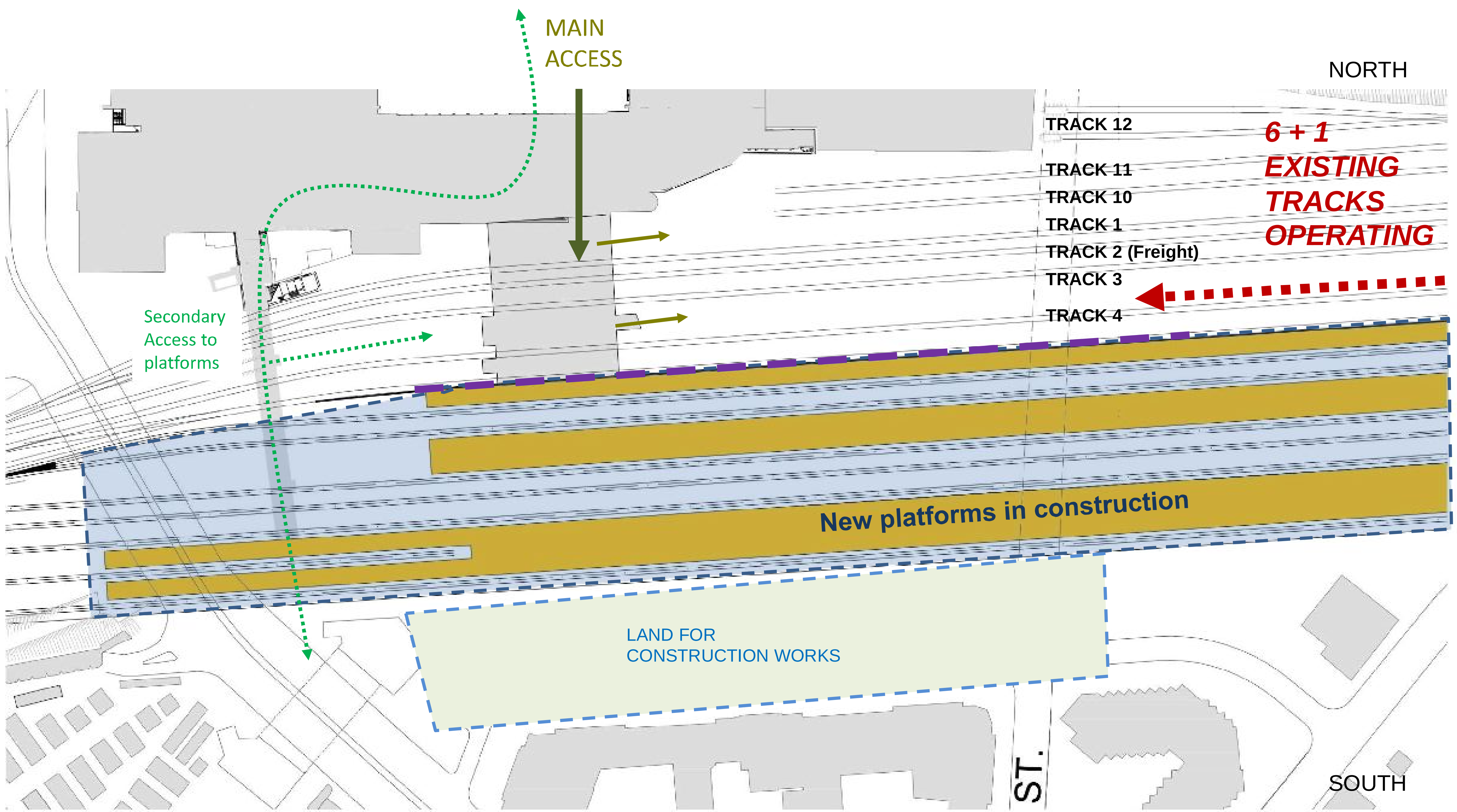
STAGE A.1: SOUTH HALF UNDER CONSTRUCTION
TRAIN OPERATIONS

A.1.7. Railway Trial Period (North Half)

6 + 1 TRACKS OPERATING

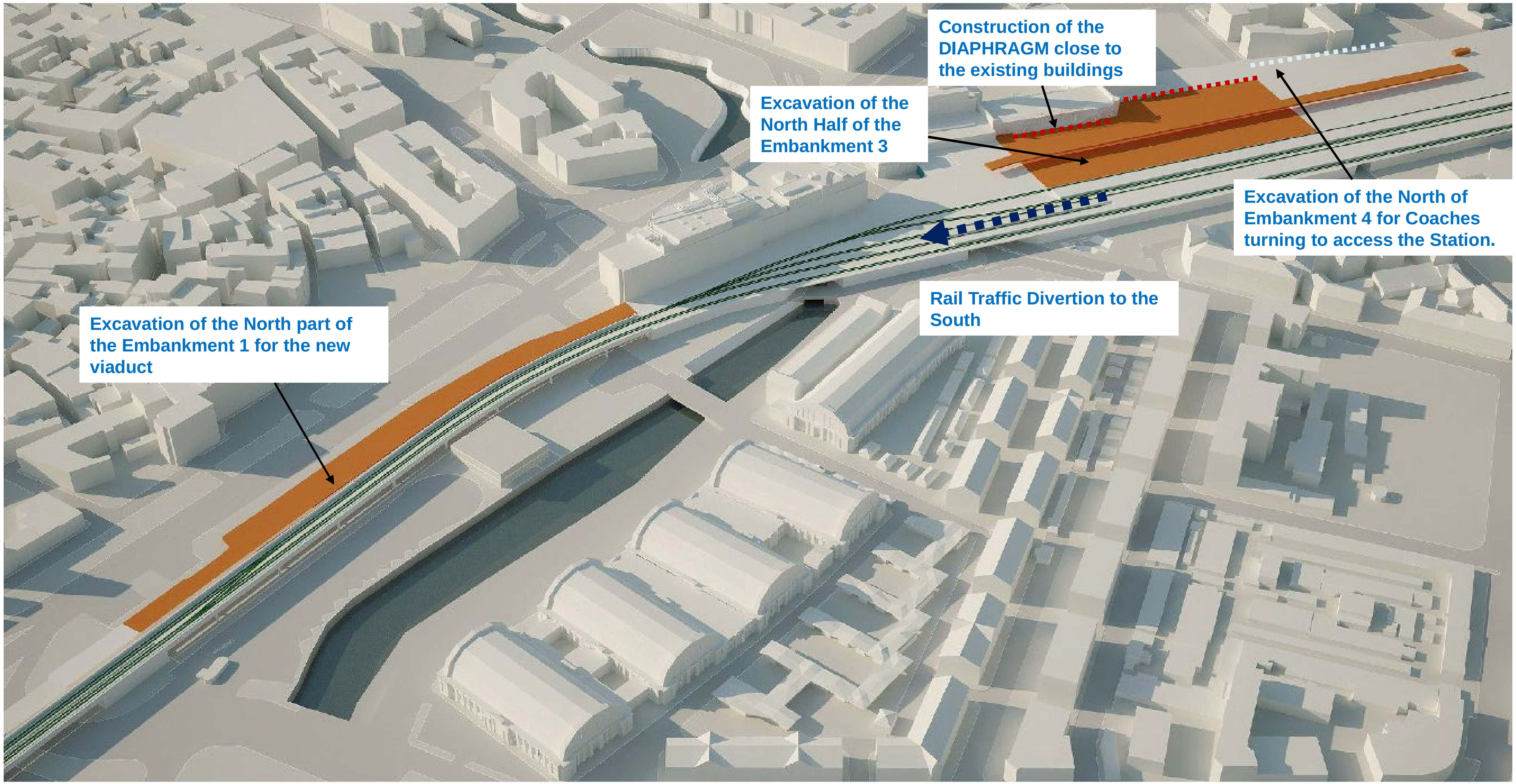


STAGE A.1: SOUTH HALF UNDER CONSTRUCTION
TRAIN OPERATIONS



AECOM

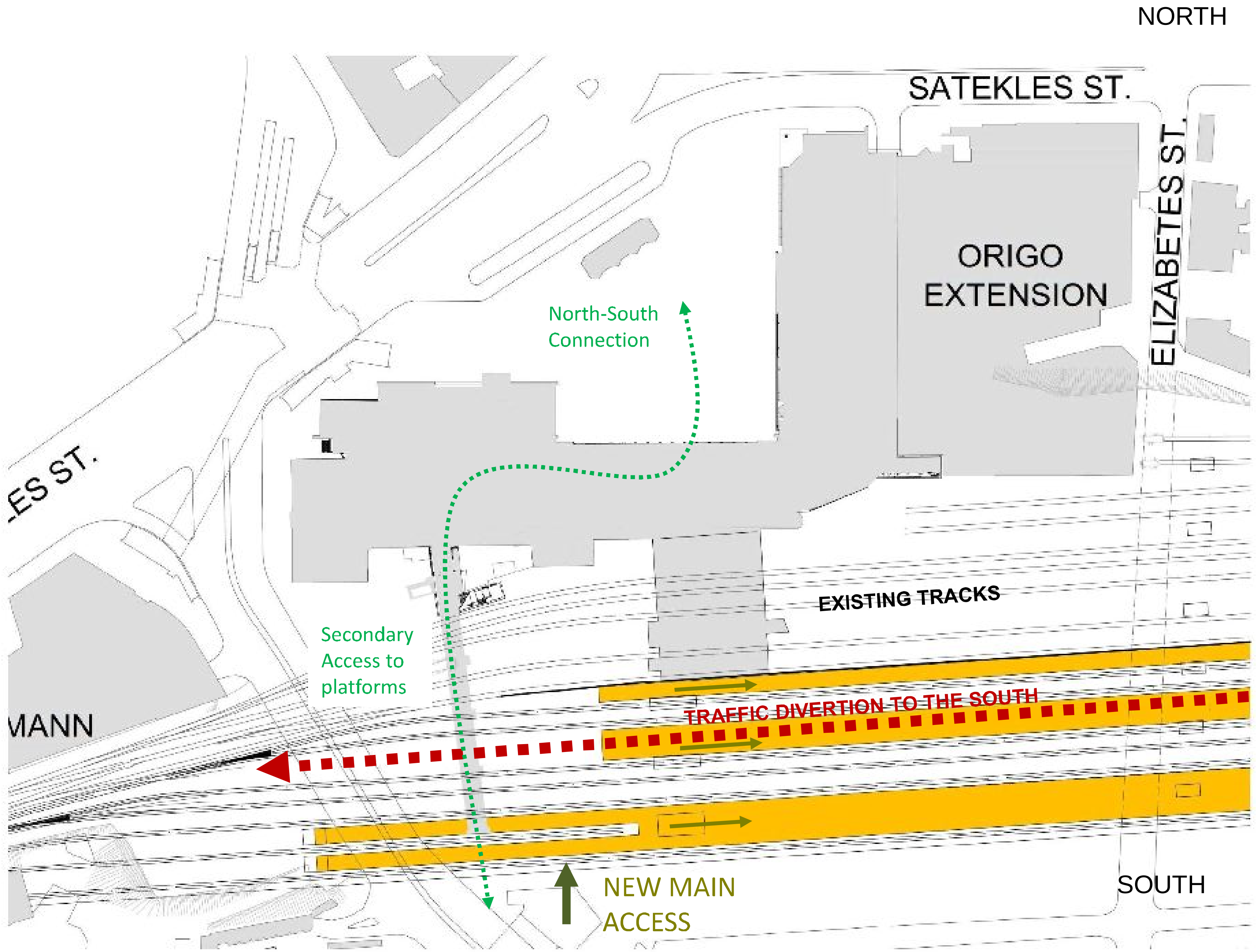
STAGE A.2: NORTH HALF UNDER CONSTRUCTION (part 1)



STAGE A.2: SOUTH HALF UNDER CONSTRUCTION

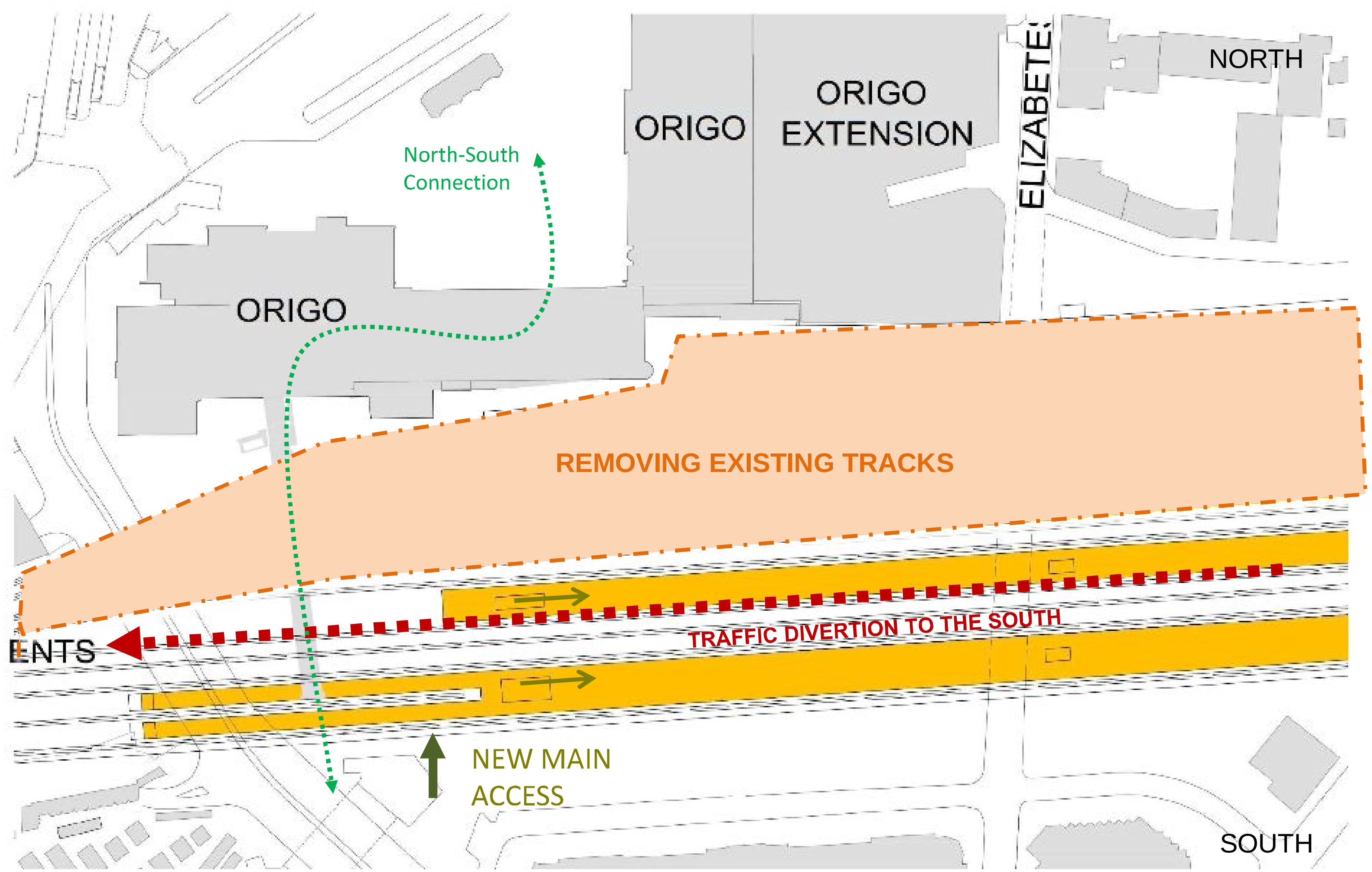
A.2.1. Rail Traffic Divertion to the new tracks in the South

- Change the switches
- New Signalling



STAGE A.2: NORTH HALF UNDER CONSTRUCTION

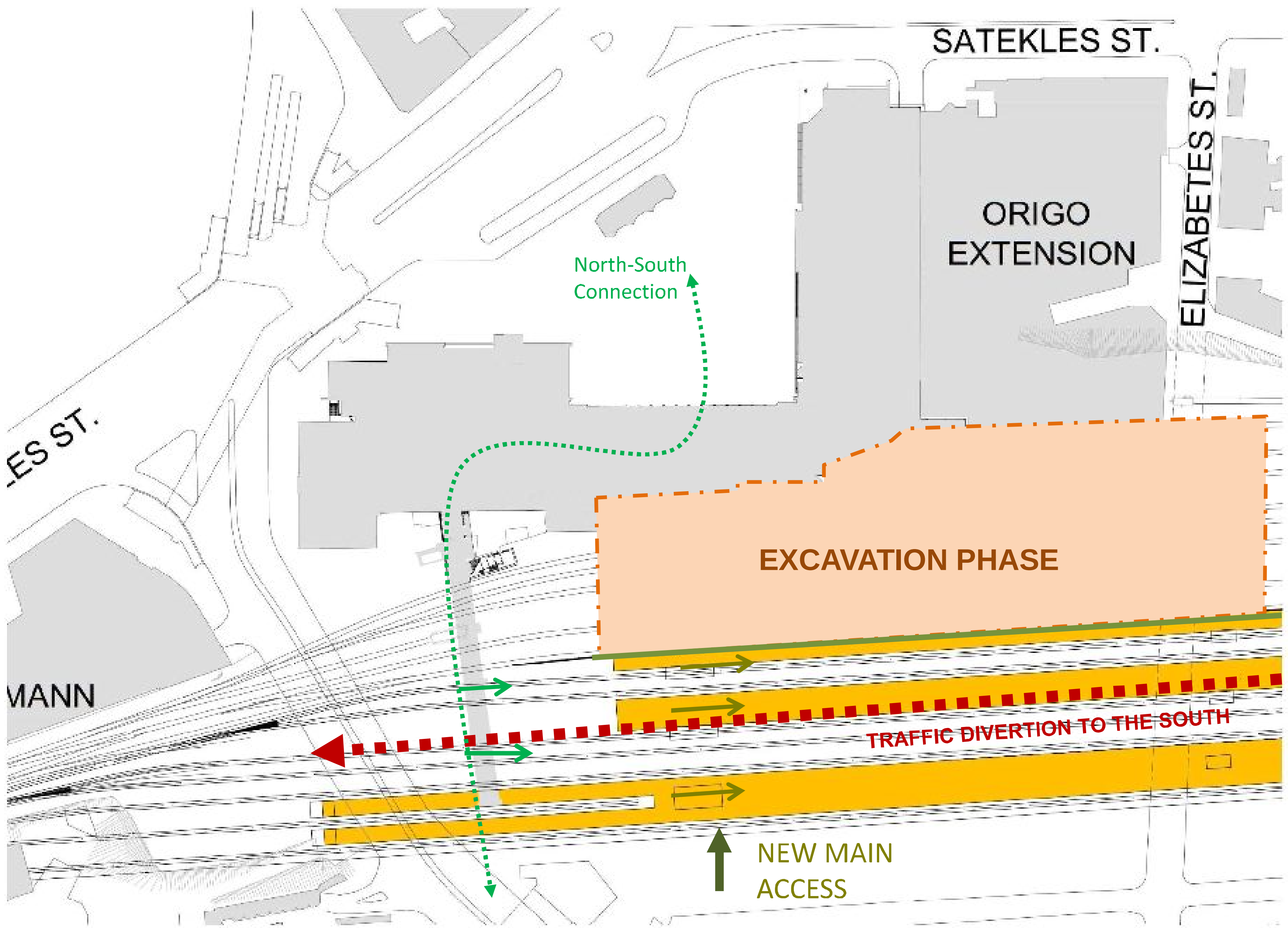
A.2.1. Rail Traffic Divertion to the new tracks in the South
A.2.2. Removing the existing tracks



AECOM

STAGE A.2: NORTH HALF UNDER CONSTRUCTION

A.2.1. Rail Traffic Divertion to the new tracks in the South
A.2.2. Removing the existing tracks
A.2.3. Excavation of the South Half of the Embankment 3. Dewatering in case to be necessary.

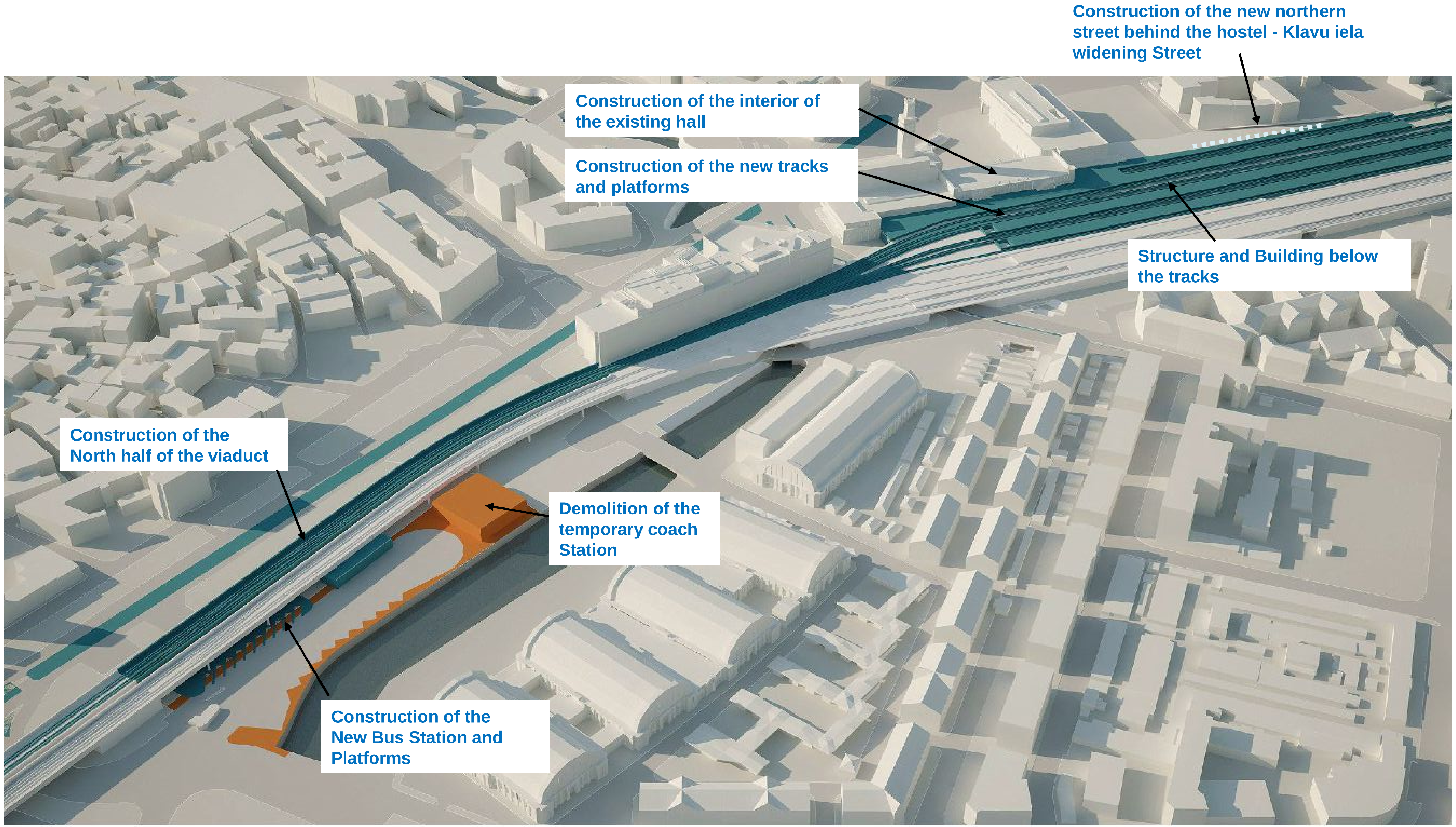


NORTH

SOUTH

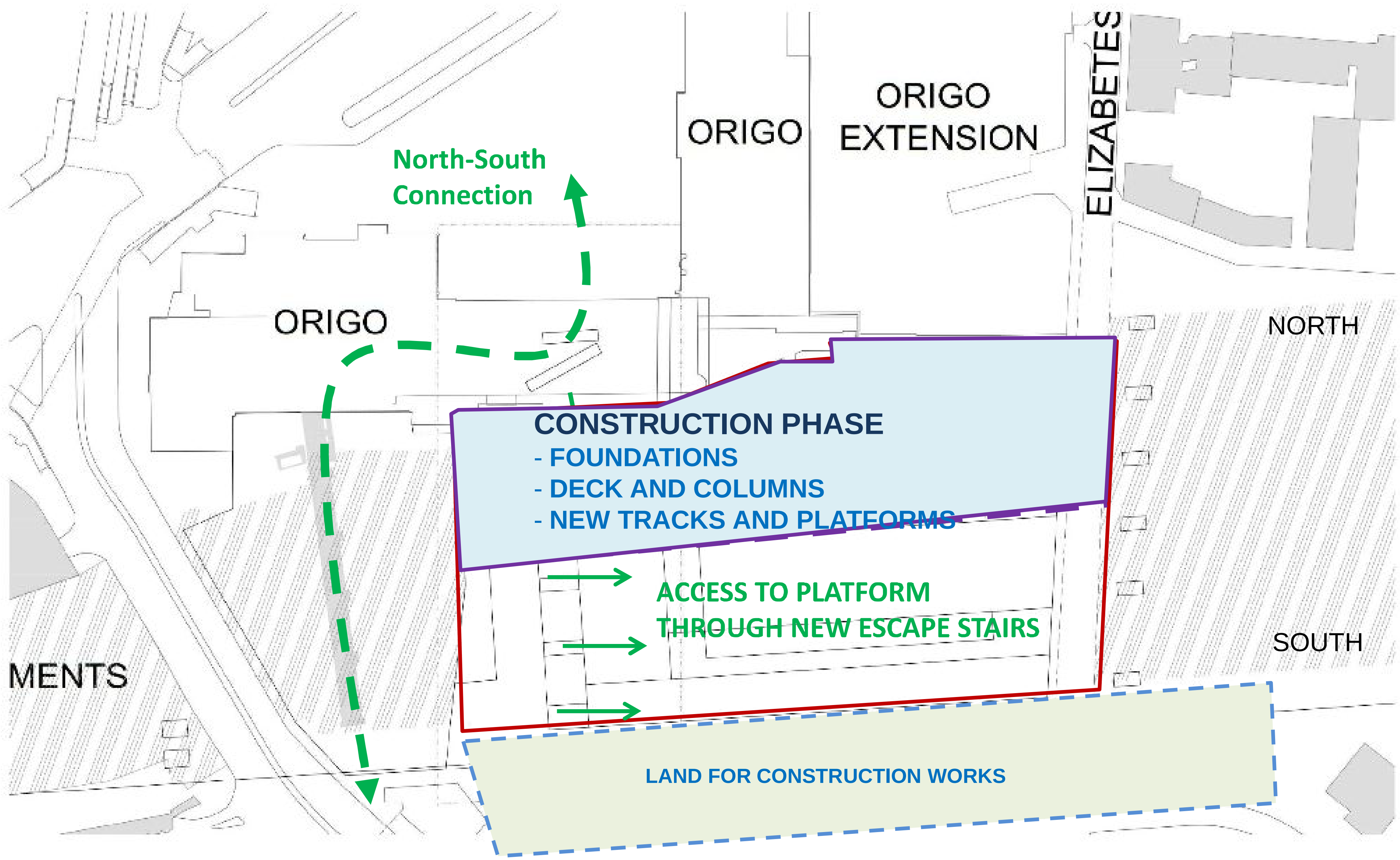
AECOM

STAGE A.2: NORTH HALF UNDER CONSTRUCTION (part 2)



STAGE A.2: NORTH HALF UNDER CONSTRUCTION

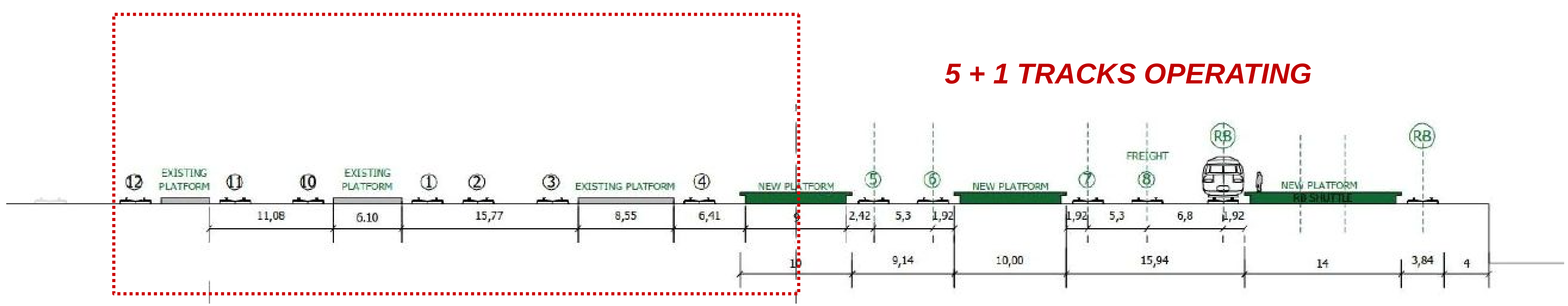
A.2.1. Rail Traffic Diversion to the new tracks in the North
A.2.2. Removing the existing tracks
A.2.3. Excavation of the South Half of the Embankment 3. Dewatering in case to be necessary
A.2.4. Construction of longitudinal Diaphragm in the middle of the embankment
A.2.5. Construction of Deck and Columns: Structure and Building below the tracks for South half of Embankment 3
A.2.6. Construction of the new tracks and platforms.
A.2.7. Transportation & City Planning:
All traffic networks, new Kiss & ride, open new streets(Gogola Iela, Elisabetes Iela, Marijas Iela, Klavu Iela, Dzirnavu Iela), new pedestrian crossings and urban improvements of the station surroundings



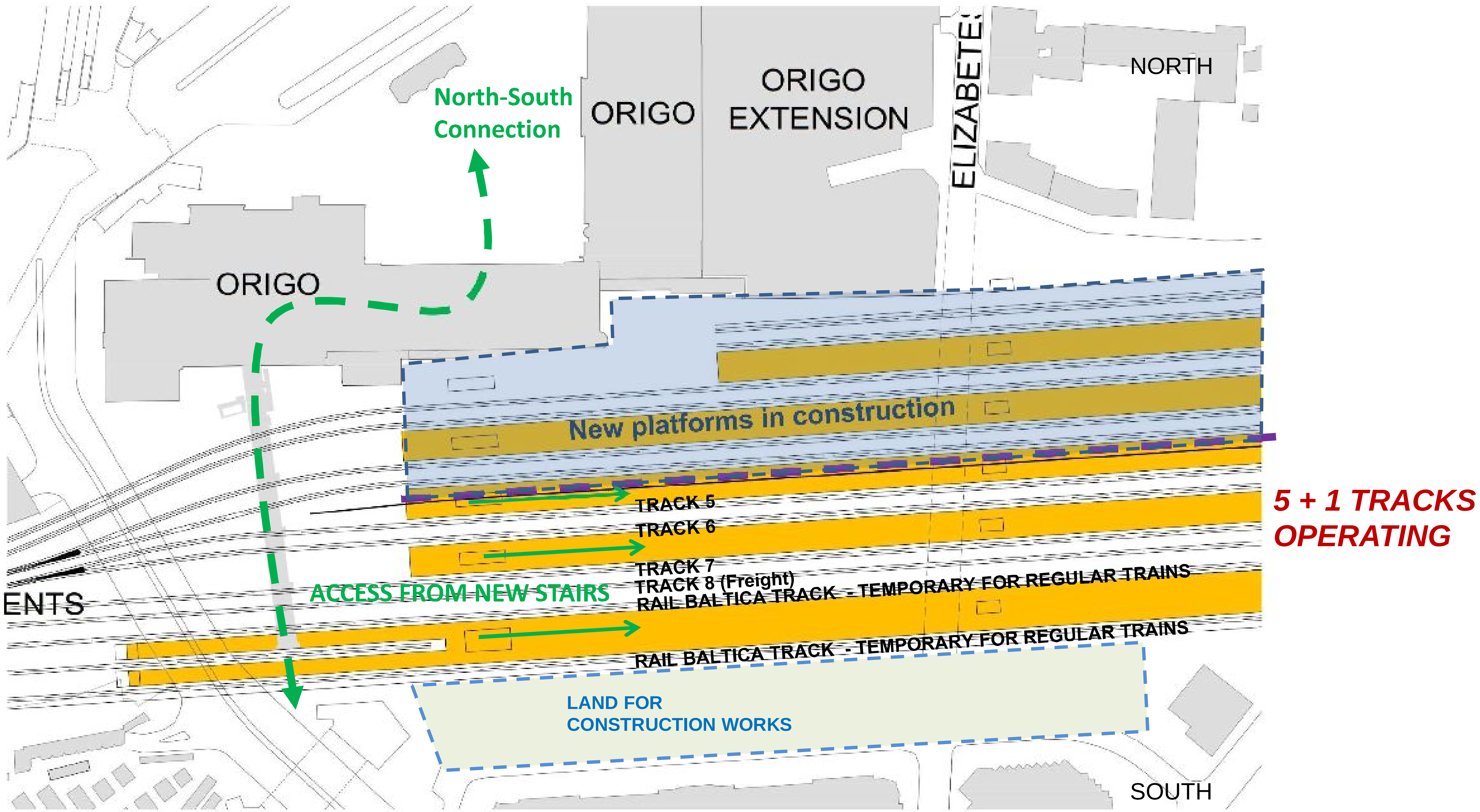
AECOM

STAGE A.2: NORTH HALF UNDER CONSTRUCTION
TRAIN OPERATIONS

A.2.8. Railway Trial Period (South Half)



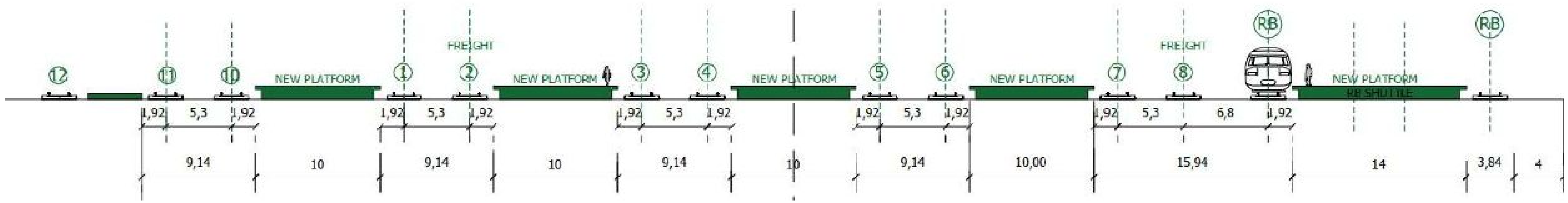
STAGE A.2: NORTH HALF UNDER CONSTRUCTION
TRAIN OPERATIONS



AECOM

END OF STAGE A

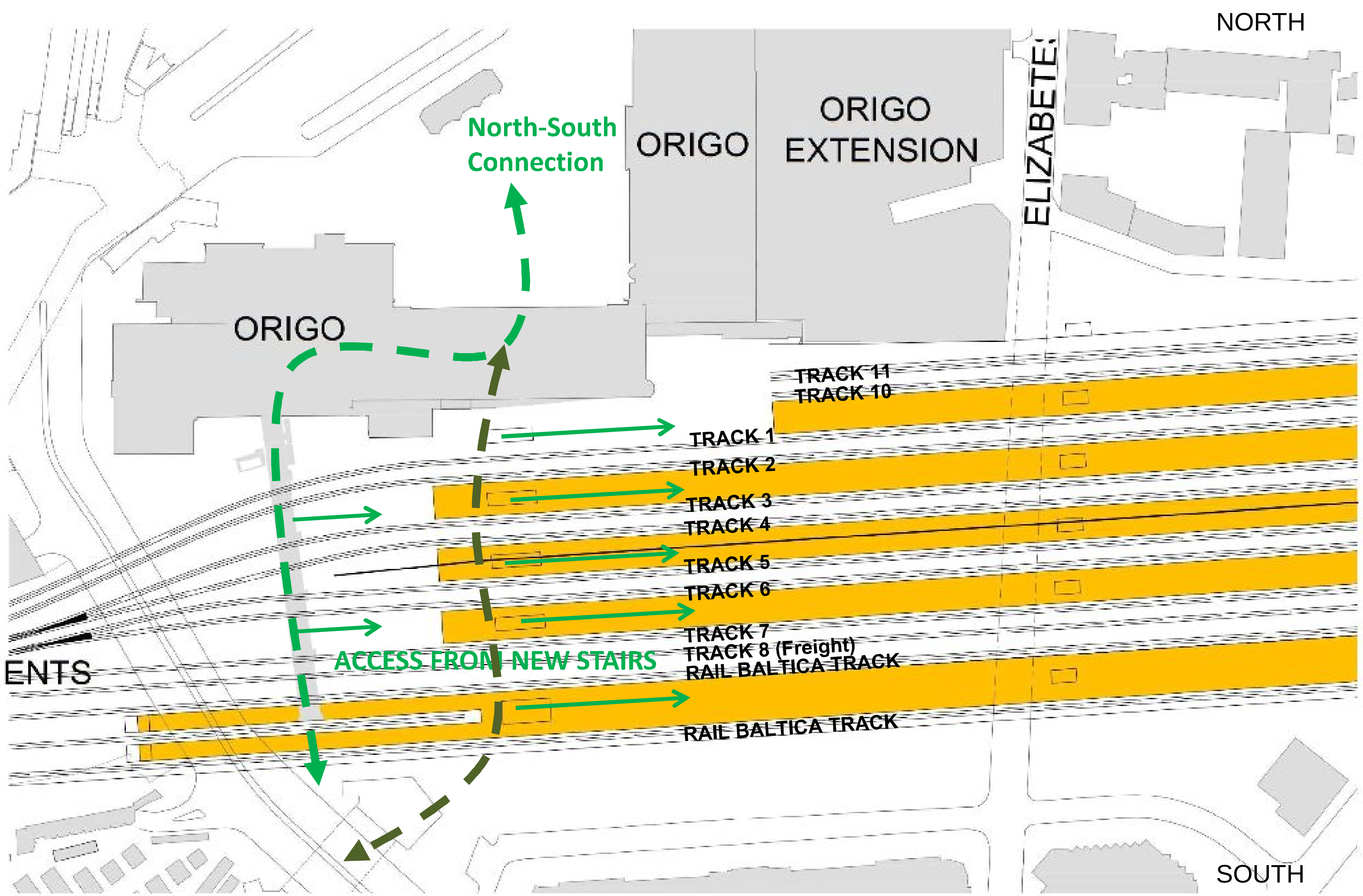
ALL TRACKS OPERATING



AECOM

END OF PHASE A

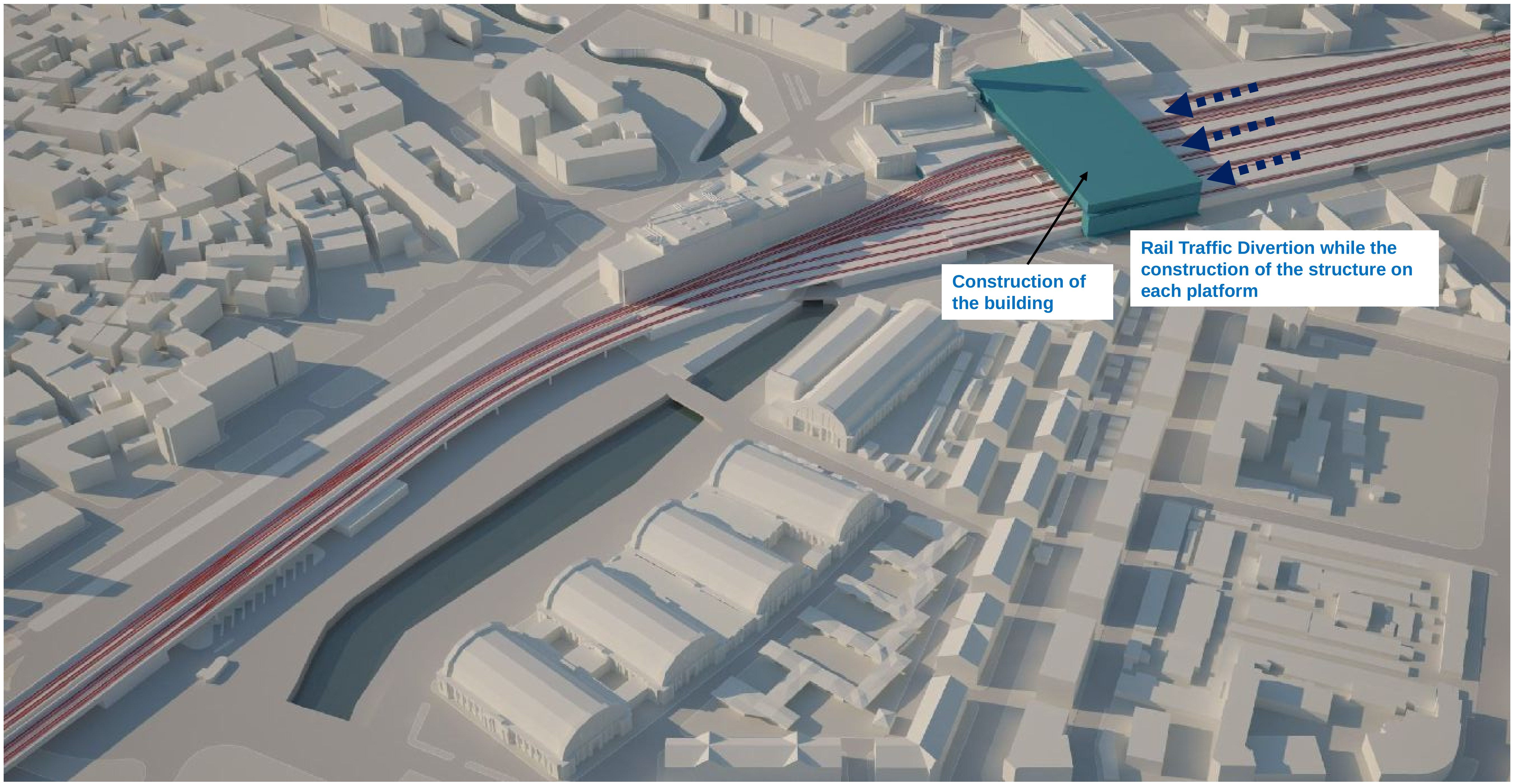
ALL TRACKS OPERATING



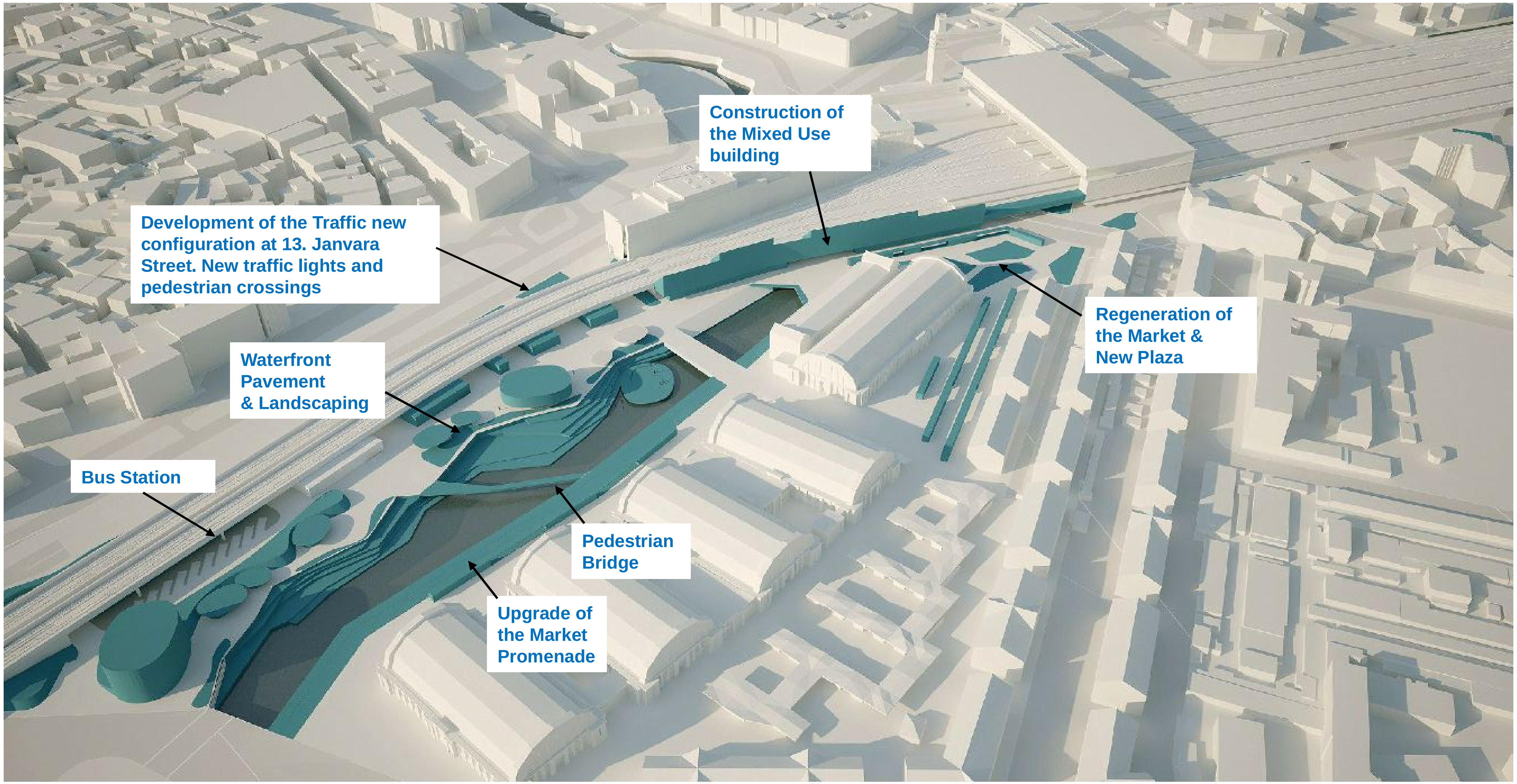
AECOM

PHASE B: Construction of the Elevated Station and Riverside Urban Development STAGE

STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION



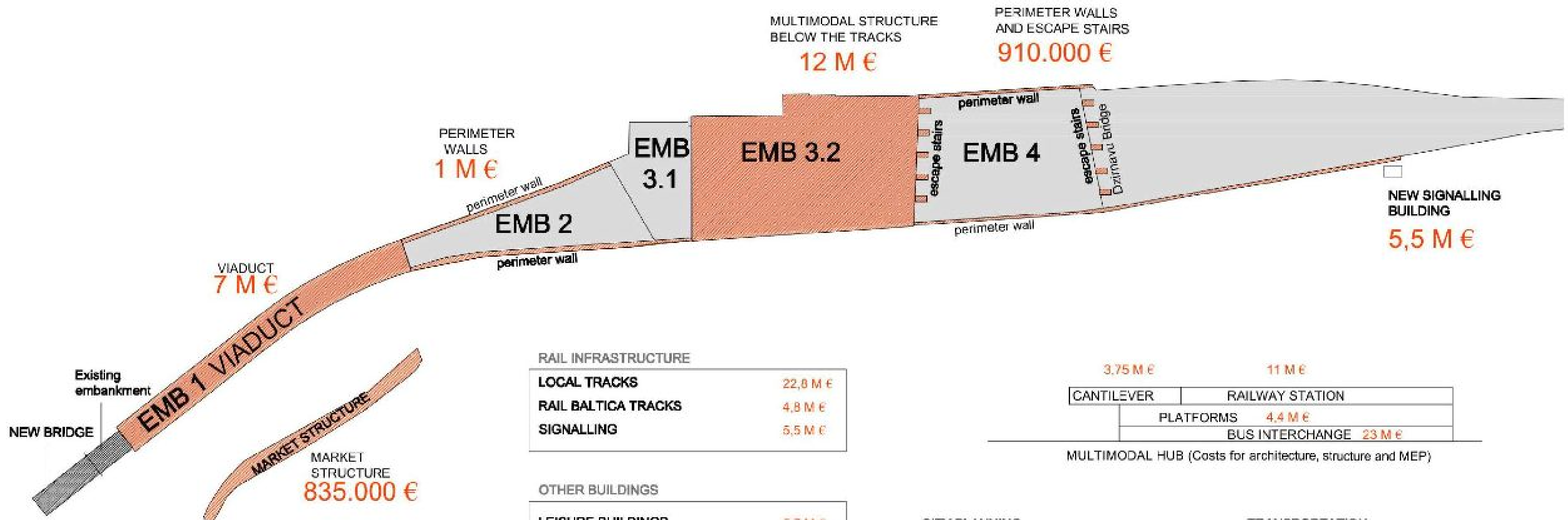
STAGE B.2: RIVERSIDE URBAN DEVELOPMENT



Cost and Programme of works of the Embankment Alternatives

OPTION 1: PROPOSAL OPTION
OPTION 2: EMBANK. 3.1 + GOGOLA BRIDGE
OPTION 3: OPTION 2 + EMBANK. 2
OPTION 4: EMBANMENT 4

OPTION 1: PROPOSAL OPTION



RAIL INFRASTRUCTURE

LOCAL TRACKS	22,8 M €
RAIL BALTICA TRACKS	4,8 M €
SIGNALLING	5,5 M €

3,75 M € 11 M €

CANTILEVER	RAILWAY STATION
PLATFORMS 4,4 M €	
BUS INTERCHANGE 23 M €	

MULTIMODAL HUB (Costs for architecture, structure and MEP)

OTHER BUILDINGS

LEISURE BUILDINGS	5,7 M €
OFFICE BUILDINGS	3 M €
RETAIL BUILDINGS	1,6 M €
CENTRAL MARKET UPGRADES	6 M €
INTERNATIONAL COACH STATION	13 M €

CITY PLANNING

UTILITIES	1,4 M €
LAND ADQUISITION	4,5 M €
LANDSCAPING	21 M €

TRANSPORTATION

ROAD NETWORK	4 M €
TROLLEY BUS	787.500 €
TRAM NETWORK	12,5 €
BIKE NETWORK	64.000 €

MANAGEMENT	27 M €

TOTAL DESIGN & CONSTRUCTION COST	190.188.321,96 €

PHASING OF COST ESTIMATES - PROPOSAL OPTION

Project Schedule

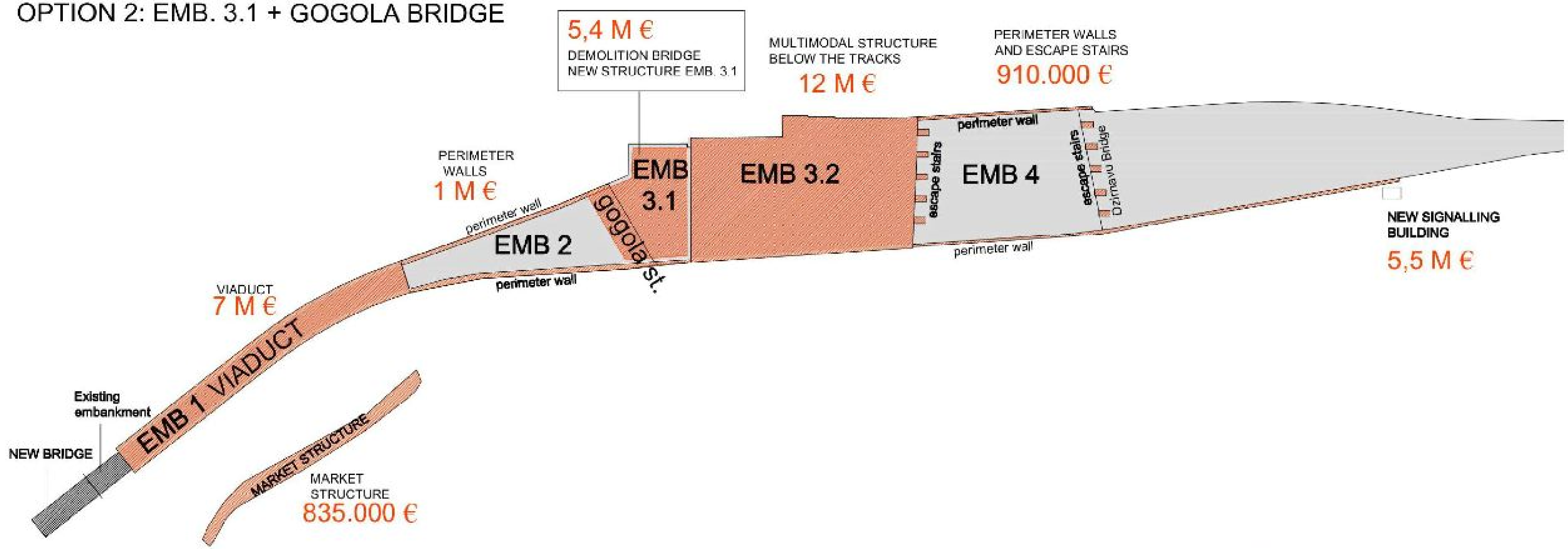
ID	TASK	START	FINISH	DURATION	ASSIGNED COST
1	**Design & Supervision Consultant Contract Award - milestone**	01/01/2016	31/01/2016	1	277.242,45 €
2	**Design (Civil, Architecture and M&E)**	01/02/2016	30/08/2017	19	4.066.222,63 €
2.1	**Initial Design Outline**	01/02/2016	30/06/2016	5	81.324,45 €
2.2	**Design Competition (Architecture) - milestone**	01/05/2016	30/06/2016	2	81.324,45 €
2.3	**Concept Design**	01/07/2016	31/12/2016	6	609.933,39 €
2.4	**Concept Design (Architecture)**	01/07/2016	31/12/2016	6	609.933,39 €
2.5	**Initial Approval**	01/01/2017	31/01/2017	1	203.311,13 €
2.6	**Detailed Design**	01/02/2017	31/07/2017	6	1.219.866,79 €
2.7	**Detailed Design (Architecture)**	01/02/2017	31/07/2017	6	1.219.866,79 €
2.8	**Full Approval**	01/08/2017	31/08/2017	1	40.662,23 €
3	**Procurement**	01/06/2017	30/04/2018	8	1.016.555,66 €
3.1	**Tender Dossier Preparation**	01/06/2017	30/09/2017	4	254.138,91 €
3.2	**Pre-qualification and shortlisting**	01/10/2017	30/11/2017	2	254.138,91 €
3.3	**Tender Process**	01/12/2017	28/02/2018	3	254.138,91 €
3.4	**Tender Evaluation**	01/03/2018	30/04/2018	2	254.138,91 €
3.5	**Contract Award (Rail Baltica & MOT & Latvian Railways) - milestone**	30/04/2018	30/04/2018		-
4	**Construction Phase**	01/06/2017	31/10/2022	54	184.828.301,22 €
4.1	**Stakeholder Engagement**	01/06/2017	31/01/2018	20	789.083,56 €
4.2	**Land Acquisition**	01/01/2018	30/04/2018	4	4.513.500,00 €
4.3	**Supervision / Consultancy**	01/05/2018	31/12/2018	8	250.000,00 €
	PHASE A: Construction of the Station at Street Level. Viaduct and the new tracks.	01/05/2018	31/10/2020	32	113.828.125,07 €
4.4	**STAGE A.1: SOUTH HALF UNDER CONSTRUCTION**	01/05/2018	30/04/2019	12	52.196.771,32 €
	A.1.1. Rail tracks Traffic Diversion to the North; Railway signalling building replacement.	01/05/2018	30/08/2018	4	8.873.451,12 €
	A.1.2. Removal of existing tracks in Centrālā stacija (South Half)	01/07/2018	31/08/2018	2	5.219.677,13 €
	A.1.3. Excavation of the South Half of the Embankment 3.	01/09/2018	31/09/2018	1	1.565.903,14 €
	A.1.4. Construction of longitudinal Diaphragm	01/10/2018	31/10/2019	1	6.263.612,56 €
	A.1.5. Structure and Building under the tracks (South Half Embankment 3)	01/11/2019	28/02/2019	4	17.224.934,53 €
	A.1.6. Construction of the new tracks and platforms.	01/01/2019	30/04/2019	4	12.918.882,13 €
	A.1.7. Railway Trial Period (South Half)	01/03/2019	30/04/2019	2	130.310,70 €
4.5	**STAGE A.2: NORTH HALF UNDER CONSTRUCTION**	01/05/2019	31/12/2021	20	61.631.353,76 €
	A.2.1. Rail tracks Traffic Diversion to the South Half	01/05/2019	30/06/2019	2	1.848.940,61 €
	A.2.2. Removal of existing tracks in Centrālā stacija (North Half)	01/07/2019	30/08/2019	2	1.540.783,84 €
	A.2.3. Excavation of South Half of Embankment 3.	01/09/2019	30/09/2019	1	6.163.135,38 €
	A.2.4. Demolition of the Diaphragm in the middle of the embankment	01/10/2019	31/10/2019	1	3.081.567,69 €
	A.2.5. Construction of Structure and Building under the tracks (South Half Embankment 3)	01/11/2019	31/05/2020	7	16.640.465,51 €
	A.2.6. Construction of the new tracks and platforms.	01/02/2020	30/06/2020	4	14.720.396,97 €
	A.2.7. Transportation & City Planning. Traffic networks & urban improvements.	01/11/2019	31/12/2020	14	17.339.474,91 €
	A.2.8. Railway Trial Period (North Half)	01/05/2020	30/06/2020	2	296.588,84 €
	PHASE B: Construction of the Elevated Station and Riverside Urban Development	01/07/2020	30/06/2022	24	65.447.592,59 €
4.6	**STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION**	01/07/2020	31/12/2021	18	41.005.144,90 €
	B.1.1 Temporary Rail Traffic diversions to build the Station Building	01/07/2020	31/08/2020	2	205.025,72 €
	B.1.2. Multimodal Hub Buiding Construction	01/09/2020	31/12/2021	16	40.800.119,17 €
4.7	**STAGE B.2: RIVERSIDE URBAN DEVELOPMENT**	01/07/2020	30/06/2022	24	24.442.447,70 €
	B.2.1. Construction of Mixed-Use Building	01/07/2020	30/06/2021	12	3.666.367,15 €
	B.2.2. Regeneration of Market & New Plaza	01/11/2020	30/04/2021	6	2.444.244,77 €
	B.2.3. Development of the Traffic new configuration at 13. Janvara Street	01/01/2021	31/12/2021	12	4.888.489,54 €
	B.2.4. Waterfront Pavement & Landscaping	01/10/2022	31/03/2022	6	7.332.734,31 €
	B.2.5. International Bus Station in 13.janvara iela/Maskavas iela	01/07/2021	31/006/2022	12	6.110.611,92 €

2016	2017	2018	2019	2020	2021	2022	CAPEX
1.659.758,14 €	3.552.876,98 €	36.195.626,21 €	41.567.028,36 €	54.818.427,02 €	45.672.932,13 €	6.721.673,12 €	190.188.321,96 €

Remaining Main Phase
Remaining Phase
Remaining Construction phase
★ Milestone

AECOM

OPTION 2: EMB. 3.1 + GOGOLA BRIDGE



* NOTE: TOTAL DESIGN & CONSTRUCTION COST FOR EACH OPTION INCLUDES GENERAL ITEMS, MANAGEMENT & CONTINGENCIES COSTS APPLIED FOR EACH DISCIPLINE WHICH HAS INFLUENCE IN THE DEVELOPMENT OF THE RIGA MULTIMODAL HUB PROJECT.

TOTAL DESIGN & CONSTRUCTION COST	196.568.008,61 €

PHASING OF COST ESTIMATES - EMBANKMENT 3.1 + GOGOLA BRIDGE OPTION

Project Schedule

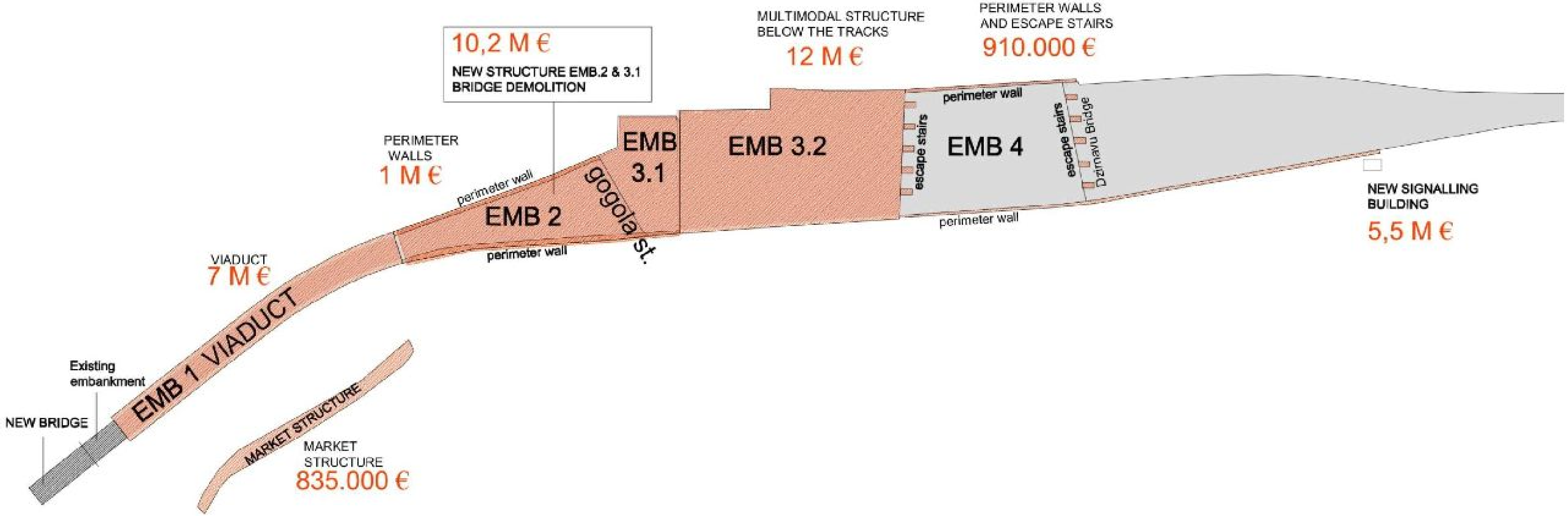
ID	TASK	START	FINISH	DURATION	ASSIGNED COST
1	**Design & Supervision Consultant Contract Award - milestone**	01/01/2016	31/01/2016	1	286.542,29 €
2	**Design (Civil, Architecture and M&E)**	01/02/2016	30/08/2017	19	4.202.620,20 €
2.1	**Initial Design Outline**	01/02/2016	30/06/2016	5	84.052,40 €
2.2	**Design Competition (Architecture) - milestone**	01/05/2016	30/06/2016	2	84.052,40 €
2.3	**Concept Design**	01/07/2016	31/12/2016	6	630.393,03 €
2.4	**Concept Design (Architecture)**	01/07/2016	31/12/2016	6	630.393,03 €
2.5	**Initial Approval**	01/01/2017	31/01/2017	1	210.131,01 €
2.6	**Detailed Design**	01/02/2017	31/07/2017	6	1.260.786,06 €
2.7	**Detailed Design (Architecture)**	01/02/2017	31/07/2017	6	1.260.786,06 €
2.8	**Full Approval**	01/08/2017	31/08/2017	1	42.026,20 €
3	**Procurement**	01/06/2017	30/04/2018	8	1.050.655,05 €
3.1	**Tender Dossier Preparation**	01/06/2017	30/09/2017	4	262.663,76 €
3.2	**Pre-qualification and shortlisting**	01/10/2017	30/11/2017	2	262.663,76 €
3.3	**Tender Process**	01/12/2017	28/02/2018	3	262.663,76 €
3.4	**Tender Evaluation**	01/03/2018	30/04/2018	2	262.663,76 €
3.5	**Contract Award (Rail Baltica & MOT & Latvian Railways) - milestone**	30/04/2018	30/04/2018		-
4	**Construction Phase**	01/06/2017	31/10/2022	58	191.028.191,07 €
4.1	**Stakeholder Engagement**	01/06/2017	31/01/2018	20	815.922,91 €
4.2	**Land Acquisition**	01/01/2018	30/04/2018	4	4.513.500,00 €
4.3	**Supervision / Consultancy**	01/05/2018	31/12/2018	8	250.000,00 €
PHASE A: Construction of the Station at Street Level. Viaduct and the new tracks.		01/05/2018	31/10/2020	36	119.585.165,65 €
4.4	**STAGE A.1: SOUTH HALF UNDER CONSTRUCTION**	01/05/2018	30/04/2019	16	55.075.291,60 €
	A.1.1. Rail tracks Traffic Diversion to the North. Railway signalling building replacement.	01/05/2018	3008/2018	4	9.362.799,57 €
	A.1.2. Removal of existing tracks in Centrālā stacija (South Half)	01/07/2018	31/08/2018	2	550.752,92 €
	A.1.3. Excavation of the South Half of the Embankment 3	01/09/2018	31/11/2018	3	2.203.011,66 €
	A.1.4. Construction of longitudinal Diaphragm	01/11/2018	31/01/2019	3	6.058.282,08 €
	A.1.5. Structure and Building under the tracks (South Half Embankment 3)	01/01/2019	30/04/2019	4	18.174.846,23 €
	A.1.6. Construction of Embankment 3.1 + Gogola Bridge demolition	01/03/2019	30/04/2019	2	5.367.870,00 €
	A.1.7. Construction of the new tracks and platforms.	01/05/2019	30/08/2019	4	12.918.882,13 €
	A.1.8. Railway Trial Period (South Half)	01/07/2019	30/08/2019	2	438.847,01 €
4.5	**STAGE A.2: NORTH HALF UNDER CONSTRUCTION**	01/09/2019	30/04/2021	20	64.509.874,04 €
	A.2.1. Rail tracks Traffic Diversion to the South Half	01/09/2019	30/10/2019	2	258.039,50 €
	A.2.2. Removal of existing tracks in Centrālā stacija (North Half)	01/11/2019	31/11/2019	2	645.098,74 €
	A.2.3. Excavation of North Half of Embankment 3	01/01/2020	31/01/2020	1	9.676.481,11 €
	A.2.4. Demolition of the Diaphragm in the middle of the embankment 3	01/02/2020	28/02/2020	1	1.935.296,22 €
	A.2.5. Construction of Structure and Building under the tracks (South Half Embankment 3)	01/03/2020	30/09/2020	7	17.417.665,99 €
	A.2.6. Construction of the new tracks and platforms.	01/07/2020	30/10/2020	4	14.720.396,97 €
	A.2.7. Transportation & City Planning. Traffic networks & urban improvements.	01/03/2020	30/04/2021	14	17.339.474,91 €
	A.2.8. Railway Trial Period (North Half)	01/09/2020	31/10/2020	2	2.517.420,61 €
PHASE B: Construction of the Elevated Station and Riverside Urban Development		01/11/2020	31/10/2022	24	65.863.602,52 €
4.6	**STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION**	01/11/2020	31/10/2022	24	41.213.149,86 €
	B.1.1 Temporary Rail Traffic diversions to build the Station Building	01/11/2020	31/12/2020	2	206.065,75 €
	B.1.2. Multimodal Hub Buiding Construction	01/01/2021	30/04/2022	16	41.007.084,11 €
4.7	**STAGE B.2: RIVERSIDE URBAN DEVELOPMENT**	01/11/2020	31/10/2022	24	24.650.452,66 €
	B.2.1. Construction of Mixed-Use Building	01/11/2020	31/10/2021	12	3.697.567,90 €
	B.2.2. Regeneration of Market & New Plaza	01/03/2021	30/08/2021	6	2.465.045,27 €
	B.2.3. Development of the Traffic new configuration at 13. Janvara Street	01/05/2021	30/04/2021	12	4.930.090,53 €
	B.2.4. Waterfront Pavement & Landscaping	01/02/2022	31/07/2022	6	7.395.135,80 €
	B.2.5. International Bus Station in 13.janvara iela/Maskavas iela	01/11/2021	31/10/2022	12	6.162.613,16 €

2016	2017	2018	2019	2020	2021	2022	CAPEX
1.715.433,16 €	3.672.184,46 €	21.846.245,55 €	39.863.807,11 €	59.474.927,18 €	45.569.629,84 €	24.425.781,31 €	196.568.008,61 €

Remaining Main Phase
Remaining Phase
Remaining Construction phase
★ Milestone

AECOM

OPTION 3: EMB.3.1. + EMB. 2 + GOGOLA BRIDGE



* NOTE: TOTAL DESIGN & CONSTRUCTION COST FOR EACH OPTION INCLUDES GENERAL ITEMS, MANAGEMENT & CONTINGENCIES COSTS APPLIED FOR EACH DISCIPLINE WHICH HAS INFLUENCE IN THE DEVELOPMENT OF THE RIGA MULTIMODAL HUB PROJECT.

TOTAL DESIGN & CONSTRUCTION COST	202.280.664,33 €

AECOM

PHASING OF COST ESTIMATES - EMBANKMENT 3.1 + EMBANKMENT 2 + GOGOLA BRIDGE OPTION

Project Schedule

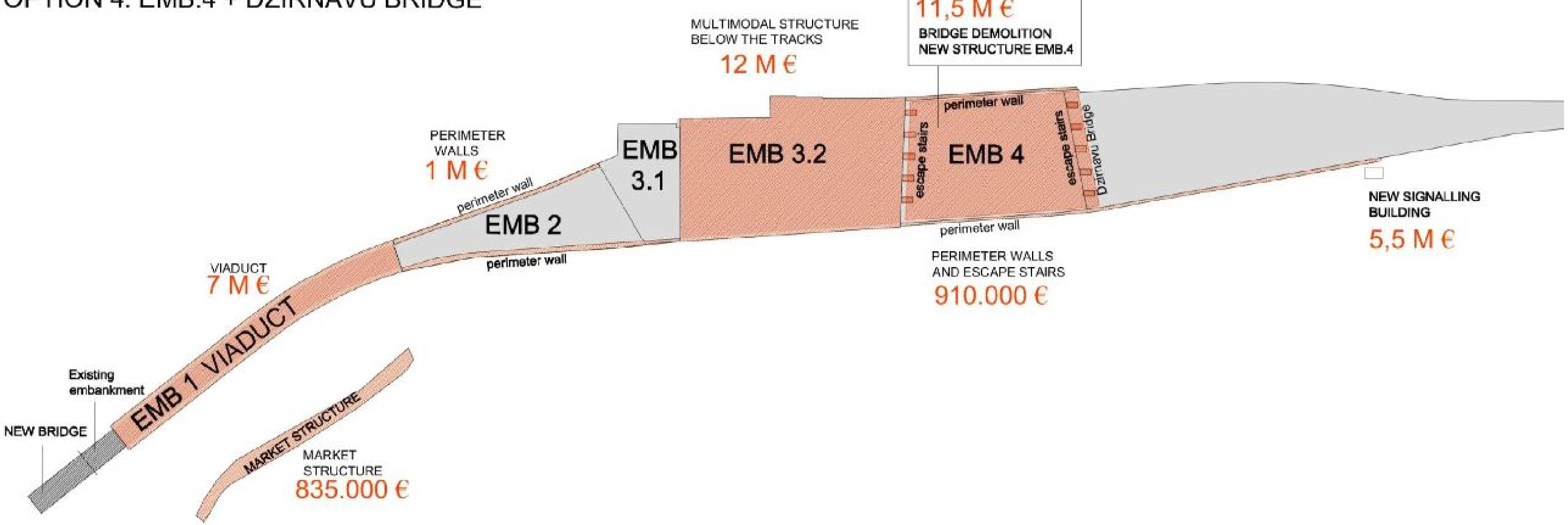
ID	TASK	START	FINISH	DURATION	ASSIGNED COST
1	Design & Supervision Consultant Contract Award - milestone	01/01/2016	31/01/2016	1	294.869,77 €
2	Design (Civil, Architecture and M&E)	01/02/2016	30/08/2017	19	4.324.756,67 €
2.1	Initial Design Outline	01/02/2016	30/06/2016	5	86.495,13 €
2.2	Design Competition (Architecture) - milestone	01/05/2016	30/06/2016	2	86.495,13 €
2.3	Concept Design	01/07/2016	31/12/2016	6	648.713,50 €
2.4	Concept Design (Architecture)	01/07/2016	31/12/2016	6	648.713,50 €
2.5	Initial Approval	01/01/2017	31/01/2017	1	216.237,83 €
2.6	Detailed Design	01/02/2017	31/07/2017	6	1.297.427,00 €
2.7	Detailed Design (Architecture)	01/02/2017	31/07/2017	6	1.297.427,00 €
2.8	Full Approval	01/08/2017	31/08/2017	1	43.247,57 €
3	Procurement	01/06/2017	30/04/2018	8	1.081.189,17 €
3.1	Tender Dossier Preparation	01/06/2017	30/09/2017	4	270.297,29 €
3.2	Pre-qualification and shortlisting	01/10/2017	30/11/2017	2	270.297,29 €
3.3	Tender Process	01/12/2017	28/02/2018	3	270.297,29 €
3.4	Tender Evaluation	01/03/2018	30/04/2018	2	270.297,29 €
3.5	Contract Award (Rail Baltica & MOT & Latvian Railways) - milestone	30/04/2018	30/04/2018	-	-
4	Construction Phase	01/06/2017	31/10/2022	54	196.579.848,72 €
4.1	Stakeholder Engagement	01/06/2017	31/01/2018	20	839.956,06 €
4.2	Land Acquisition	01/01/2018	30/04/2018	4	4.513.500,00 €
4.3	Supervision / Consultancy	01/05/2018	31/12/2018	8	250.000,00 €
	PHASE A: Construction of the Station at Street Level. Viaduct and the new tracks.	01/05/2018	31/10/2020	30	124.740.276,32 €
4.4	STAGE A.1: SOUTH HALF UNDER CONSTRUCTION	01/05/2018	30/04/2019	12	57.652.846,94 €
	A.1.1. Rail tracks Traffic Diversion to the North; Railway signalling building replacement.	01/05/2018	3008/2018	4	9.800.983,98 €
	A.1.2. Removal of existing tracks in Centrālā stacija (South Half)	01/07/2018	31/08/2018	2	576.528,47 €
	A.1.3. Excavation of the South Half of the Embankment 3	01/09/2018	31/11/2018	3	1.729.585,41 €
	A.1.4. Construction of longitudinal Diaphragm	01/11/2018	31/01/2019	3	4.612.227,76 €
	A.1.5. Structure and Building under the tracks (South Half Embankment 3)	01/01/2019	30/04/2019	4	17.295.854,08 €
	A.1.6. Construction of Embankment 3.1+ Embankment 2 + Gogola Bridge demolition	01/03/2019	30/04/2019	2	10.174.500,00 €
	A.1.7. Construction of the new tracks and platforms.	01/05/2019	30/08/2019	4	12.918.882,13 €
	A.1.8. Railway Trial Period (South Half)	01/07/2019	30/08/2019	2	544.285,12 €
4.5	STAGE A.2: NORTH HALF UNDER CONSTRUCTION	01/09/2019	30/04/2021	20	67.087.429,38 €
	A.2.1. Rail tracks Traffic Diversion to the South Half	01/09/2019	30/10/2019	2	872.136,58 €
	A.2.2. Removal of existing tracks in Centrālā stacija (North Half)	01/11/2019	31/11/2019	2	939.224,01 €
	A.2.3. Excavation of North Half of Embankment 3	01/01/2020	31/01/2020	1	3.354.371,47 €
	A.2.4. Demolition of the Diaphragm in the middle of the embankment 3	01/02/2020	28/02/2020	1	11.404.862,99 €
	A.2.5. Construction of Structure and Building under the tracks (South Half Embankment 3)	01/03/2020	30/09/2020	7	18.113.605,93 €
	A.2.6. Construction of the new tracks and platforms.	01/07/2020	30/10/2020	4	14.720.396,97 €
	A.2.7. Transportation & City Planning. Traffic networks & urban improvements.	01/03/2020	30/04/2021	14	17.339.474,91 €
	A.2.8. Railway Trial Period (North Half)	01/09/2020	31/10/2020	2	343.356,51 €
	PHASE B: Construction of the Elevated Station and Riverside Urban Development	01/11/2020	31/10/2022	24	66.236.116,34 €
4.6	STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION	01/11/2020	31/10/2022	24	41.399.406,77 €
	B.1.1 Temporary Rail Traffic diversions to build the Station Building	01/11/2020	31/12/2020	2	206.997,03 €
	B.1.2. Multimodal Hub Buiding Construction	01/01/2021	30/04/2022	16	41.192.409,74 €
4.7	STAGE B.2: RIVERSIDE URBAN DEVELOPMENT	01/11/2020	31/10/2022	24	24.836.709,57 €
	B.2.1. Construction of Mixed-Use Building	01/11/2020	31/10/2021	12	3.725.506,44 €
	B.2.2. Regeneration of Market & New Plaza	01/03/2021	30/08/2021	6	2.483.670,96 €
	B.2.3. Development of the Traffic new configuration at 13. Janvara Street	01/05/2021	30/04/2021	12	4.967.341,91 €
	B.2.4. Waterfront Pavement & Landscaping	01/02/2022	31/07/2022	6	7.451.012,87 €
	B.2.5. International Bus Station in 13.janvara iela/Maskavas iela	01/11/2021	31/10/2022	12	6.209.177,39 €

2016	2017	2018	2019	2020	2021	2022	CAPEX
1.765.287,04 €	3.779.017,70 €	20.899.885,48 €	44.324.288,98 €	61.149.847,87 €	45.783.126,82 €	24.579.210,44 €	202.280.664,33 €

Remaining Main Phase
Remaining Phase
Remaining Construction phase
★ Milestone

AECOM

OPTION 4: EMB.4 + DZIRNAVU BRIDGE



* NOTE: TOTAL DESIGN & CONSTRUCTION COST FOR EACH OPTION INCLUDES GENERAL ITEMS, MANAGEMENT & CONTINGENCIES COSTS APPLIED FOR EACH DISCIPLINE WHICH HAS INFLUENCE IN THE DEVELOPMENT OF THE RIGA MULTIMODAL HUB PROJECT.

TOTAL DESIGN & CONSTRUCTION COST	203.794.783,19 €

AECOM

PHASING OF COST ESTIMATES - EMBANKMENT 4 OPTION

Project Schedule

ID	TASK	START	FINISH	DURATION	ASSIGNED COST
1	**Design & Supervision Consultant Contract Award - milestone**	01/01/2016	31/01/2016	1	297.076,94 €
2	**Design (Civil, Architecture and M&E)**	01/02/2016	30/08/2017	19	4.357.128,50 €
2.1	**Initial Design Outline**	01/02/2016	30/06/2016	5	87.142,57 €
2.2	**Design Competition (Architecture) - milestone**	01/05/2016	30/06/2016	2	87.142,57 €
2.3	**Concept Design**	01/07/2016	31/12/2016	6	653.569,28 €
2.4	**Concept Design (Architecture)**	01/07/2016	31/12/2016	6	653.569,28 €
2.5	**Initial Approval**	01/01/2017	31/01/2017	1	217.856,43 €
2.6	**Detailed Design**	01/02/2017	31/07/2017	6	1.307.138,55 €
2.7	**Detailed Design (Architecture)**	01/02/2017	31/07/2017	6	1.307.138,55 €
2.8	**Full Approval**	01/08/2017	31/08/2017	1	43.571,29 €
3	**Procurement**	01/06/2017	30/04/2018	8	1.089.282,13 €
3.1	**Tender Dossier Preparation**	01/06/2017	30/09/2017	4	272.320,53 €
3.2	**Pre-qualification and shortlisting**	01/10/2017	30/11/2017	2	272.320,53 €
3.3	**Tender Process**	01/12/2017	28/02/2018	3	272.320,53 €
3.4	**Tender Evaluation**	01/03/2018	30/04/2018	2	272.320,53 €
3.5	**Contract Award (Rail Baltica & MOT & Latvian Railways) - milestone**	30/04/2018	30/04/2018	-	-
4	**Construction Phase**	01/06/2017	31/10/2022	61	198.051.295,62 €
4.1	**Stakeholder Engagement**	01/06/2017	31/01/2018	20	846.325,96 €
4.2	**Land Acquisition**	01/01/2018	30/04/2018	4	4.513.500,00 €
4.3	**Supervision / Consultancy**	01/05/2018	31/12/2018	8	250.000,00 €
PHASE A: Construction of the Station at Street Level. Viaduct and the new tracks.		01/05/2018	31/10/2020	36	126.106.619,87 €
4.4	**STAGE A.1: SOUTH HALF UNDER CONSTRUCTION**	01/05/2018	30/04/2019	16	58.336.018,72 €
	A.1.1. Rail tracks Traffic Diversion to the North; Railway signalling building replacement.	01/05/2018	30/08/2018	4	10.792.163,46 €
	A.1.2. Removal of existing tracks in Centrālā stacija (South Half)	01/07/2018	31/08/2018	2	583.360,19 €
	A.1.3. Excavation of the South Half of the Embankment 3 & Embankment 4	01/09/2018	31/11/2018	3	1.750.080,56 €
	A.1.4. Construction of longitudinal Diaphragm	01/11/2018	31/01/2019	3	4.666.881,50 €
	A.1.5. Structure and Building under the tracks (South Half Embankment 3)	01/01/2019	30/04/2019	4	15.750.725,05 €
	A.1.6. Construction of Embankment 4 area & Demolition Dzirnavu bridge	01/03/2019	30/04/2019	2	11.448.480,14 €
	A.1.7. Construction of the new tracks and platforms.	01/05/2019	30/08/2019	4	12.918.882,13 €
	A.1.. Railway Trial Period (South Half)	01/07/2019	30/08/2019	2	425.445,69 €
4.5	**STAGE A.2: NORTH HALF UNDER CONSTRUCTION**	01/09/2019	30/04/2021	20	67.770.601,16 €
	A.2.1. Rail tracks Traffic Diversion to the South Half	01/09/2019	30/10/2019	2	1.626.494,43 €
	A.2.2. Removal of existing tracks in Centrālā stacija (North Half)	01/11/2019	31/11/2019	2	1.016.559,02 €
	A.2.3. Excavation of North Half of Embankment 3 & Embankment 4	01/01/2020	31/01/2020	1	2.710.824,05 €
	A.2.4. Demolition of the Diaphragm in the middle of the embankment 3 & 4	01/02/2020	28/02/2020	1	11.521.002,20 €
	A.2.5. Construction of Structure and Building under the tracks (South Half Embankment 3)	01/03/2020	30/09/2020	7	18.298.062,31 €
	A.2.6. Construction of the new tracks and platforms.	01/07/2020	30/10/2020	4	14.720.396,97 €
	A.2.7. Transportation & City Planning. Traffic networks & urban improvements.	01/03/2020	30/04/2021	14	17.339.474,91 €
	A.2.8. Railway Trial Period (North Half)	01/09/2020	31/10/2020	2	537.787,28 €
PHASE B: Construction of the Elevated Station and Riverside Urban Development		01/11/2020	31/10/2022	24	66.334.849,79 €
4.6	**STAGE B.1: CONSTRUCTION OF THE ELEVATED STATION**	01/11/2020	31/10/2022	24	41.448.773,50 €
	B.1.1 Temporary Rail Traffic diversions to build the Station Building	01/11/2020	31/12/2020	2	207.243,87 €
	B.1.2. Multimodal Hub Buiding Construction	01/01/2021	30/04/2022	16	41.241.529,63 €
4.7	**STAGE B.2: RIVERSIDE URBAN DEVELOPMENT**	01/11/2020	31/10/2022	24	24.886.076,30 €
	B.2.1. Construction of Mixed-Use Building	01/11/2020	31/10/2021	12	3.732.911,44 €
	B.2.2. Regeneration of Market & New Plaza	01/03/2021	30/08/2021	6	2.488.607,63 €
	B.2.3. Development of the Traffic new configuration at 13. Janvara Street	01/05/2021	30/04/2021	12	4.977.215,26 €
	B.2.4. Waterfront Pavement & Landscaping	01/02/2022	31/07/2022	6	7.465.822,89 €
	B.2.5. International Bus Station in 13.janvara iela/Maskavas iela	01/11/2021	31/10/2022	12	6.221.519,07 €

2016	2017	2018	2019	2020	2021	2022	CAPEX
1.778.500,63 €	3.807.333,47 €	21.962.021,67 €	44.784.529,92 €	61.002.807,80 €	45.839.713,43 €	24.619.876,28 €	203.794.783,19 €

Remaining Main Phase
Remaining Phase
Remaining Construction phase
★ Milestone

AECOM