Preparation of the Operational Plan

Global Forum Rail Baltica
Vilnius, 04/04/2019
Aim of the study

Traffic Study
- Freight Transport Demand
- Passenger Transport Demand
- Freight Services
- Regional passenger services
- Long-distance passenger services

Operational Plan
- Rolling Stock Fleet Train Consists
- Draft Timetable
- Track Layout / Station facilities
- Assessment of line and station capacity
- Traffic Management / Signalling
- Staffing Plan
- Operational Costs (Infrastructure operation)

Maintenance Plan
- Rolling Stock Maintenance Strategy
- Infrastructure Maintenance Strategy
- Maintenance Vehicles Maintenance Facilities
- Maintenance Organisation
- Staffing Plan
- Operational & Investment Costs

Viable and feasible best-practise solution as input for the engineering design
Input data – Workflow and (simplified) main categories

Input data
- Previous Study Work
- Data from Stakeholders
- Other Sources

Consolidated information
- Traffic
  - Study corridor (adjacent lines, e.g. 1520 mm)
- Infrastructure
  - New line sections
  - Upgraded line sections

Operational Plan
- Infrastructure Model
- Timetable
- Maintenance/Organisation/Operational Costs

Market experience of consultant
Agenda

1. General Planning Principles
2. Traffic Studies
3. Track layout
4. Rolling Stock
5. Timetable Planning
6. Infrastructure & Rolling Stock Maintenance
7. Conclusions
General Planning Principles
Integrated infrastructure optimisation means.....

Optimisation

Market Offer

Rolling Stock → Infrastructure

....evaluating changes in each of the elements to optimize the system as a whole

....gaining information on the relationship of the elements and their ability to meet the market demands
From traditional planning to an integrated approach - the model

**Traditional approach**

Long-term

- Demand (market development)
- Railway infrastructure
- Rolling Stock
- Timetable (infrastructure-oriented offer)
- Operation of railway

Short-term

**Integrated approach**

Long-term

- Demand (market development)
- Timetable (market-oriented offer)
- Railway infrastructure
- Rolling Stock

Short-term

- Operation of railway

Integrating a market-oriented offer into the long-term planning process allows for an optimal infrastructure planning and realization

Source: BAV
Implementing an integrated infrastructure planning process

- Staggered approach towards building the required infrastructure
- A phased realisation in knowledge of the target state
- Phased Pre and intermediate stages representing a step towards the target state being upward compatible
Traffic Studies
Freight train service

- **Consolidated forecast of freight volumes** based on CBA and terminal studies (Muuga, Salaspils, Kaunas)

- Overall **volumes translated to number of sample paths** to provide for **required flexibility** along the line

- Most of the **market potential** can be **expected to be raised** within the **first 10..15 years** of operation (2036/46)

- **Introduction of FinEst** link would **induce further traffic growth**, also on Lithuanian line sections

- Naturally, **highest volumes** expected on section **Palemonas – border PL/LT**.

→ **Provision of sufficient capacity with focus on time horizon 2036/46** and support for optional further growth (FinEst link scenario)

→ **At least 2 freight paths per hour per direction** (3 for 2036/46) required on section **Kaunas - Poland** to provide for necessary flexibility in timetabling and handling of traffic peaks
## Freight train service

### Consolidated freight forecast

<table>
<thead>
<tr>
<th>Line section</th>
<th>Total number of trains [train pairs/day]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2026</td>
</tr>
<tr>
<td>Muuga - Salaspils</td>
<td>12</td>
</tr>
<tr>
<td>Salaspils - Kaunas triangle</td>
<td>14</td>
</tr>
<tr>
<td>Vaidotai - Kaunas triangle</td>
<td>13</td>
</tr>
<tr>
<td>Kaunas Triangle - Palemonas</td>
<td>19</td>
</tr>
<tr>
<td>Palemonas - border PL/LT</td>
<td>27</td>
</tr>
<tr>
<td>Kaunas Triangle East - Kaunas Triangle North</td>
<td>4</td>
</tr>
<tr>
<td>Kaunas Triangle North - Kaunas Triangle South</td>
<td>10</td>
</tr>
<tr>
<td>Kaunas Triangle South - Kaunas Triangle East</td>
<td>9</td>
</tr>
</tbody>
</table>

### Required freight train paths (timetabling flexibility)

<table>
<thead>
<tr>
<th>Line Section</th>
<th>Freight train paths per hour per direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2026</td>
</tr>
<tr>
<td>Muuga - Salaspils</td>
<td>1</td>
</tr>
<tr>
<td>Salaspils - Kaunas triangle</td>
<td>1</td>
</tr>
<tr>
<td>Vaidotai - Kaunas triangle</td>
<td>1</td>
</tr>
<tr>
<td>Kaunas Triangle - Palemonas</td>
<td>1,5</td>
</tr>
<tr>
<td>Palemonas - border PL/LT</td>
<td>2</td>
</tr>
</tbody>
</table>

Assumption: 22 operating hours per day on average
## Passenger Train Service - 3 types of services

<table>
<thead>
<tr>
<th>Long Distance High Speed Trains HST (234 km/h)</th>
<th>Night train services NT (200 km/h)</th>
<th>Regional Express trains RE (200 km/h)</th>
</tr>
</thead>
</table>
- Basic headway: 120’ (2026/2036/2046: not all slots used)  
- Extension to Helsinki with opening of FinEst-Link | - 2 train pairs/d (Warszawa – Tallinn, Berlin/Vienna – Vilnius) | - Forecast carried out for the operational plan reveals significant potential in all three Baltic states  
- Basic headway: 120’ / partially 60’  
- Integrated timetabling solution with RIX shuttle (30'/15’)  
- Service designed to complement high speed train service (interconnectivity, filling timetable gaps)  
- Assumption: Trains stop at all proposed intermediate stations |
| Potential for substantially more passenger traffic compared to global CBA, also for Lithuania (e.g. regional trains to Panevėžys, Marijampolė, Kaunas - Vilnius)  
- Interconnectivity regional trains / HST to be considered at Kaunas Central station as major hub and also at Vilnius, Panevėžys, RIX, Riga, Tallinn. |
Passenger Train Service Pattern

- **Line-based concept** with fixed interval timetables following offer-oriented approach
- **All lines** assumed to be **operational** within **first ten years** of operation
- **Ramp-up of demand** within first 10 years of operation expected
- Development of regional traffic subject to further implementing decisions by national authorities in EE, LT and LV
- **Concept 2056** for passenger services as **realistic upper boundary**, not only dependant of FinEst link
- **Differences** between time periods mainly regarding **off-peak services** (more trains later)
Passenger Train Service Pattern 2056

Trains/day, both directions

<table>
<thead>
<tr>
<th></th>
<th>HST</th>
<th>RE</th>
<th>FT</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>16</td>
<td>48</td>
<td>114</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>96</td>
<td>0</td>
<td>130</td>
<td></td>
</tr>
</tbody>
</table>

Stop
- Terminus / High Speed Station
- Stop at all regional stations (not all stops indicated)

Train category
- High Speed Train HST
- Night Train NT
- Regio Express RE
- RIX/HEL shuttle

Service interval [Peak]
- 30’ (64 trains p.d.)
- 60’ (32 trains p.d.)
- 120’ (16 trains p.d.)
- No interval

References:
ETC Mobility Solutions
COWI
Institut für Verkehrstechnik GmbH Berlin - Dresden

04/04/2019
Track layout

- **Iterative development** of a track plan based on the Preliminary Design for the Rail Baltica alignment in the three Baltic states including additional information from the stakeholders.

- **For all time horizons** 2026/2036/2046/2056

- Overview of the infrastructure as **schematic track layout** indicating the **location of all operational points** (stations, passing loops, emergency crossovers, junctions, passenger stops).

- To be **updated** with the **continuation** of the design and implementation process.
Rolling Stock
## Passenger traffic - fleet size

<table>
<thead>
<tr>
<th>Train type</th>
<th>Line</th>
<th>Turnarounds and fleet size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2026</td>
</tr>
<tr>
<td>HST</td>
<td>11 Warszawa - Tallinn/Helsinki</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>12 Vilnius - Tallinn/Helsinki</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>13 Warszawa - Vilnius</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>14 Kaunas - Vilnius</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reserve (15%)</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total with reserve</strong></td>
<td><strong>18</strong></td>
</tr>
<tr>
<td>NT</td>
<td>41 Warszawa - Tallinn/Helsinki</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>42 Warszawa - Vilnius</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>0</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reserve (15%)</strong></td>
<td><strong>0</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total with reserve</strong></td>
<td><strong>0</strong></td>
</tr>
<tr>
<td>RE/RIX/HEL</td>
<td>21 RIX - Tallinn</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>22 Pärnu - Tallinn</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>24 Bauska - Salacgriva</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>25 Bauska - Skulte</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>26 Marijampolé - Riga</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>27 Vilnius - Panevezys</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>28 Białystok - Vilnius</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>29 Kaunas - Vilnius</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>31 Riga - RIX</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>51 Helsinki - Tallinn</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>17</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reserve (15%)</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total with reserve</strong></td>
<td><strong>20</strong></td>
</tr>
<tr>
<td>Model</td>
<td>Builder</td>
<td>Train Control System</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Pendolino ED250</td>
<td>Alstom</td>
<td>ERTMS, SHP, Mirel, L2B/P2B</td>
</tr>
<tr>
<td>SMILE EC 250</td>
<td>Stadler AG</td>
<td>ERTMS + 1 national</td>
</tr>
<tr>
<td>Flirt3 (8 cars)</td>
<td>Stadler AG</td>
<td>ERTMS + 1 national</td>
</tr>
<tr>
<td>Zefiro 300 (8 cars)</td>
<td>Bombardier Transportation</td>
<td>ERTMS + National Systems</td>
</tr>
<tr>
<td>Dart</td>
<td>PESA</td>
<td>ERTMS, ETCS, SHP</td>
</tr>
<tr>
<td>ICE 4 (7-cars)</td>
<td>Siemens Mobility</td>
<td>ERTMS5, L2B, P2B</td>
</tr>
<tr>
<td>Velaro D (8 cars)</td>
<td>Siemens Mobility</td>
<td>ERTMS + additional</td>
</tr>
<tr>
<td>Talgo 250</td>
<td>Patentes Talgo / Bombardier</td>
<td>ETCS L1, L2, L2B, ASFA</td>
</tr>
<tr>
<td>Talgo 350</td>
<td>Patentes Talgo / Bombardier</td>
<td>ETCS L1, L2, L2B, ASFA</td>
</tr>
<tr>
<td>Talgo Avril</td>
<td>Patentes Talgo</td>
<td>ETCS L1, L2, L2B, ASFA</td>
</tr>
<tr>
<td>Osiris (8 cars)</td>
<td>CAF Alstom</td>
<td>ERTMS + additional</td>
</tr>
<tr>
<td>AT 300 (5 cars, 7 cars)</td>
<td>Hitachi Rail</td>
<td>ETCS L2 + additional</td>
</tr>
<tr>
<td>Javelin (A Train)</td>
<td>Hitachi Rail</td>
<td>ERTMS</td>
</tr>
</tbody>
</table>
Timetable Vangazi - Iecava 2056
Timetable construction Tallinn

Tallinn node – traffic flows

proposed track layout for Tallinn Ülemiste

track occupation Tallinn Ülemiste – timetable 2056
Timetable construction Kaunas & Riga
Infrastructure improvement at Riga Central Station

- Entering the bay platform leads to train-path conflicts
- One turning track in the east usable only for regional trains (usable length < 200 m)
- Terminating longer trains from the south need to proceed as far as Acone depot (+11.6 km)
- Trains from the north are required to continue further south to Riga Airport station, which will also have very limited station track capacity, or alternatively to Jaunmārupe
- No room to handle additional trains during peak hours in 2056
- Change of train sequence not possible since there is no free waiting track for the train to be overtaken. Thus no prioritization possible of long-distance over regional express trains needed in case of failures and delays

- Overtaking of delayed train in Riga Central station possible
- Beginning/terminating passenger train runs in the morning and evening, which might require additional platform occupation time
- Direction change of terminating services at the platform, also for HST services if needed
- Providing interconnectivity between 1435 mm HST and regional trains using adjacent platform edges
- Providing reserve capacity in case one platform tracks needs to be closed down for infrastructure maintenance work etc.
- Allowing longer scheduled stops of train services, e.g. to synchronize with 1520 mm timetable
- Providing additional capacity in case of prolonged platform occupation time

Advantages

Original solution

Suggested layout improvement

04/04/2019
Track layout Kaunas triangle from an operational point of view

- Layout depicts operational requirements
- Track layout/indicated chainages subject to further technical design
- Implementations of stations and maintenance facilities subject to further implementing decisions
- Operational plan to be updated at later stages

"Fastest" connection Vilnius - Riga

- High speed turnouts
- "Fastest" connection
- KUN station west of mainline
  - Bigger curve radius on southern leg of triangle
  - Implementation as regional station as per intergovernmental agreement
  - Access to airport (subject to further implementing decisions)
  - Platforms on sidings to allow fast speed of passing HST
  - Additional Passing loop capacity (Kaunas node/Karmelava)

Connecting station also to Panevėžys / Riga

- Karmelava freight station in lateral location
  - Rail access to all directions (Vilnius with reversing at KUN)
  - Road access, short ways to Kaunas FEZ/KUN
  - Extendability (terminal space)
  - Operational plan to be updated at later stages

Infrastructure Heavy maintenance base

- With access to all directions (if implemented)
- Additional Passing loop capacity (Kaunas node/Karmelava)
- Long-term infrastructure Heavy maintenance base

Additional Passing loop capacity (Kaunas node/Karmelava)
- Karmelava freight station (Terminal / Parking / Rolling)
- Karmelava freight station in lateral location

Kaunas Triangle South junction

- High speed turnouts
- Optional industrial siding to Kaunas FEZ
- Optimal Industrial siding to Kaunas FEZ
- Infrastructure Heavy maintenance base
- Access to airport (subject to further implementing decisions)
Conclusions on Kaunas Node

- Starting with single track solution is sufficient
- Detailed design study for Kaunas Central station to be carried out taking into account 1435mm/1520mm requirements
- With growing traffic double tracking 1435 mm Palemonas – Kaunas Central recommended
- Double tracking Kaunas Central – Jiesia lower priority, also depending on decision on Kaunas Central station layout (turning facility south of Nemunas river)
- Double track option to be considered in station/junction layouts (Palemonas, Kaunas Central, Jiesia)
- Timeline subject to decisions on regional traffic and service provision on Kaunas – Vilnius line
Infrastructure & Rolling Stock Maintenance
Infrastructure maintenance organisation

- Rail Baltica Maintenance
  - Administration
  - Substructure & Tracks
  - Signalling & train control equipment
  - Bridges, structures, tunnels & drainage
  - Stations
  - Electric supply (low voltage)
  - Catenary & high Voltage power supply

- Location 1
- Location 2
- Location n

Local work teams
Existing, planned and proposed Rolling Stock Maintenance Facilities
Conclusions
Conclusions - I

- The service pattern of regional services has to be confirmed and further developed by the regional and national authorities as soon as possible to size infrastructure for first 20 years of operation.

- The transnational train services and operational rules between the Baltic States and Poland must be coordinated including the planning by PKP PLK, the national and regional authorities in Poland.

- The future operation on the 1520 mm network should be further developed in order to analyse the interdependencies with operation on Rail Baltica in more detail.

- Need and technical requirements for freight train service shall be further elaborated taking into account all relevant stakeholders. This process shall be embedded in ongoing market research activities for the North Sea – Baltic rail freight corridor.
Conclusions - II

- Future 1435 mm network south of Kaunas needs to be finally decided regarding interconnectivity to already existing single track line sections (Trakiszki -) Mockava – Šeštokai – Marijampolė - Kazlų Rūda– Jiesia and future location of the regional passenger station at Marijampolė.

- More detailed investigations incl. timetable stability analysis to prove functionality of proposed infrastructure layout in Kaunas node and to choose the final infrastructure layout.

- Station track layout and location of passing loops shall be further detailed based on elaboration of operational plan during further design stages (spatial planning, technical design).

Operational plan should be updated annually to reflect the latest planning stages