

Fehmarnbelt Fixed Link

Fehmarn Belt – what happens and when?

Johnny Restrup-Sørensen
Contract Director, Railway



The Fixed Link as part of the European TEN T corridor

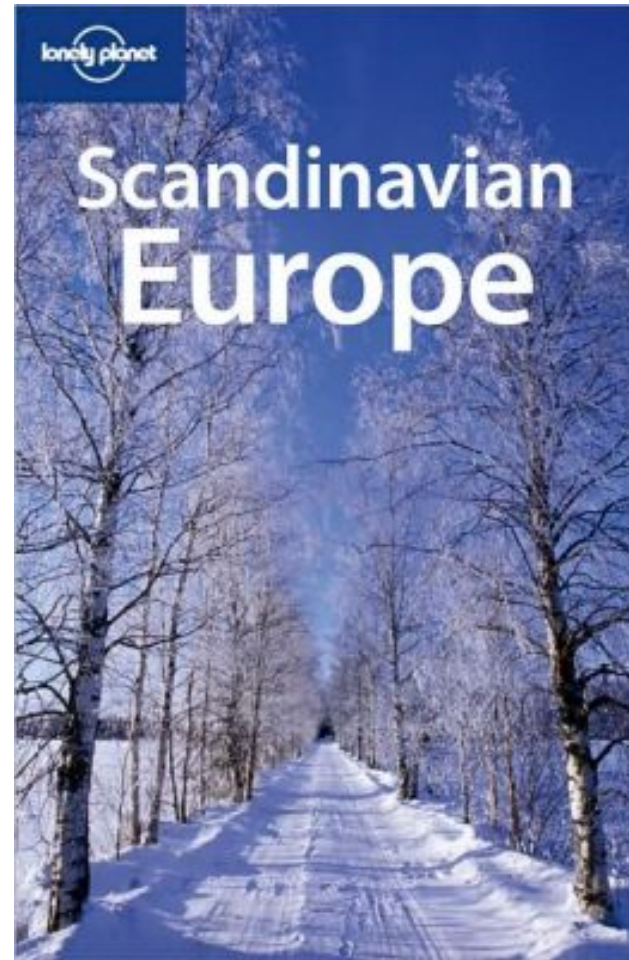
We will close an important gap between Scandinavia and Central Europe and facilitate:

- greener **transport** by moving freight from road to rail
- higher **competitiveness**
- better **opportunities** for society, business and people
- strengthening the Danish Rail **infrastructure**

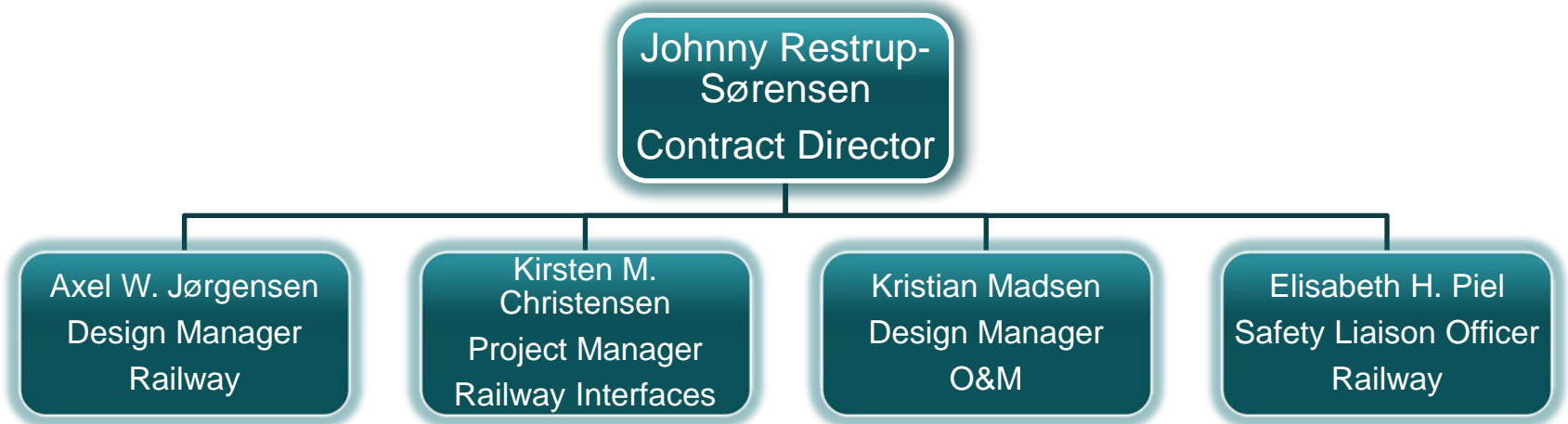


Scandinavia is brought closer to Europe

- Scandinavia's largest trading partners are just south of Fehmarn Belt
- The link will fulfill the promise we made to Sweden and Norway in 1990
- A greener corridor is created, moving the goods from road to rail



Railway organisation



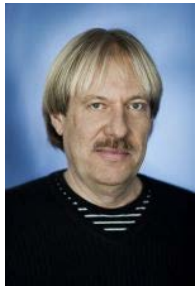
Key-staff, Railway



- Johnny Restrup-Sørensen,
Contract Director



- Kristian Madsen,
Design Manager
O&M



- Axel W. Jørgensen,
Design Manager



- Elisabeth H. Piel,
Safety Liaison
Officer



- Kirsten M. Christensen,
Project Manager

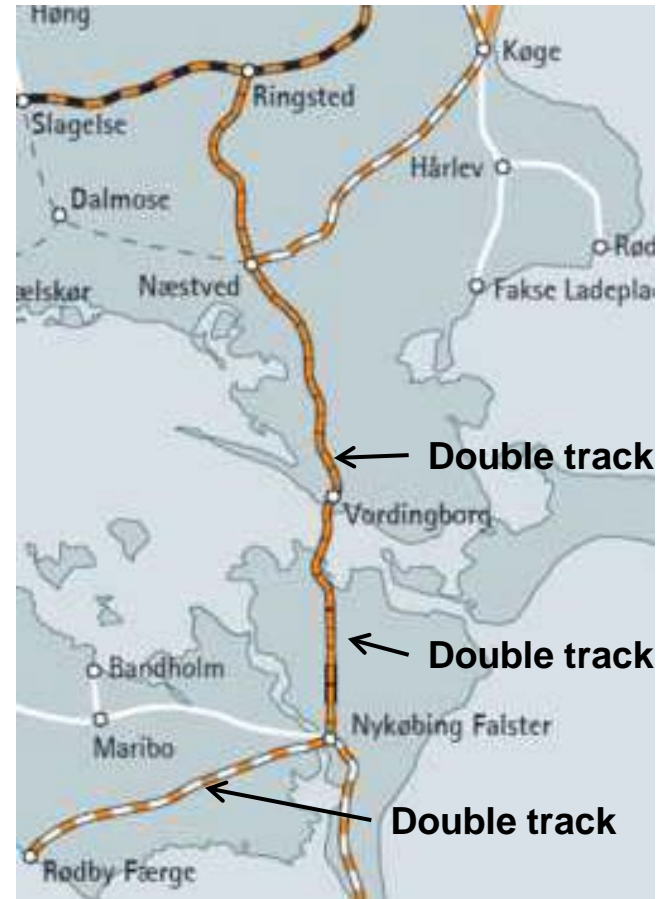
Improved railway infrastructure from Lübeck to Ringsted



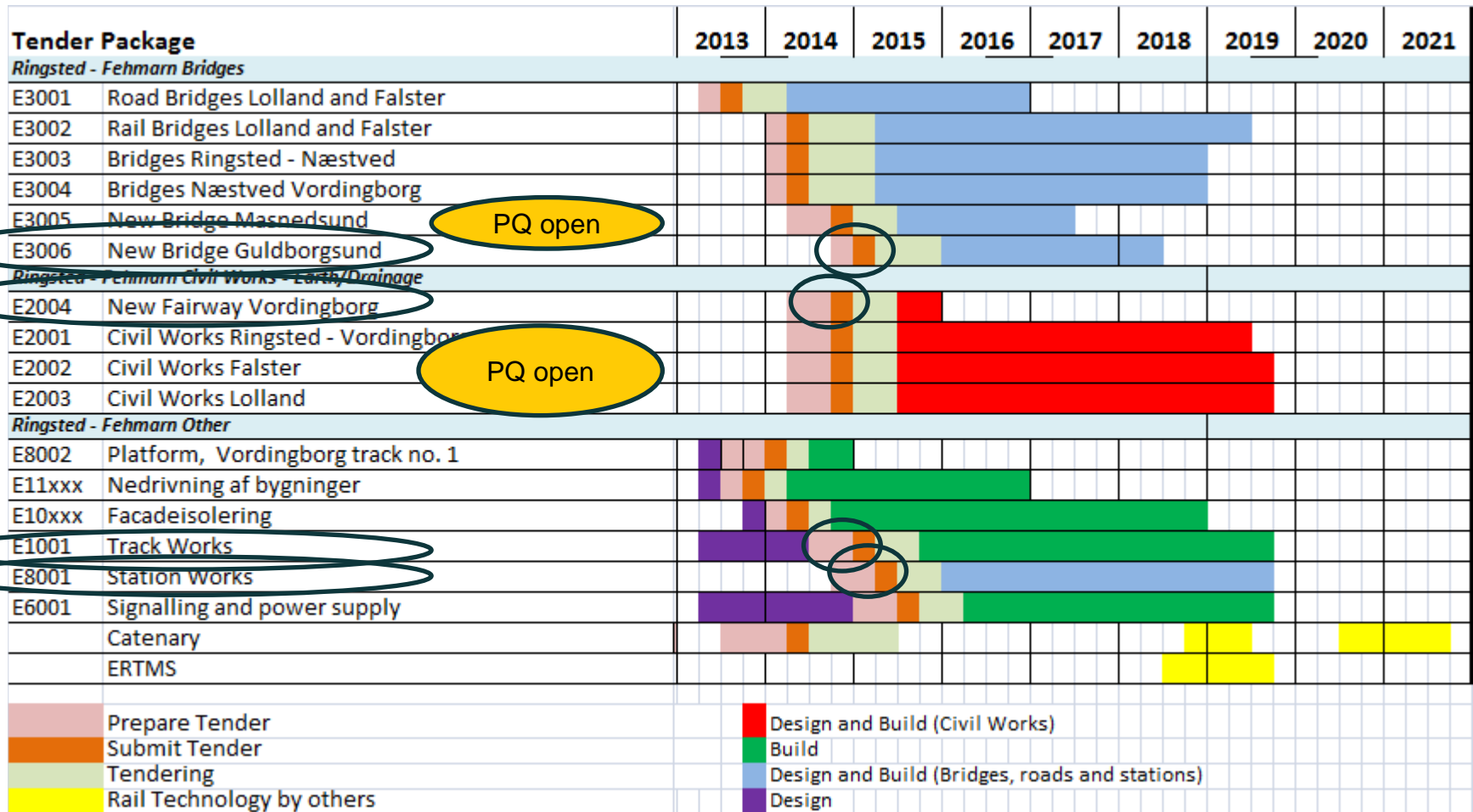
German hinterland Lübeck - Puttgarden



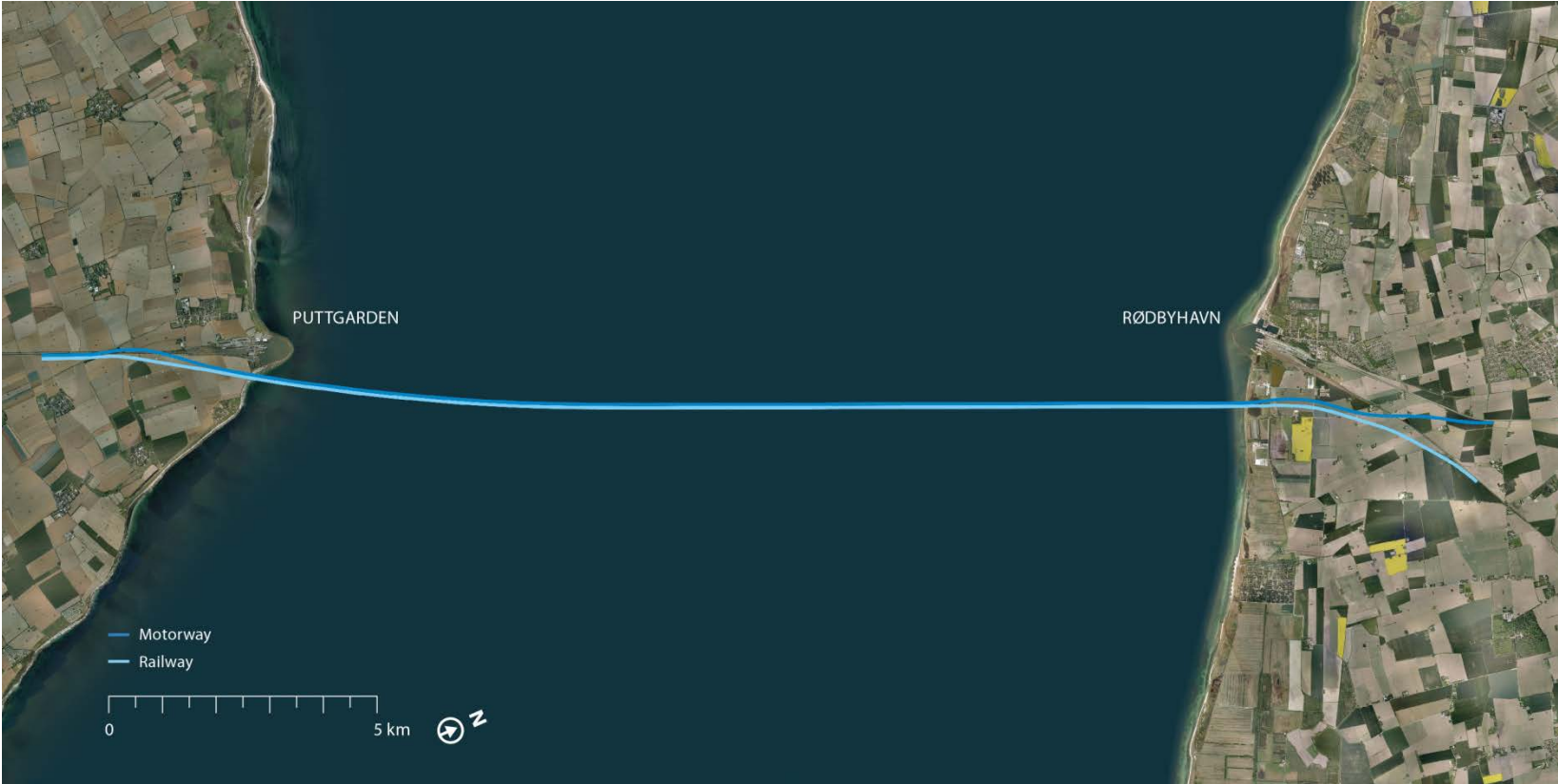
Danish hinterland Rødby – Ringsted



Current and Future Tenders



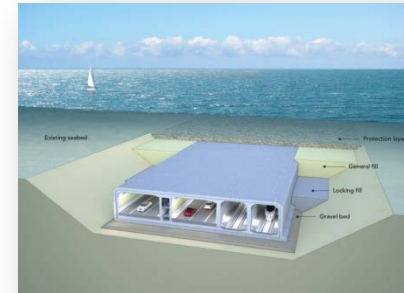
The Fixed Link Puttgarden - Rødby



The immersed Tunnel is the optimal Solution

▪ Immersed tunnel

- Limited/less impact on the environment
- No impact on navigational safety
- Known construction technology
- Safe and reliable in service



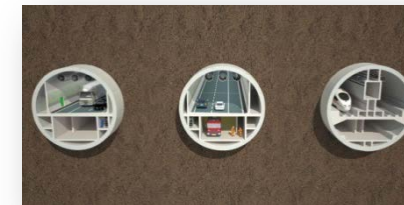
▪ Cable-stayed bridge

- Greater/major impact on the environment
- Collision hazard to shipping
- Very technically challenging

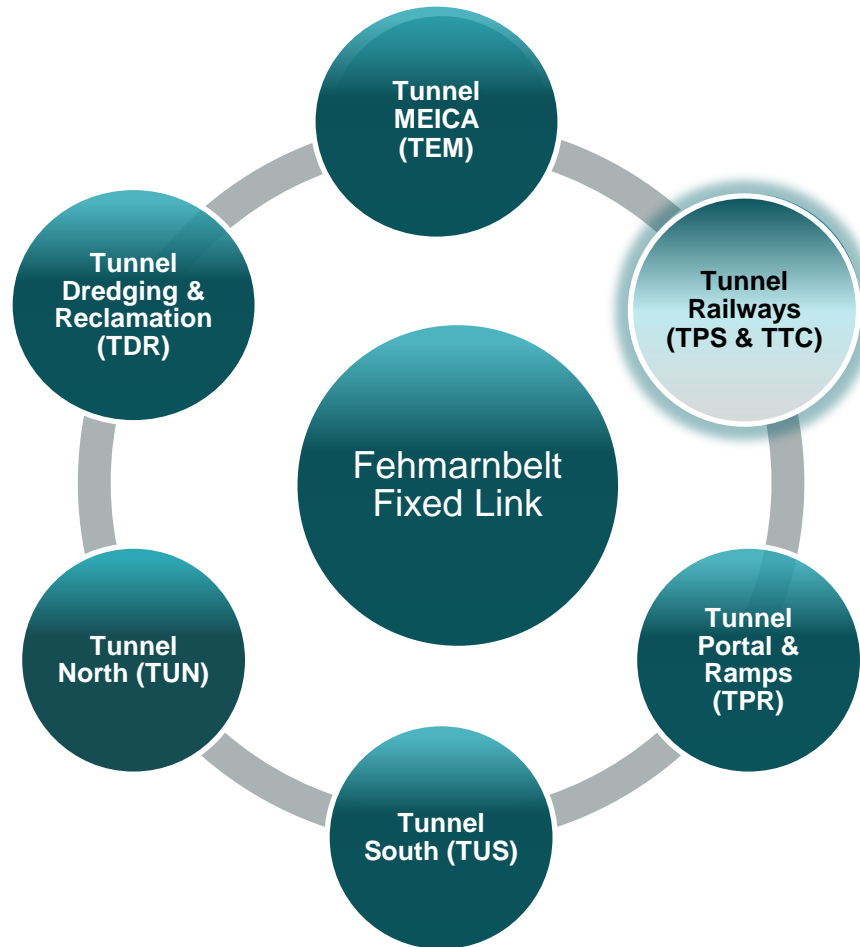


▪ Bored tunnel

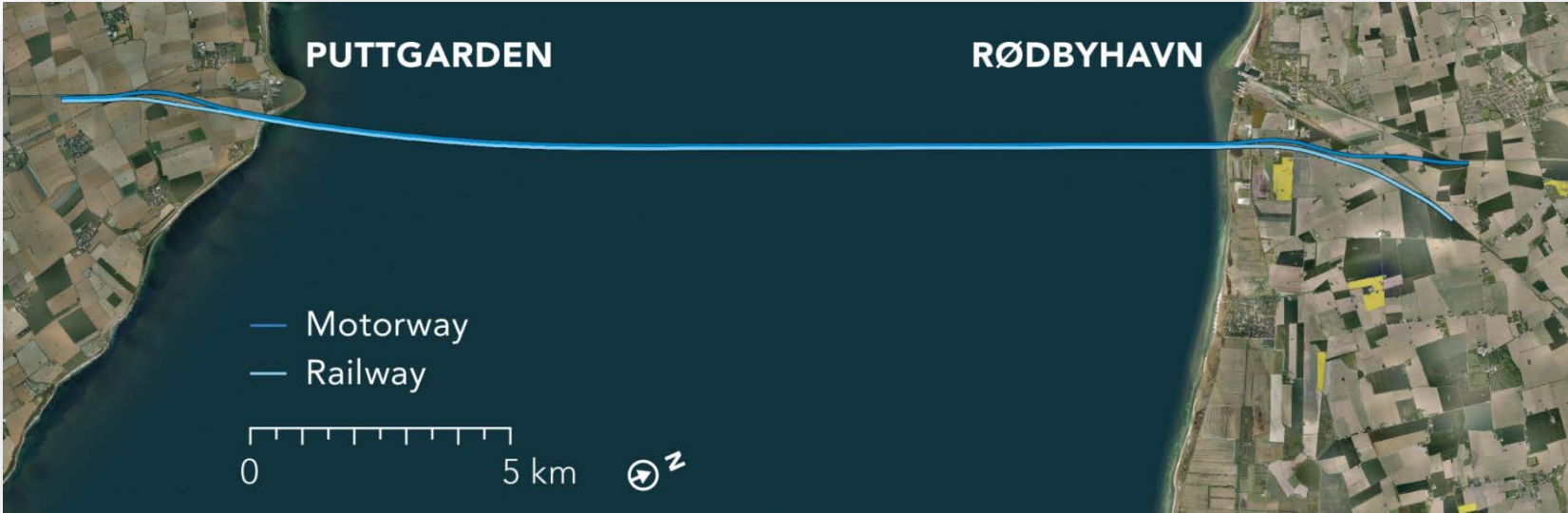
- Same limited impact on the environment as the immersed tunnel
- Much more expensive
- Extremely technically challenging



Contract overview – Civil Works



The immersed Tunnel





**Tunnel portal on Lolland,
Denmark**

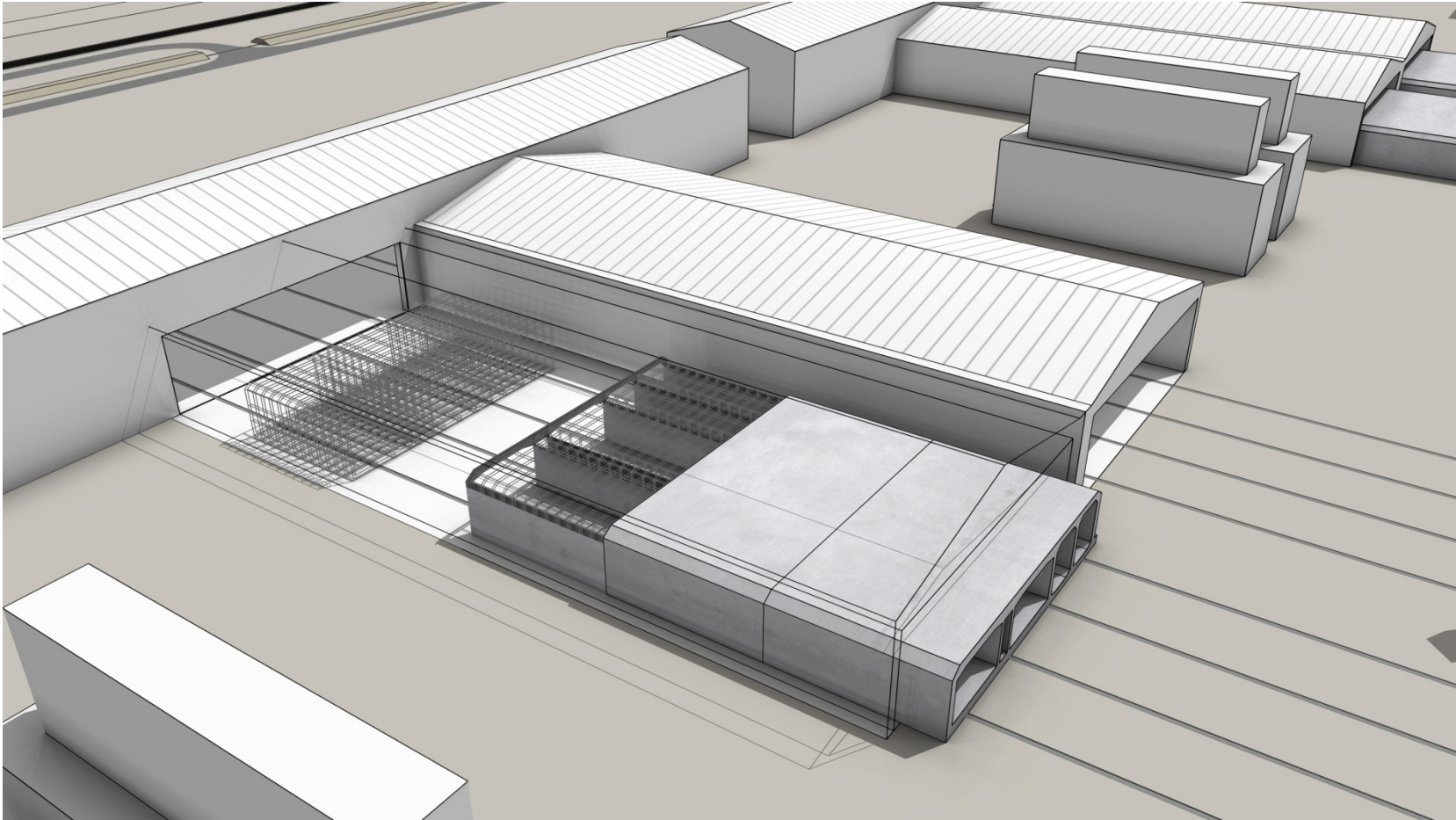
New Nature – for Plants, Animals and People



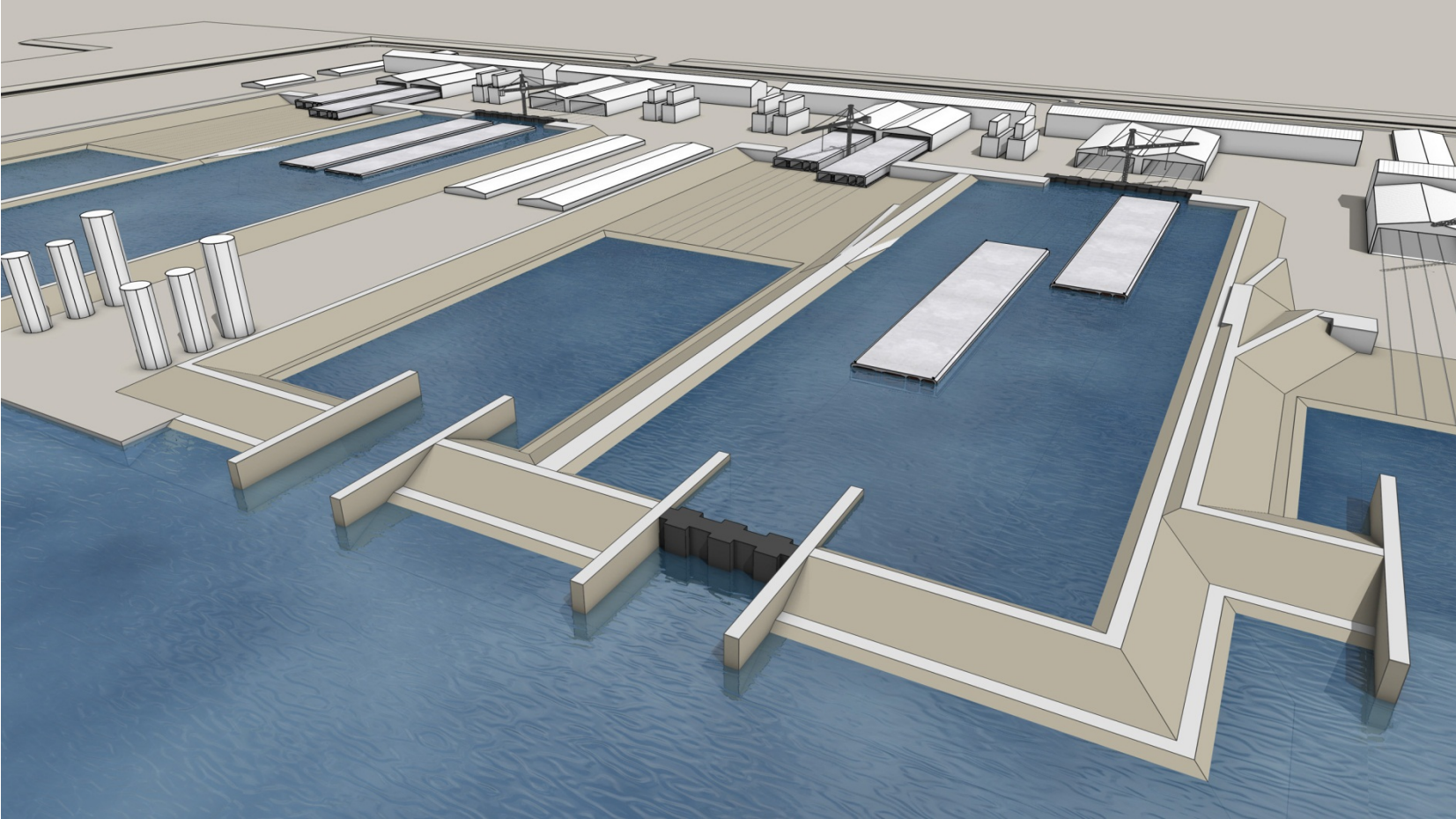


**Tunnel portal on Fehmarn,
Germany**

Serial and Controlled Tunnel Production



Tunnel Elements tugged from Dock



Each Element immersed and connected



The Prequalified Joint Ventures

- Nine large and strong joint ventures
- 27 companies
- Experienced companies from all over the world – including Denmark and Germany
- A healthy competition with regards to method, innovation and price

The Companies in the Joint Ventures

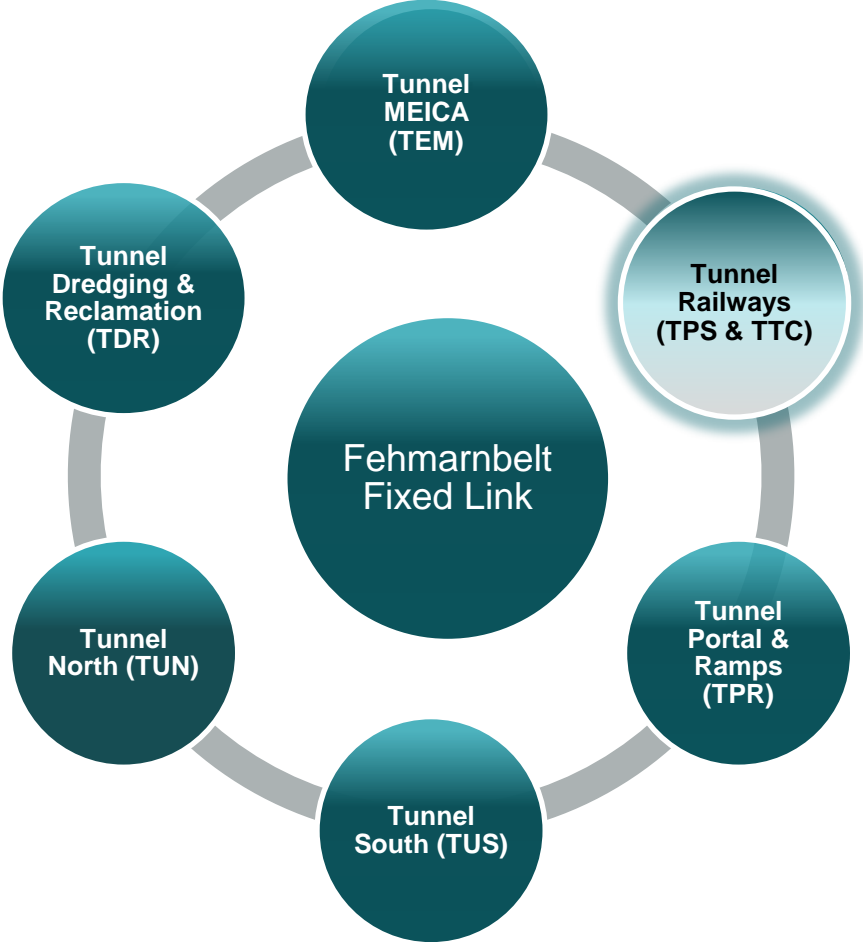


How far we are

- **Summer 2013:** Danish EIA published
- **Ultimo summer 2013:** German approval application submitted
- **2014:** Final bids from CW bidders
- **2015:** Start of construction works
- **2021:** Opening of the Fixed Link



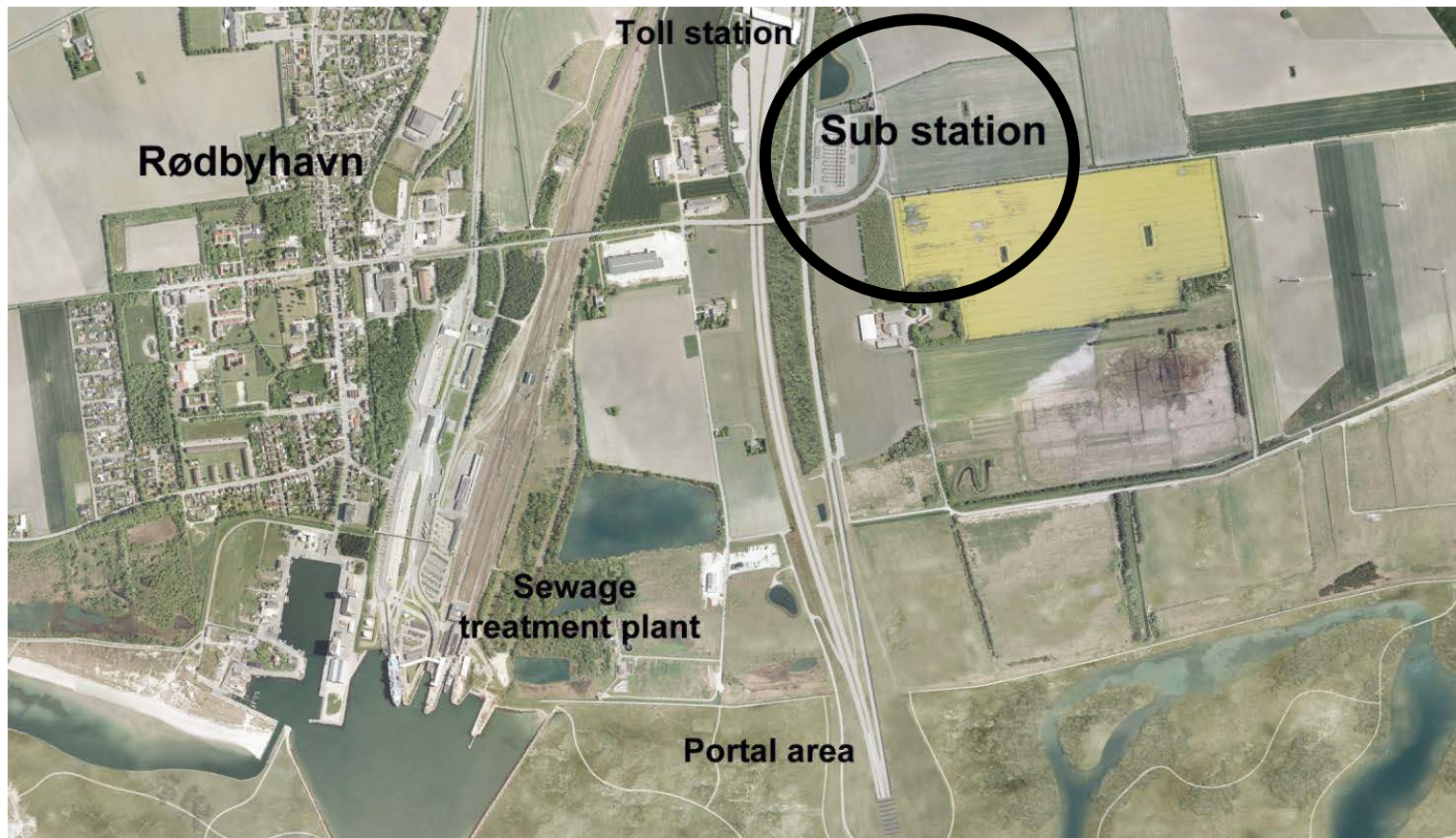
Contract overview - Railway



Railway contract overview

- **Tunnel Power Supply (TPS)**
- Tunnel Trackworks and Catenary (TTC)
- Tunnel ETCS System (TES)
- Tunnel Railway Communication GSM-R (TRC)

TPS - Location



TPS - Systems

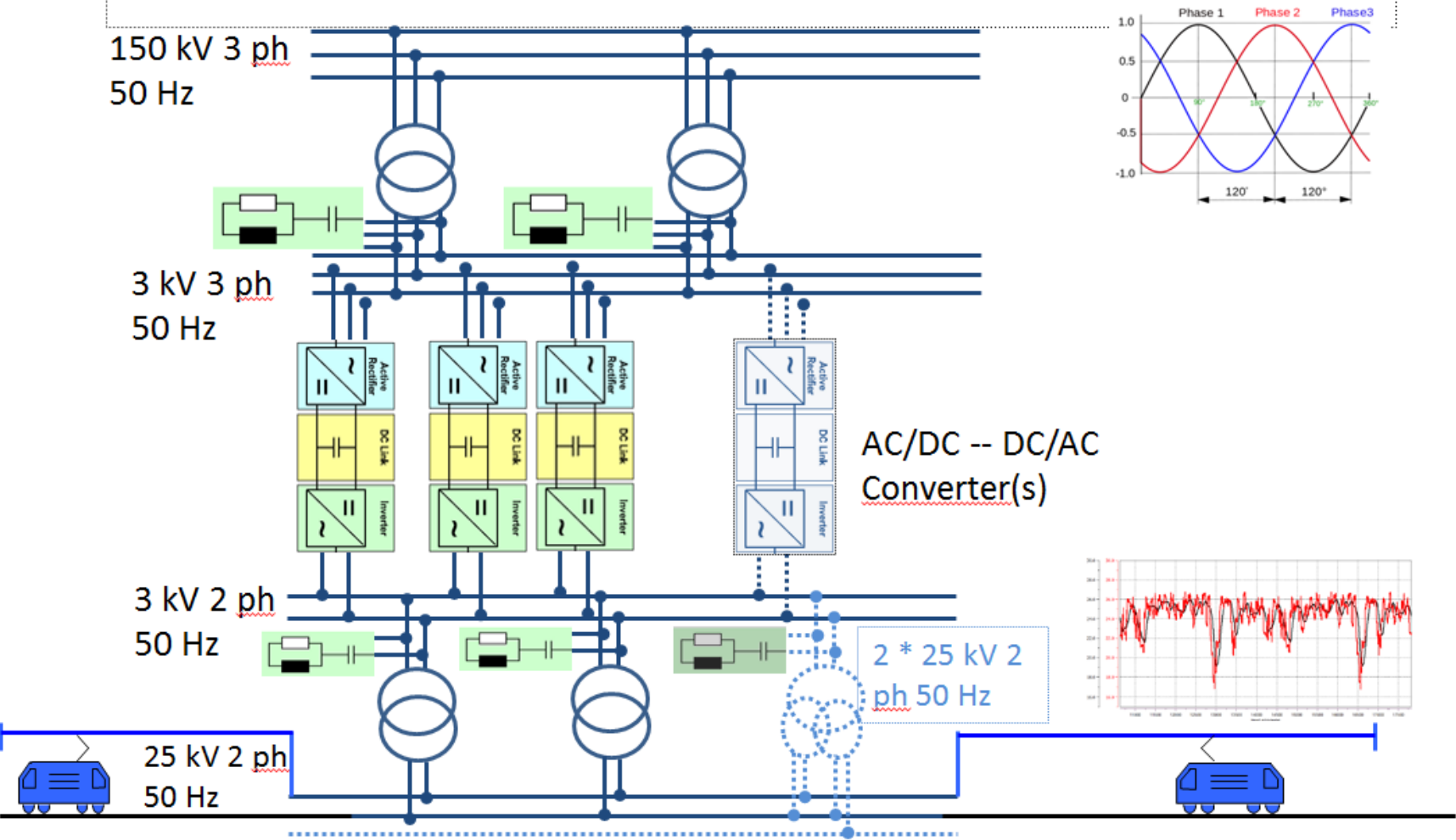
Traction Power Supply

- 25kV single phase power sub stations
- Balancing converters or inverters
- Switchgear
- Filter equipment if necessary
- Remote control system
- Building and fit out

Power Supply Tunnel MEICA

- 20kV three phase power sub stations
- Earthing & Bonding

TPS - Example of single phase converter station



TPS - Key programme milestones

- **2014:**
 - Prequalification period
 - Start Tender period
 - Negotiation meetings
- **2015:** Contract signing
- **2016:** Start of construction works
- **2018:** Permanent Power MEICA
- **2020:** Permanent Traction Power
- **2021:** Opening of the Fixed Link



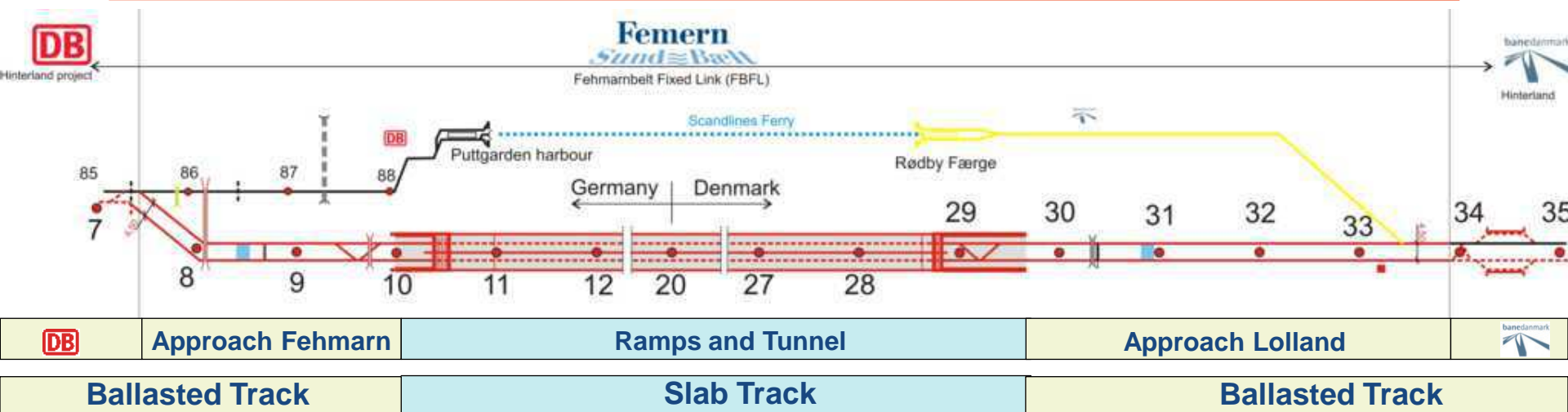
Prequalified consortia

- TPS
 - Bravida Danmark A/S
 - Cegelec Mobility – Siemens A/S Consortium
 - Elektrobudowa SA
- TEM
 - Strabag Bravida Consortium
 - TEMA Consortium (Lorne Stewart & Sweco)
 - ALSTOM Transporte (ALSTOM Transport Danmark A/S, INDRA SISTEMAS, SA & Tecnimont Civil Construction SpA)
 - Femern Electrical and Mechanical Contractors (Cegelec Mobility, Vinci Energies GSS)

Railway contract overview

- Tunnel Power Supply (TPS)
- **Tunnel Trackworks and Catenary (TTC)**
- Tunnel ETCS System (TES)
- Tunnel Railway Communication GSM-R (TRC)

TTC - Ballasted and slab track, crossovers



TTC - Systems

Trackworks

- Ballasted track
- Slab track
- Crossovers
- Level Crossings
- Test trains

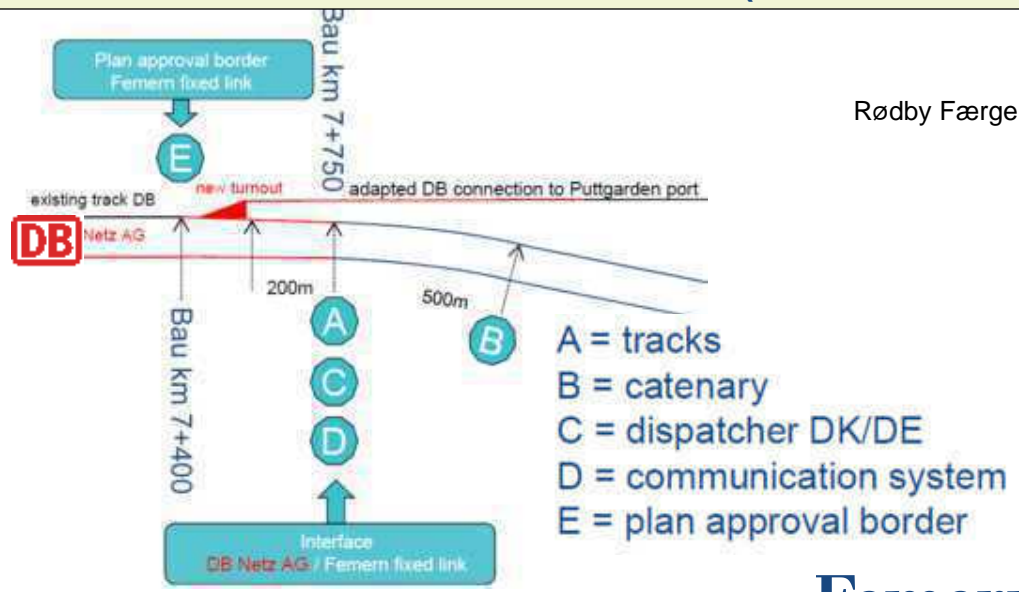
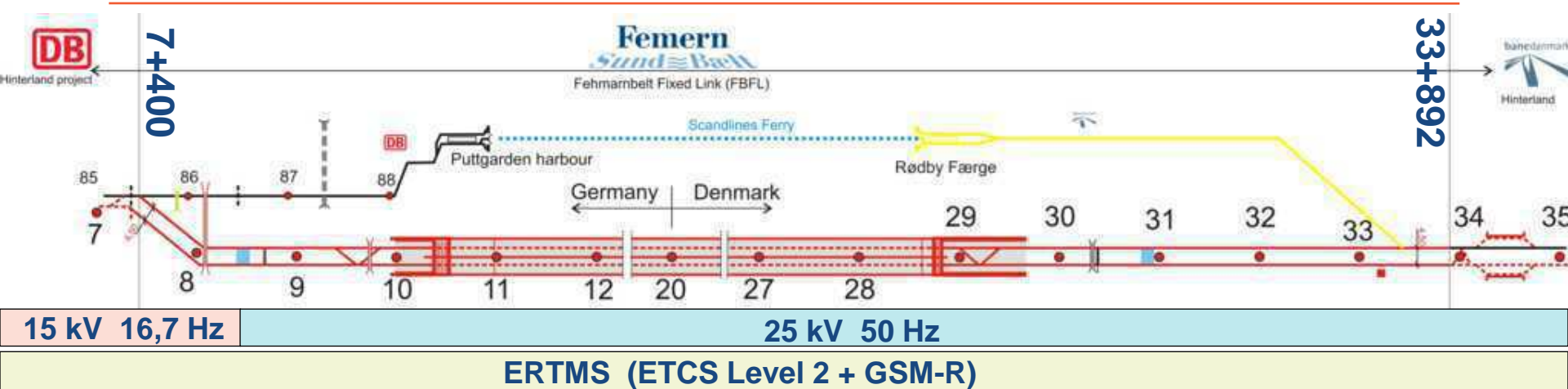
Catenary & Conductor Rail

- Overhead Catenary Systems
- Overhead Conductor Rail
- Remote Control System
- System Separation Sections
- Sectioning Breakers
- Circuit Breakers

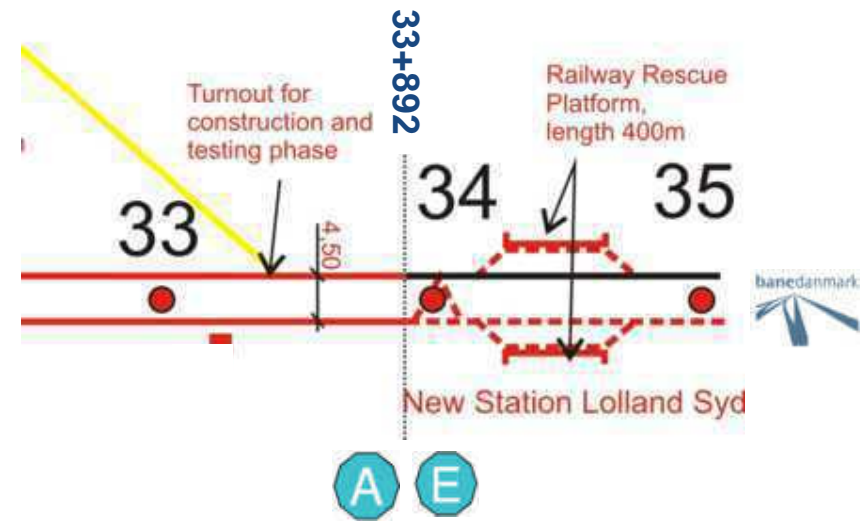
TTC - Overhead Contact Rail



TTC - Positions of interfaces in D and DK



Rødby Færge



TTC - Key programme milestones

- **2014/2015:**
 - Prequalification period
 - Start Tender period
 - Negotiation meetings

- **2016:** Contract signing

- **2016:** Mobilisation and detailed Design begins

- **2019:** Construction works begins

- **2021:** Testing and commissioning

- **2021:** Opening of the Fixed Link



The design must live up to all relevant laws, standards and regulations

- EU Regulations
- TSI (Technical Specification for Interoperability)
- German Norms and Standards
- Danish Norms and Standards



The Femern A/S online marketplace for subcontractors

Companies wishing to be subcontractors to the tunnel construction under the Fehmarnbelt have an opportunity to showcase what they can offer. Femern A/S has opened a website – www.markedsportal.femern.com - where companies can introduce themselves and what they can provide – free of charge.

Contact with the bidding contractors

Femern A/S will *not* be coordinating contact between the principal contractors and subcontractors.

A contract between a principal contractor and sub-contractor will be a commercial agreement between the parties on market terms.

Railway traffic prognosis 2028

78 freight trains & 40 passenger trains passing the tunnel per day



Thank you for your attention!



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www.femern.com



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www.blog.femern.com

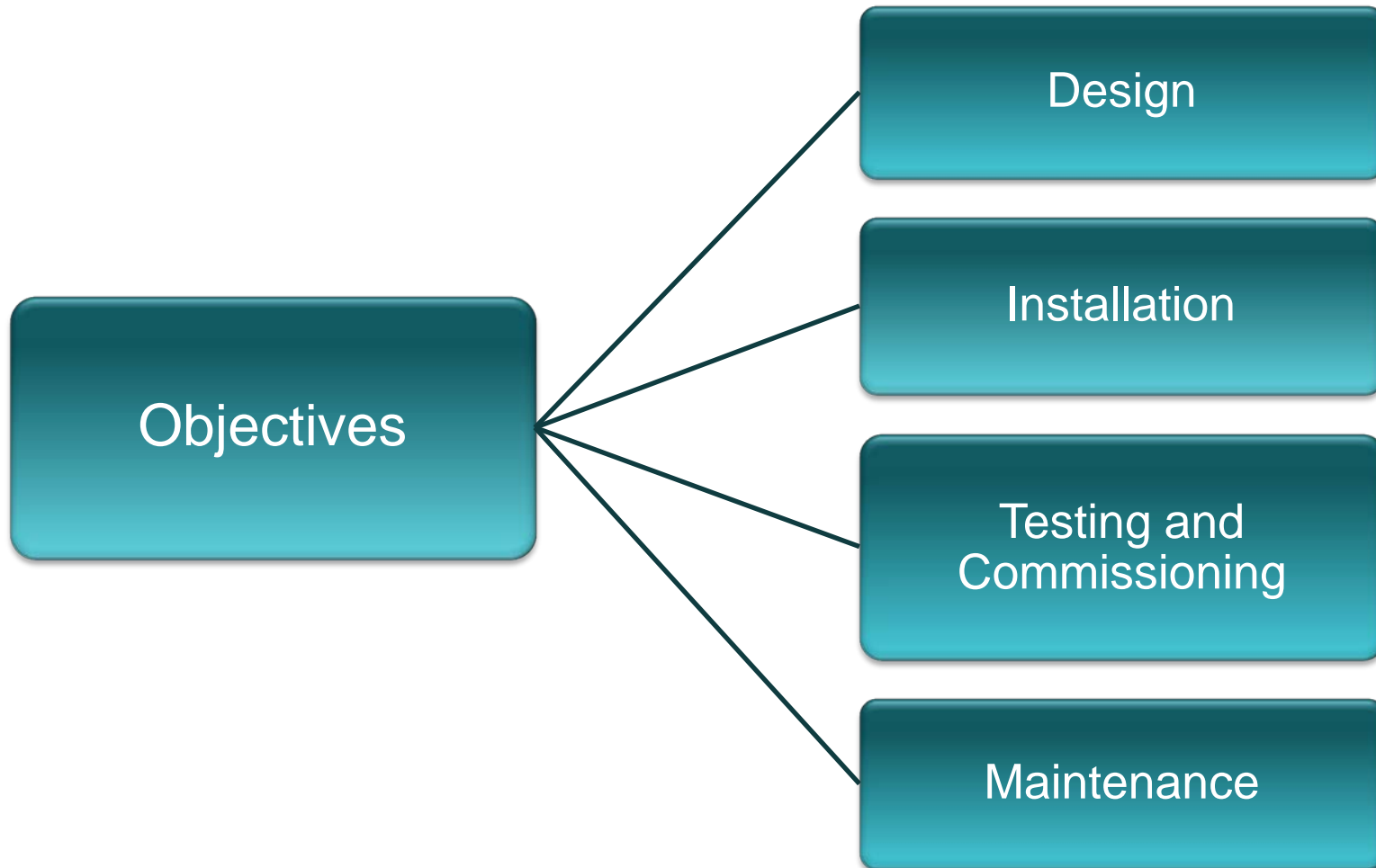
**FEHMARNBELT
DAYS 2014**

COPENHAGEN

30 SEPTEMBER - 2 OCTOBER

www.fehmarnbeltdays.com

TPS and TTC objectives



TPS and TTC objectives

Design

- Efficiency
- Reliability
- Availabillity
- Maintainability
- Safety, Regulatory Compliance

Installation

- Safe & Efficient Installation Methods
- Timely Installation – Programme Driven
- Quality Workmanship

TPS and TTC objectives

Testing & Commissioning

- Planned progressive testing programme
- Accurate & accessible test records
- Seamless handover into service

Maintenance

- Safe & efficient maintenance service
- Planned preventative maintenance
- Continuous improvement

The design must live up to the European railway safety requirements (EN50126, CSM & TSI)

The specific technical component and its functional system shall be safely integrated as a sub-system in the entire Railway Transportation System

The design must live up to RAMS requirements according to EN50126

Reliability

→ Low failure rate, MTBF

Availability

→ Low down time $MTBF/(MTBF+MTTR)$

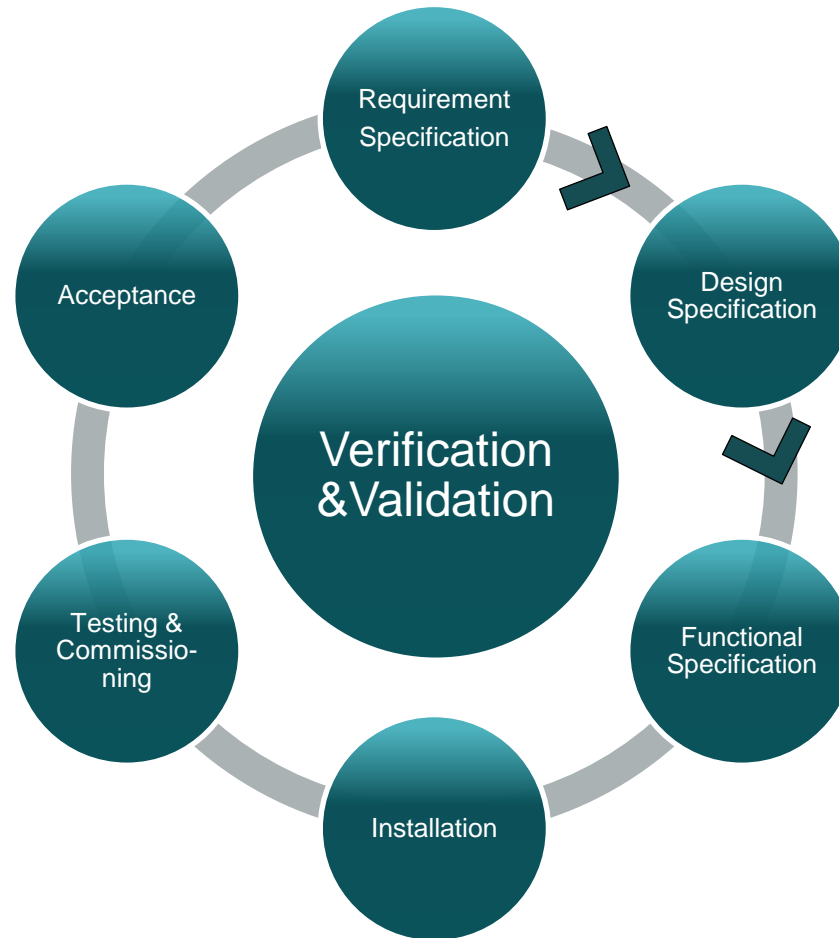
Maintainability

→ Sufficient time for maintenance, MTTR

Safety

→ Is uncompromising and permeates the RAM requirements

All design is to be verified & validated according to EN50126



Challenges & opportunities

