# The Combined Bridge

## Rail Baltica's solution for connecting both sides of the Daugava

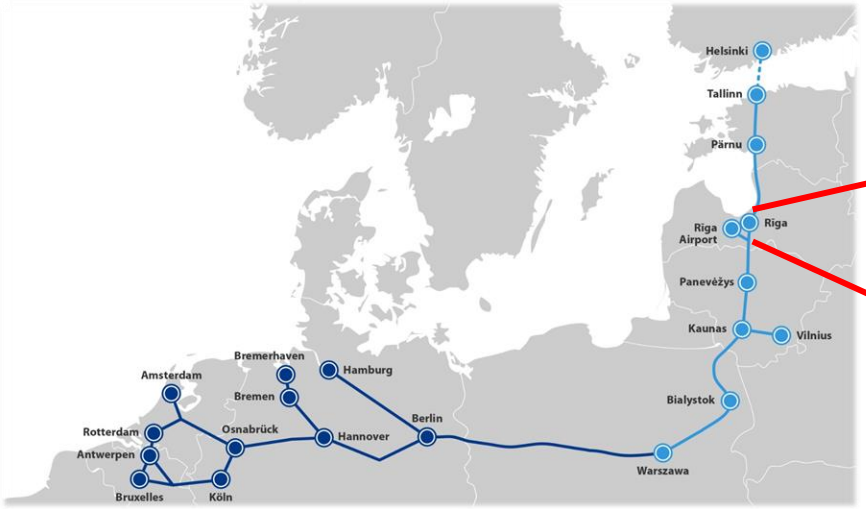
Design approach, progress and technical solutions for the combined road and rail bridge over the Daugava

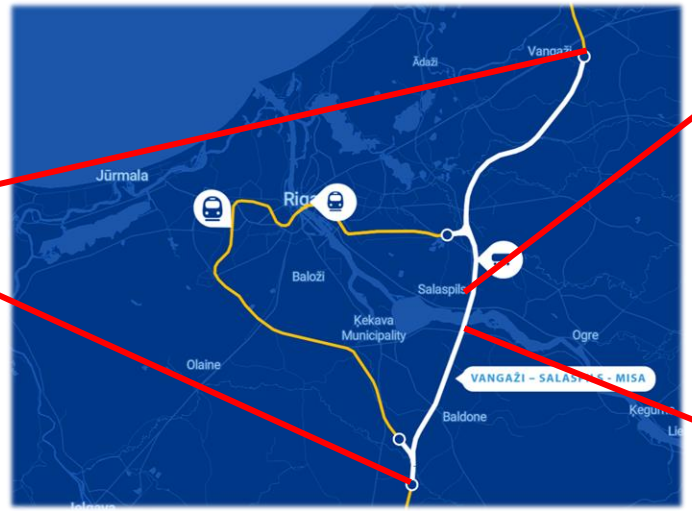
31st October 2022 | Riga

# Project overview

# Introduction to the project

Feasibility studies | **Design** | Construction Supervision | Testing & Commissioning | Operations | Maintainance



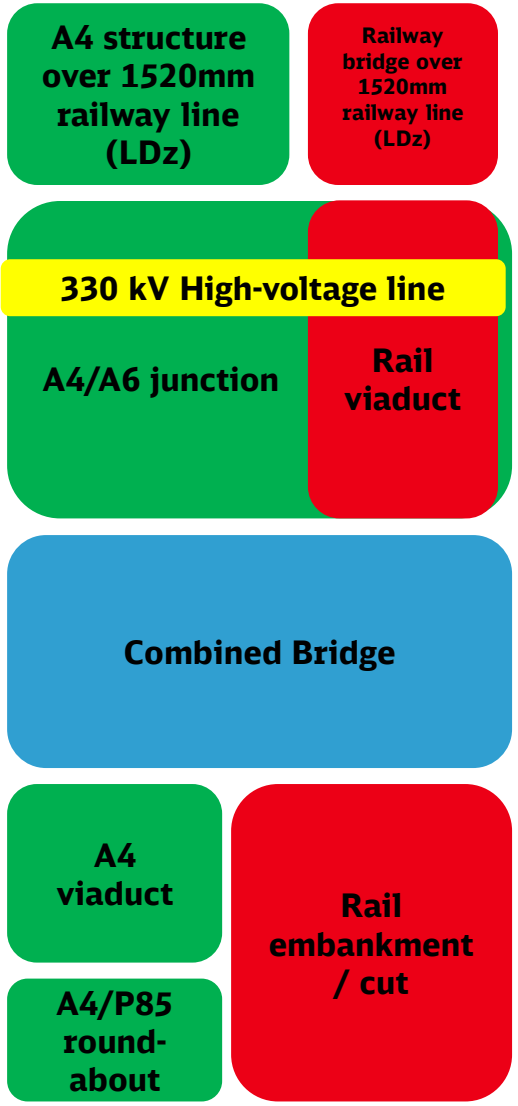


- **The Vangazi-Salaspils-Misa design section is part of the Riga node, connecting the main line with the Riga central section, including Riga Central Station and Riga Airport**
- **It consists of 29 rail bridges, 17 road overpasses, 2 triangles, 3 wildlife crossings, 2 highway junctions, the Salaspils freight handling terminal and the unique 1,1 km long combined road-rail bridge over the Daugava**

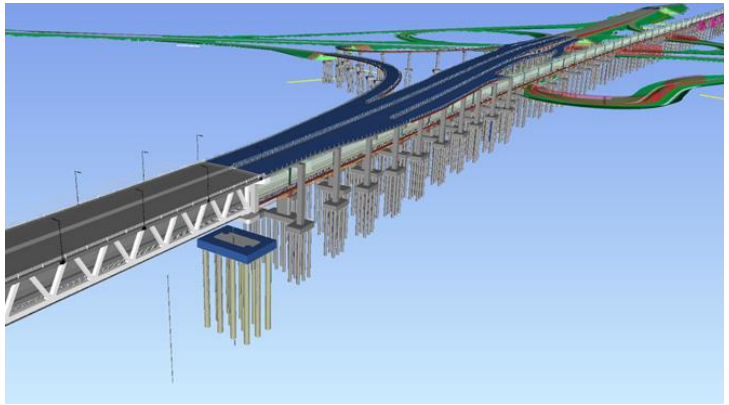
# Main objects to consider around Combined Daugava Bridge

*Plan view*


*Schematic view*




- **Highway junctions, northern railway viaduct and required clearance over existing A6 and LDz railway line are main constraints for design in the north**



**Why combined?**

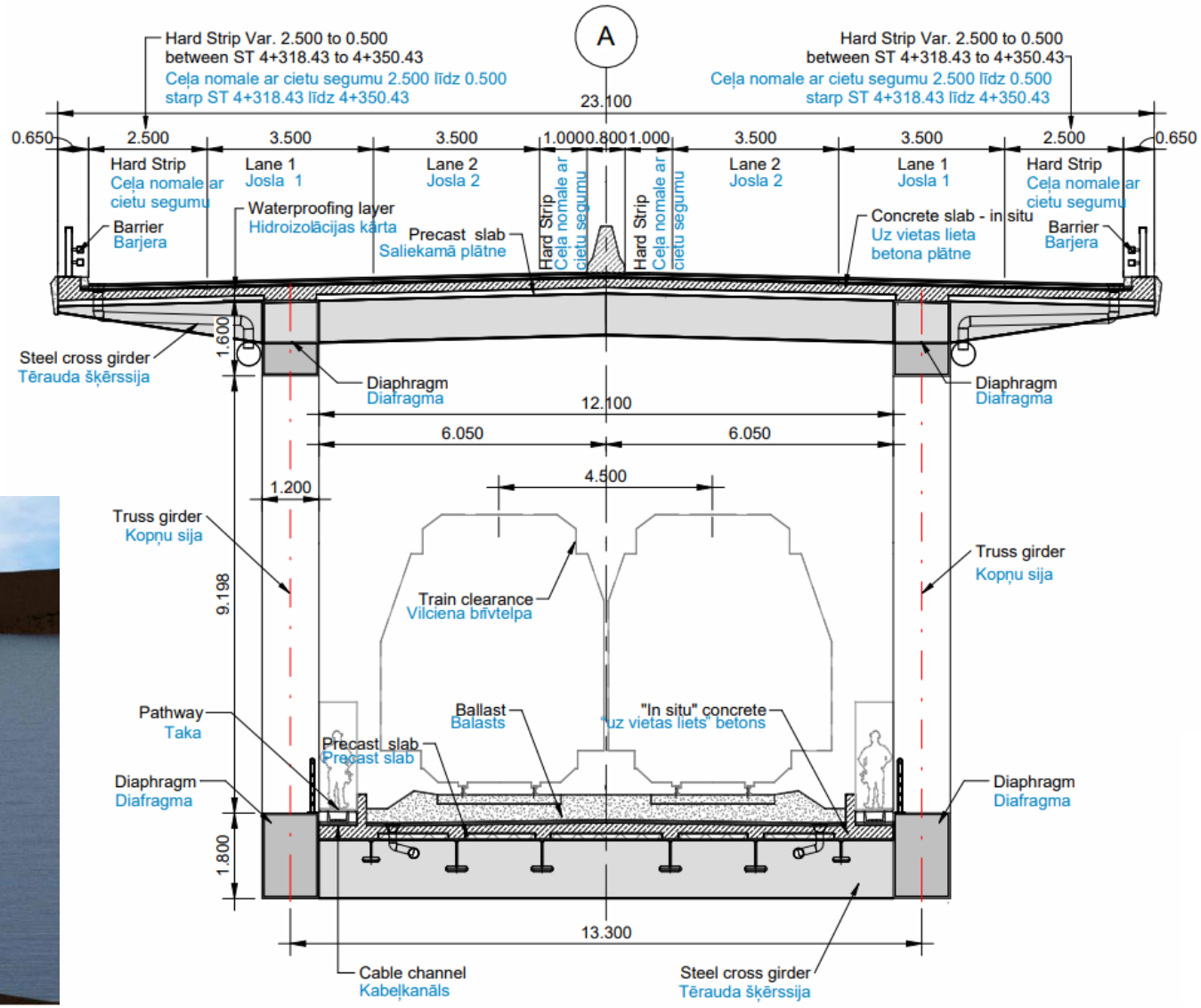
- **Possibility to gain synergies during construction and operation and maintenance phase**
- **Optimized environmental and spatial impacts**

Road
Rail
Combined

# Technical solution

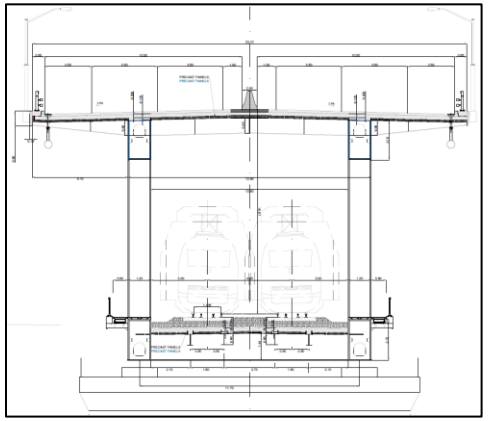
# Technical features of the combined bridge

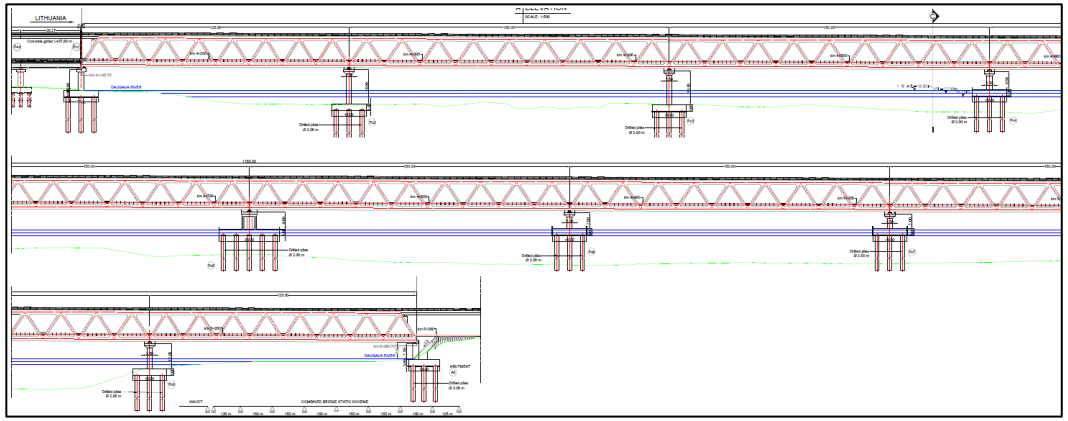
- truss-type bridge made up of 8 spans of 125 m + 6 x 150 m + 125 m spans
- Steel truss has a width of 14,5 m and a height of 12,6 m
- 2 rail tracks with 249 km/h design speed
- 2 highway lanes in each direction with 90 km/h design speed + hard shoulder

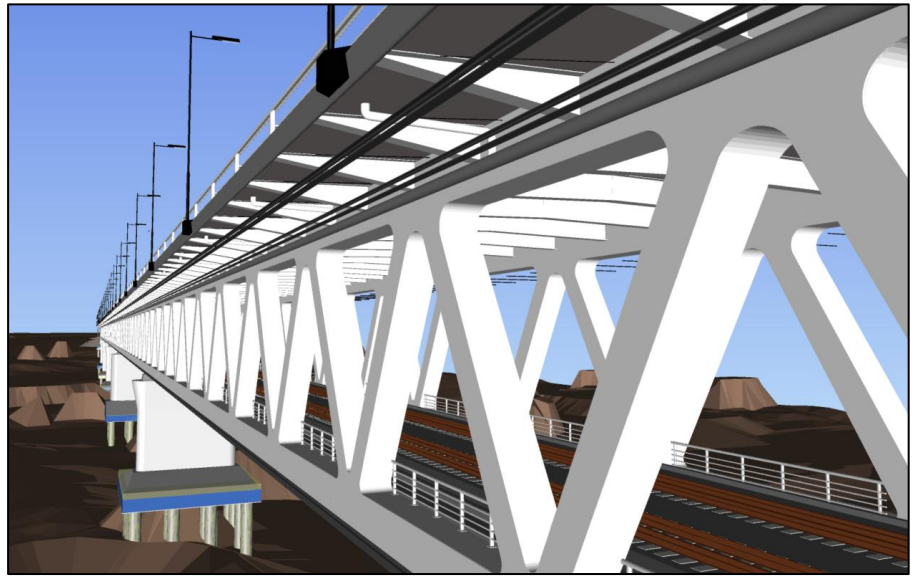


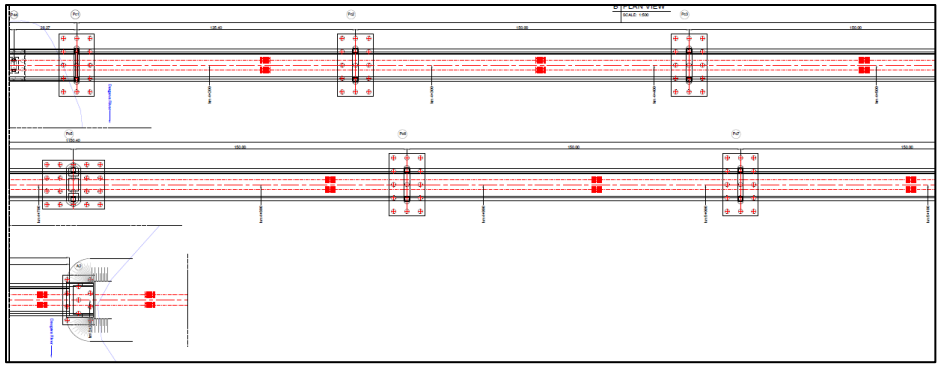
# General arrangement of the combined bridge

- **The general arrangement of the steel truss is a sensitive topic, as it is crucial for the overall bearing capacity of the bridge but also directly linked to construction cost (quantities of steel over 1,1 km length).**



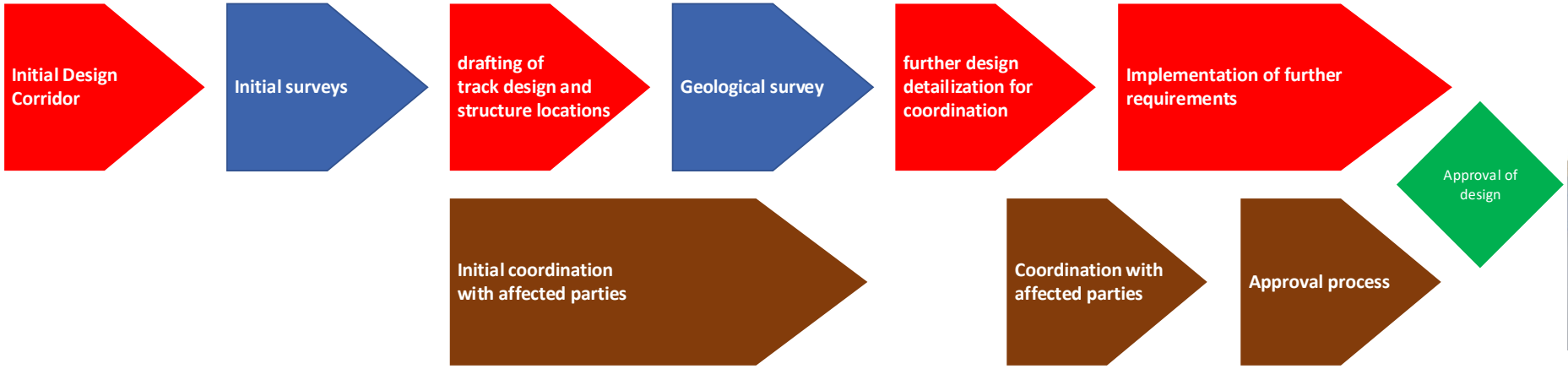


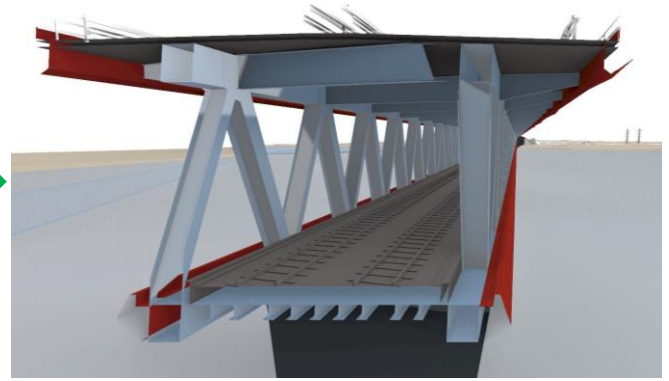




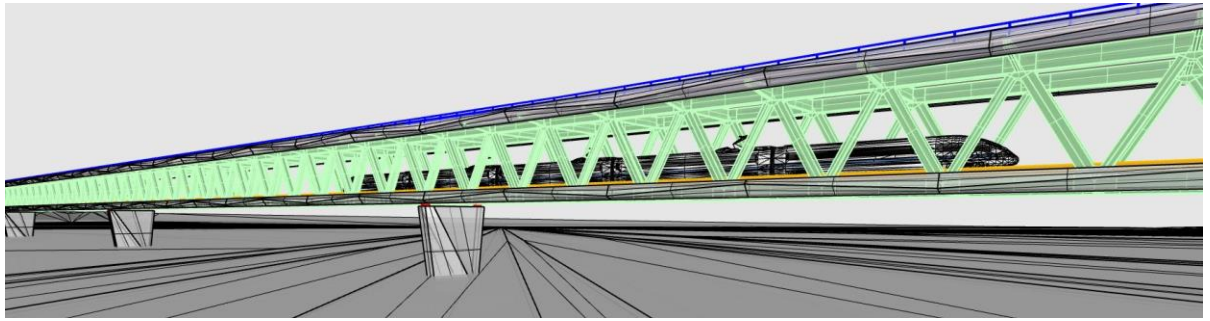
# Design approach

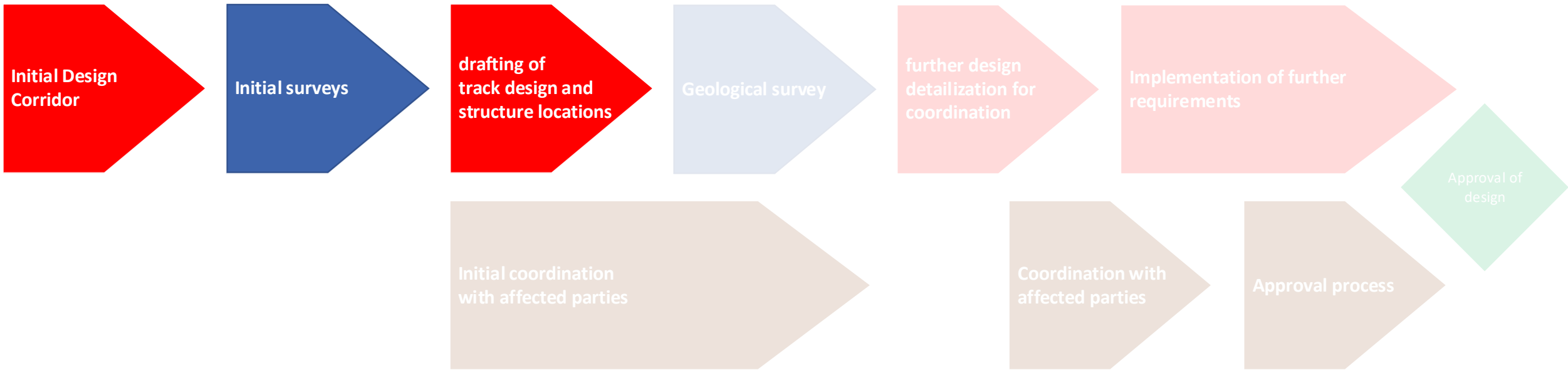
# General approach



- **A complex design project like this, can be only managed with a clear work breakdown structure and design organization:**
  - To initiate a smooth design process, it is crucial to be aware of all stakeholder interests while having available all necessary input data on time
  - This can be ensured by a proper design workflow, outlining the design and work schedule, deliverables for each discipline and milestones for interdisciplinary and stakeholder coordination




Initial Design Corridor
Initial surveys
drafting of track design and structure locations
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further design detailization for coordination
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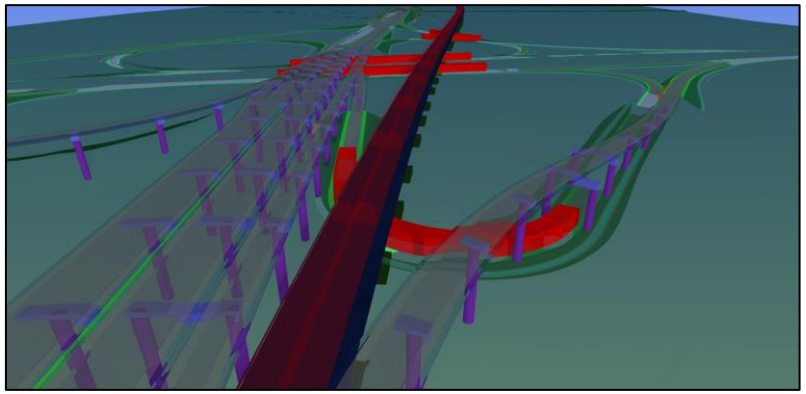
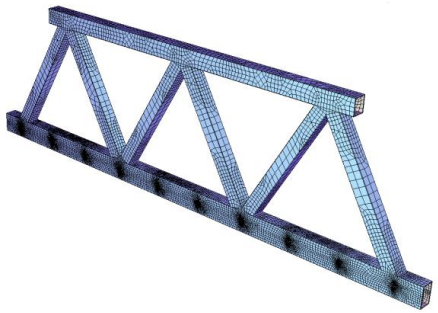
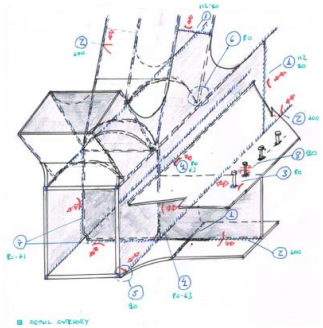
# Engineering challenge combined bridge

- Economical decision to go for a combined bridge instead of separate rail only and road only bridge
- Definition of road and rail corridor and their interface points
- Environmental aspects
- Performing geological investigations in the river
- Combined loads from road and rail traffic
- Definition of truss layout and general arrangement
- Safety aspects
- Maintenance aspects
- Interfaces with utilities and affected parties (stakeholders)
- Construction sequence and time for construction

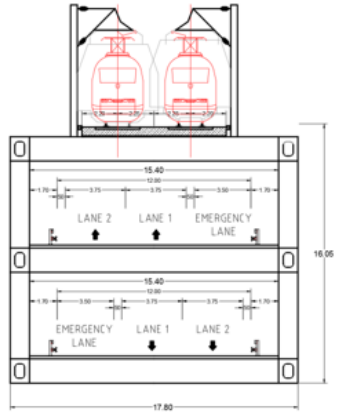




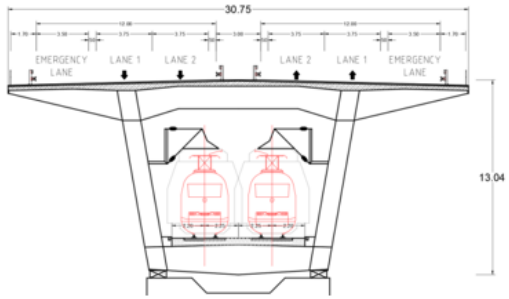


# Economical decision to go for a combined bridge instead of separate rail only and road only bridge

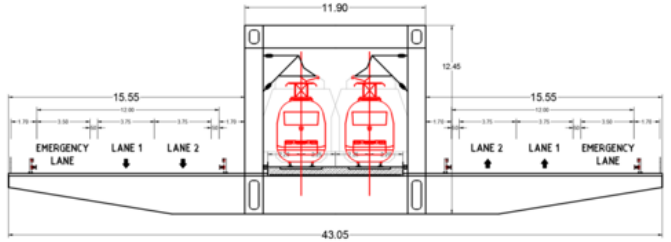
- Initial basis were two seperated bridges for the road and railway crossing over the Daugava
- Comparable construction cost for individual bridges vs. Combined road-rail bridge
- Decision taking process took into account an iterative process of finding the most optimum conceptual solution, considering the stakeholder's interests and needs


Variant Deck B – Road on top



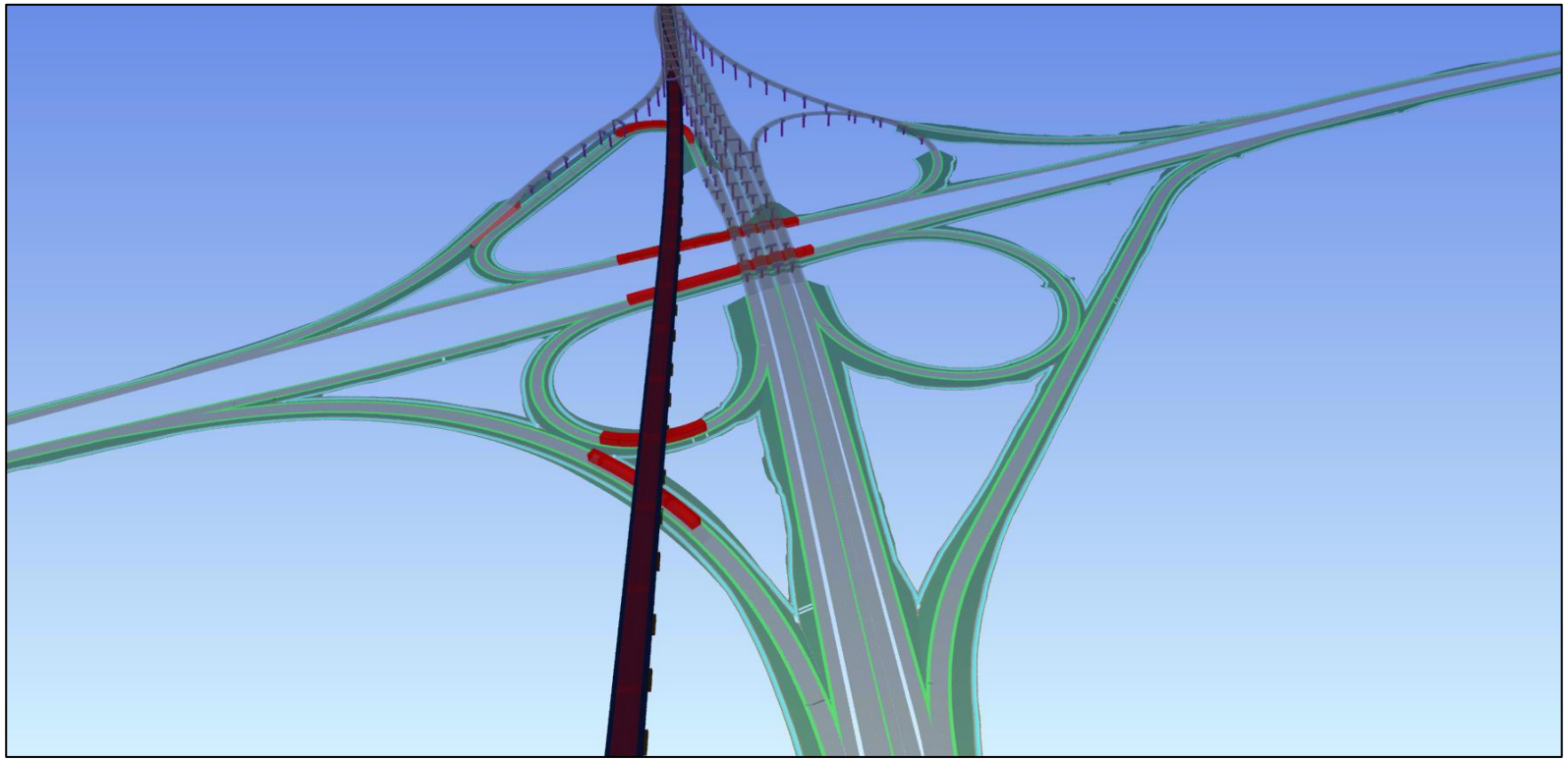

Variant Deck A – Railway on top




Variant Deck C –Railway and Road at the same level

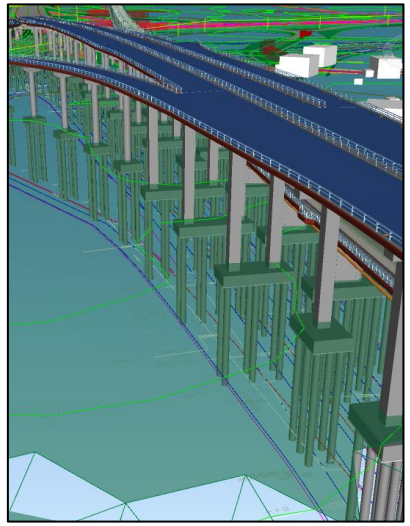
# Definition of road and rail corridor and their interface points

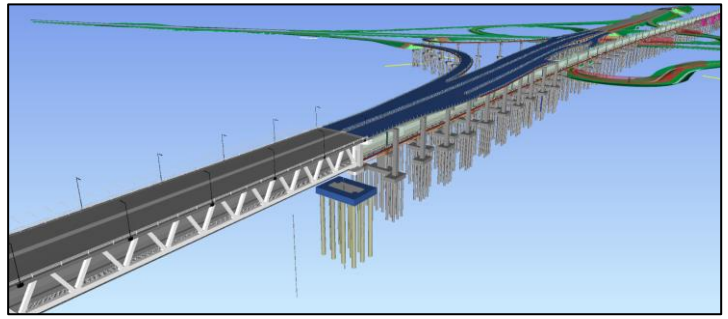
- The transition between road and railway infrastructure must be fixed at an early stage.
- To allow a smooth extension of the existing A4 highway over the Daugava, the railway alignment was adjusted and is joining the A4 corridor.



# Alignment for the combined road-rail bridge over the river Daugava

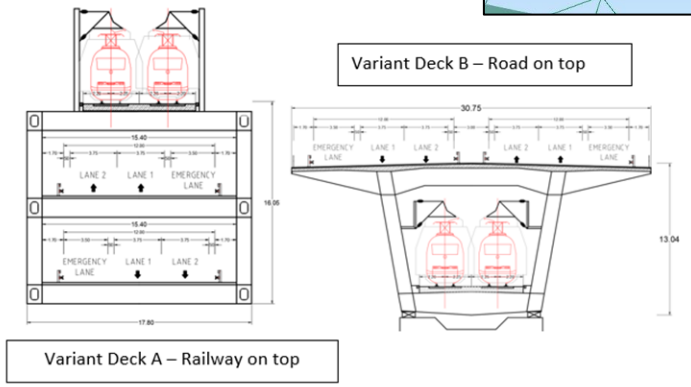
- Unifying of infrastructures for road and rail
- Design speed for road and rail
- Interference with environment (noise protection)
- Cost optimization
- Military mobility
- Interfaces with main utilities
- Stakeholder interests





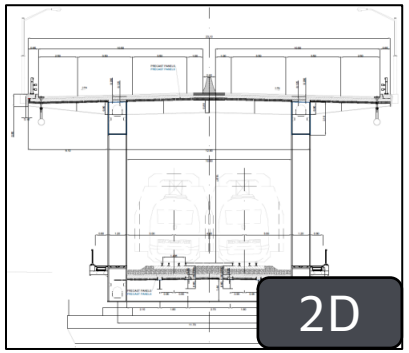
## Solution

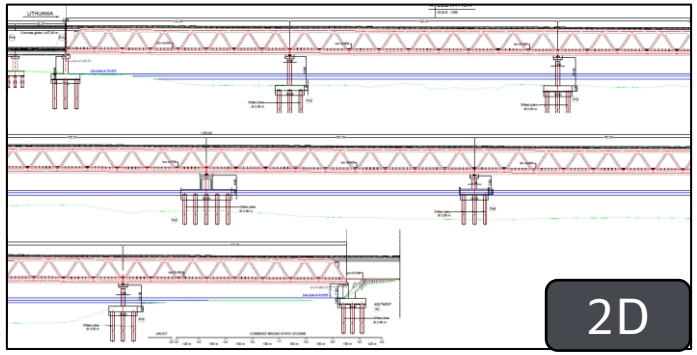
- Simplified cross section in height and width (main driver for cost)
- Adjustment of rail alignment towards existing highway A4
  - Simplify crossing points between rail and road infrastructure

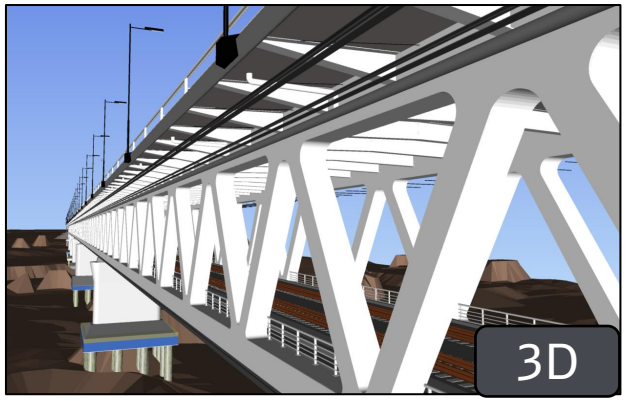



# Digital design with BIM 5D

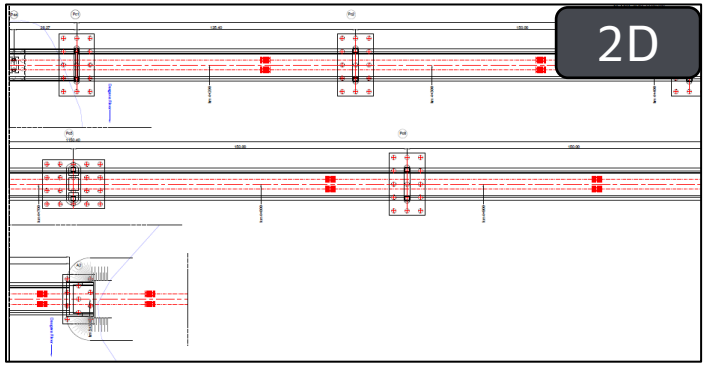
- **Having several levels of different infrastructures interfacing with each other, BIM offers a great tool to fix interfaces, validate clearances and visualize complex design situations for stakeholders without engineering background**

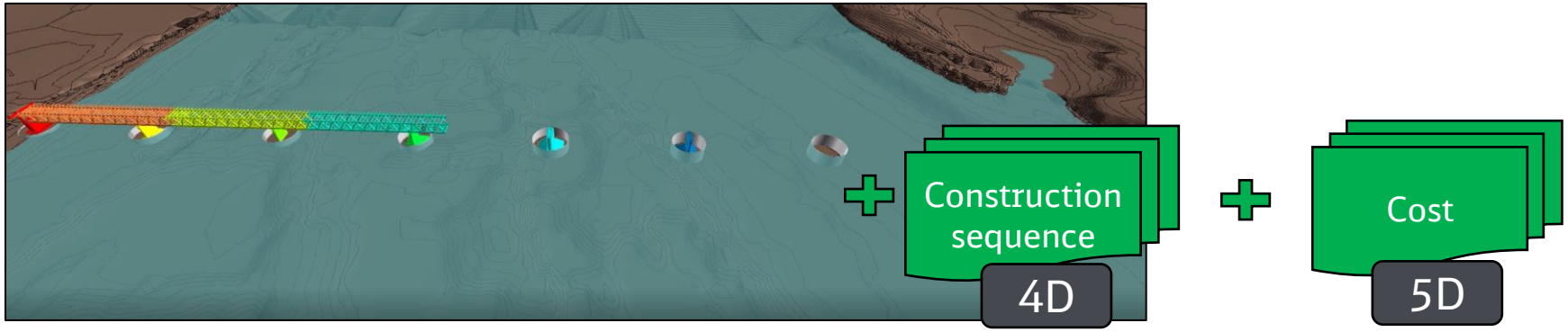


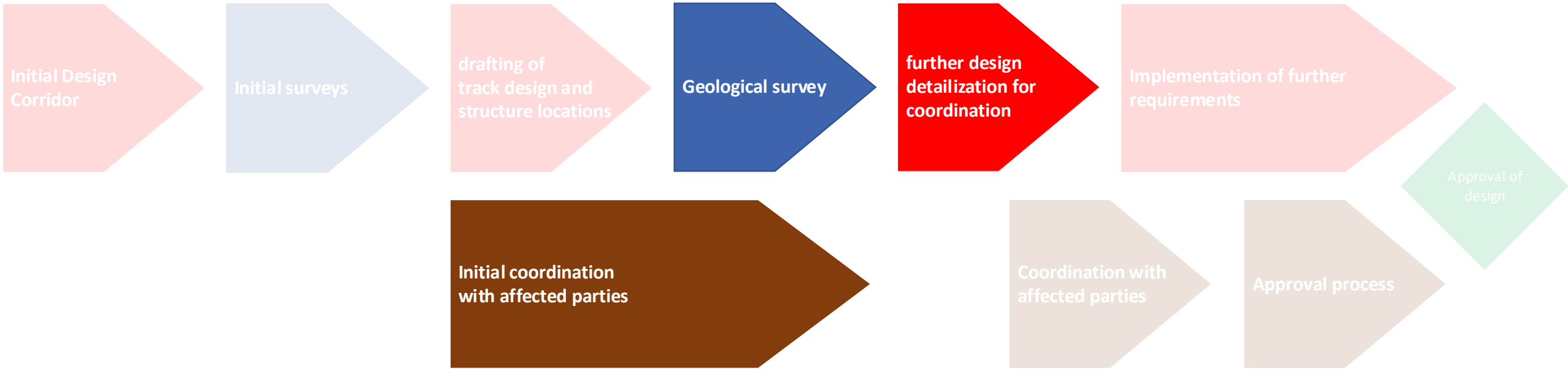





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# Investigation of unexploded ordnances (UXOs) within Daugava in cooperation with Latvian Armed Forces


# Geological Investigations in Daugava river – Mobilization of a floating platform

# Geological Investigations in Daugava river

# Performing geological investigations in the river

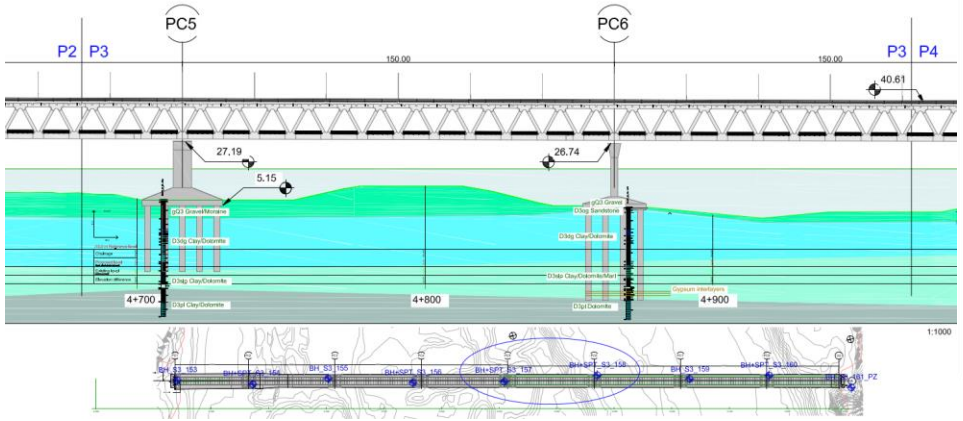
- To size the dimension of the foundation for the bridge piers, it is required to have detailed information about the soil conditions
- To carry out investigations in the Daugava river, it was necessary to build a floating platform, stable and big enough to fit the drilling rig and all other equipment
- Investigations under each pier in up to 40m depth (under river bed – which is up 22 m under the surface)

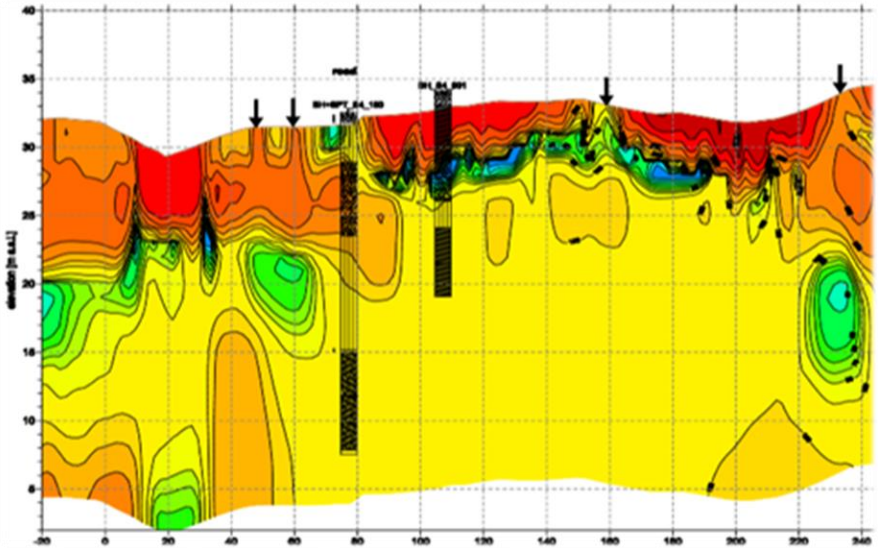
# Risk of karst voids near to rail and road infrastructure

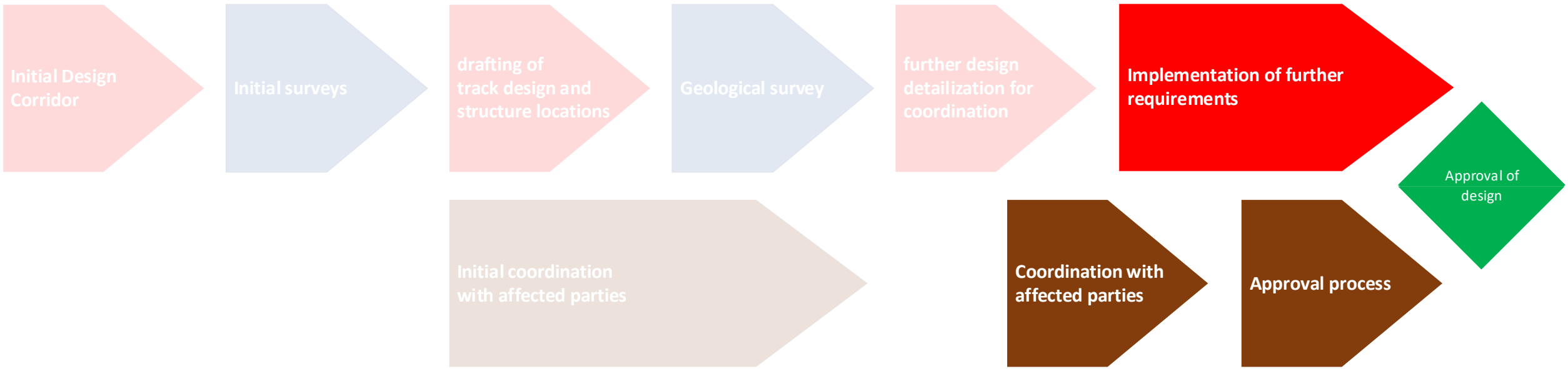
- **Potential karst voids present a <u>risk for safe railway operation</u> (settlements in the area of the infrastructure)**

**<u>Solution</u>**

- **Geophysical investigations**
- **Comparison of resistivity longitudinal profile with actual results from drillings**
- **<u>Verification drillings in risk areas</u>**
- **Identification from potential karstifications**
- **Foresee mitigation measures**

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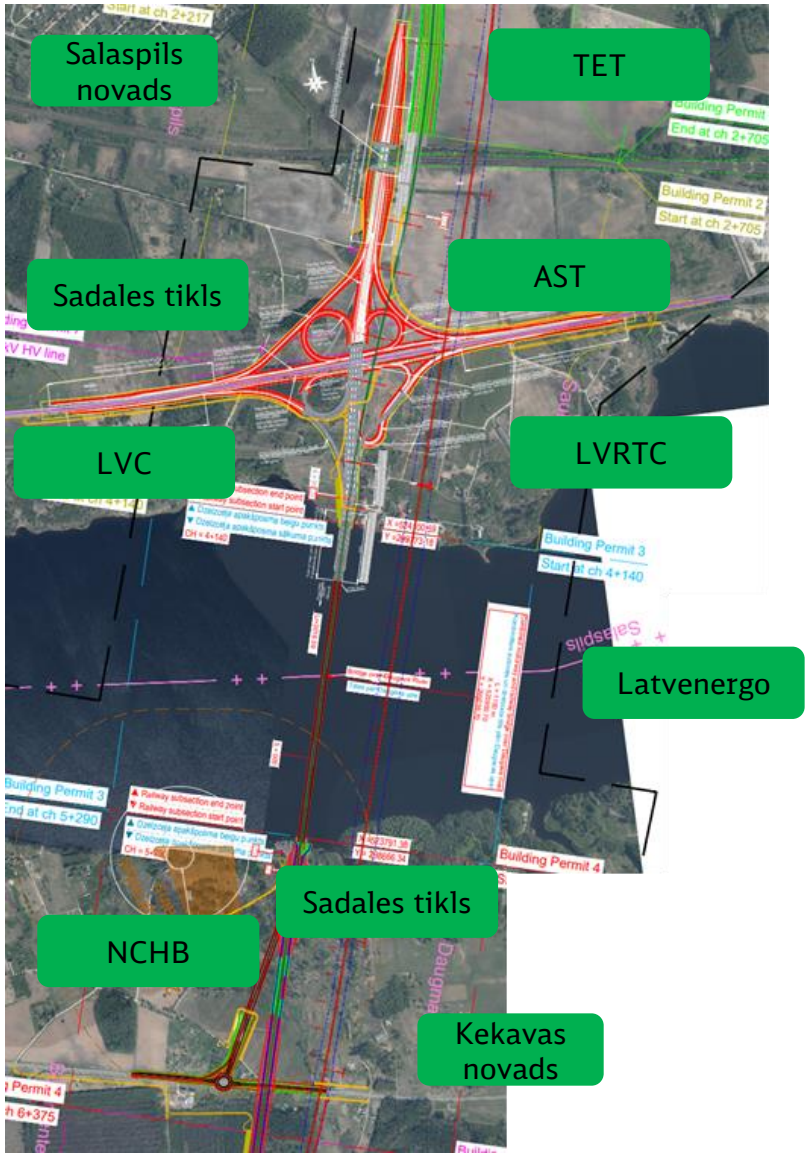
# Upcoming challenges

## Detailization of construction sequencing


## Affected Party approvals



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