RAMBØLL

Bright ideas.
Sustainable change.

Light Rail on Ring 3

Establishing Copenhagen's first modern light rail system

Agenda

01 **Introduction**

02 **The Copenhagen Metro and Light Rail Company**

03 **The Light Rail Project along Ring 3 in Copenhagen**

04 **Further Light Rail Projects the Ramboll Light Rail Service Line is involved in**

05 **Discussion and Questions**

Steffen Plogstert

Leader Light Rail Service Line

Rail Germany, Light Rail

Karlsruhe, Germany

Background

20 years of experience in light rail systems both as consultant and for an operator

Since 2018 qualified as "Betriebsleiter" (operations superintendent) in accordance to the German light rail regulatory regime BOStrab.

Relevant project experience in operations, rolling stock, railway systems and infrastructure design.

Functional experience

2022>>>	Leader Light Rail Service Line, Ramboll Rail
2014-2021	Leader Operations, Rolling Stock and Systems, Ramboll Germany
2012-2014	Leader Planning and Design (Infrastructure), Rhein-Neckar-Verkehr GmbH (rnv), Mannheim
2011-2012	Leader International Studies, TransportTechnologie-Consult Karlsruhe GmbH (TTK)
2009-2010	Senior Consultant, Interfleet Technology Pty. Ltd. (Australia)
2001-2008	Project Leader, TransportTechnologie-Consult Karlsruhe GmbH (TTK)

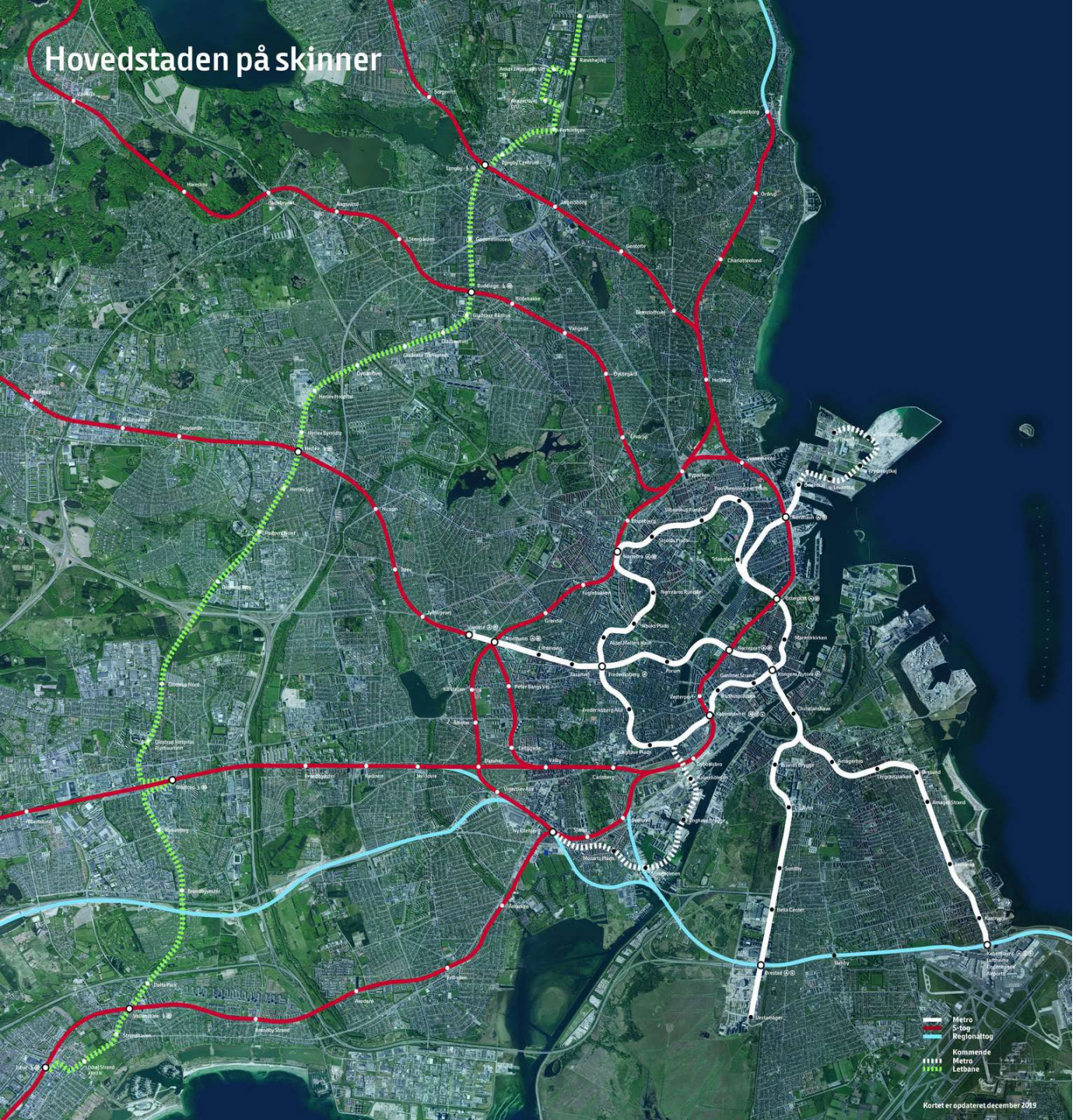
Selected references

- Rolling Stock, Operations & Maintenance and Rail Systems expert for Hovedstadens Letbane I/S, Copenhagen (part of client rolling stock team since 2014)
- Future tram for Kiel – responsible for power supply, signalling and homologation; Betriebsleiter
- Depot Study for the Bonn light rail operator – project leader to determine the future location and layout of the light rail depots
- Rolling stock support and procurement projects – including for the cities of Bonn, Düsseldorf, Nürnberg and Regensburg
- Implementation of a new unattended people mover / mini-metro at the Frankfurt international airport; responsible for operation and rail systems as client representative
- Ongoing support to Auckland (NZ) Airport with respect to the planned introduction of the future Auckland light rail system to airport grounds
- Assessor for the signalling system of the (now opened) tramway in Odense, Denmark

Presented by Steffen Plogstert, part of Hovedstaden Letbanes rolling stock team

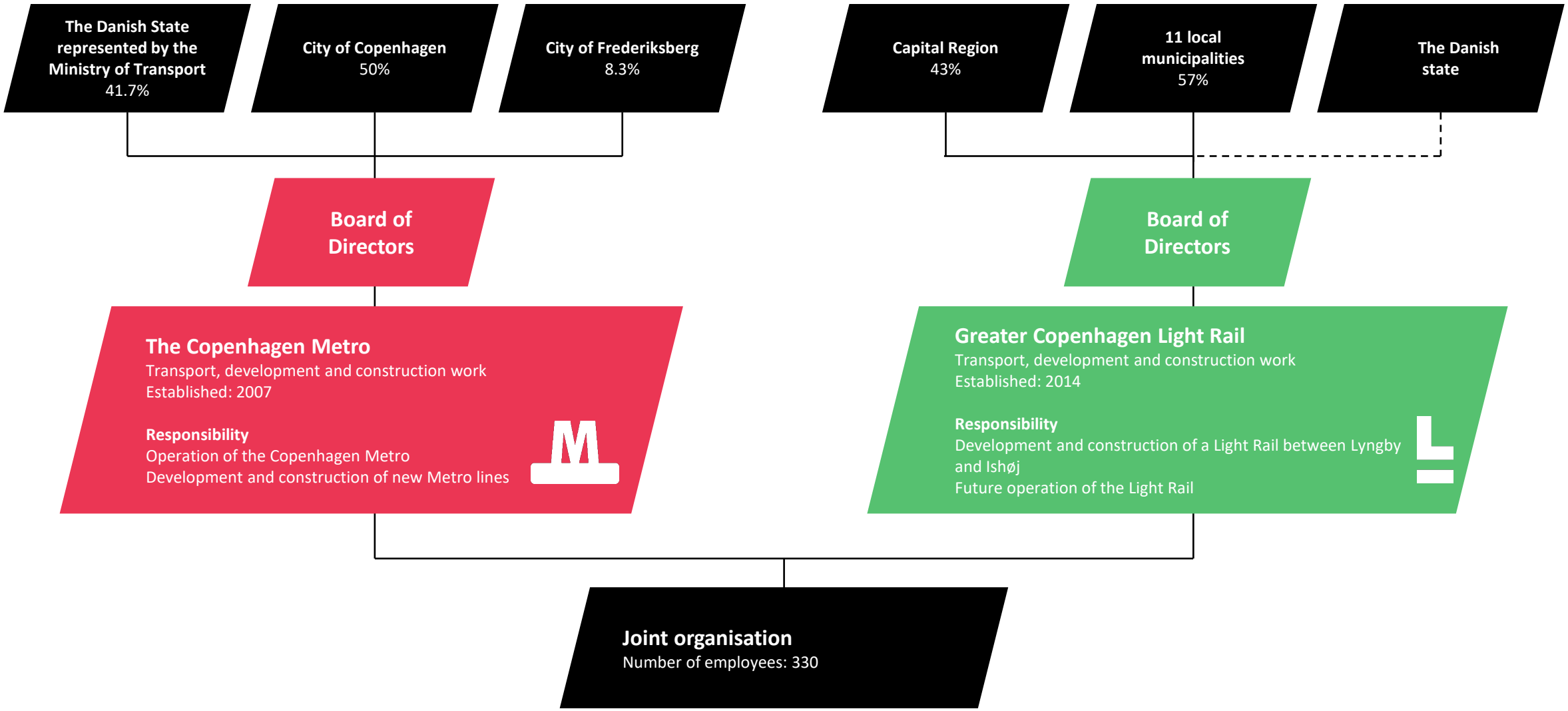
The Copenhagen Metro and the Greater Copenhagen Light Rail

- We create good public transport solutions for Denmark’s cities.
- Four Copenhagen Metro lines and a coming Light Rail between Ishøj and Lyngby.



Getting the capital on track

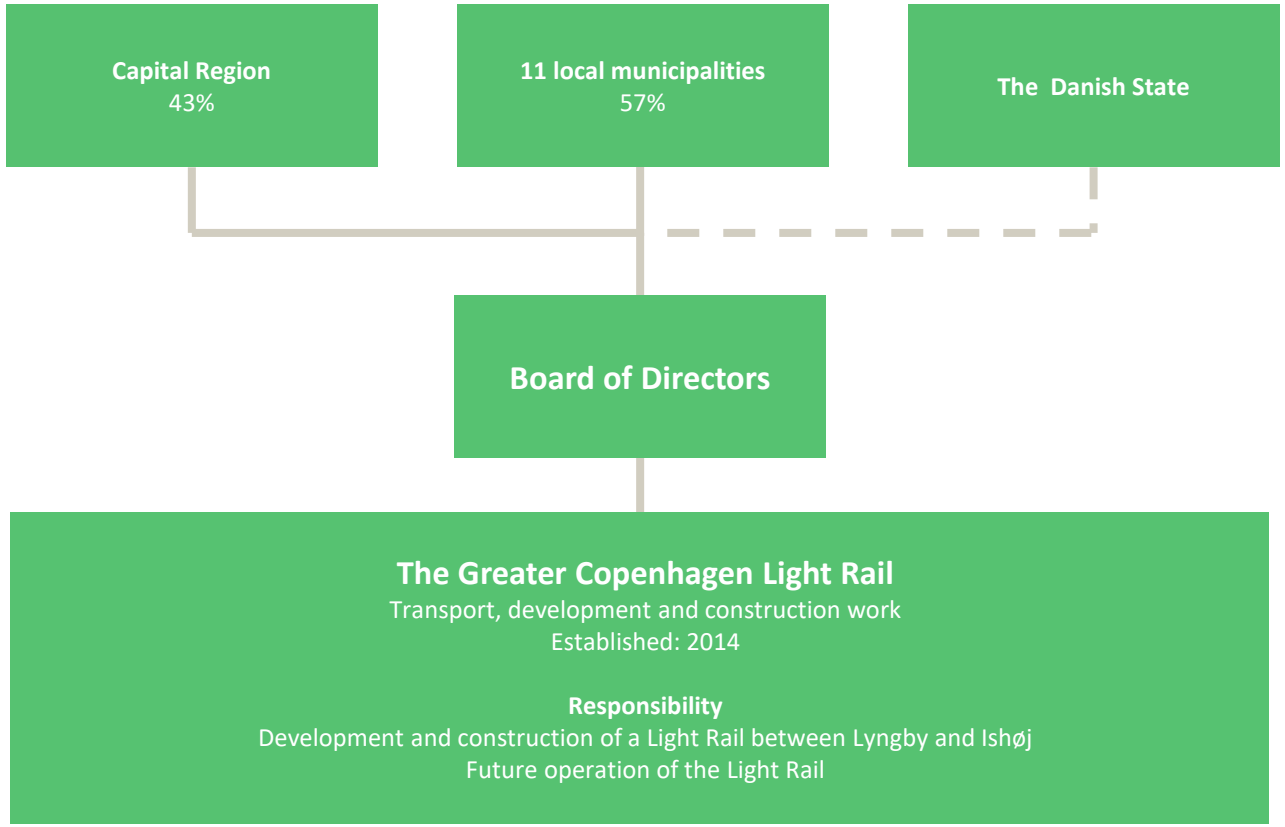
Organisation chart for The Copenhagen Metro and Greater Copenhagen Light Rail



Light Rail on Ring 3 Crossing the capital easily

In 2025, the line between Lyngby and Ishøj will open.

Organisation chart for the Greater Copenhagen Light Rail



Facts about the Light Rail

- The Greater Copenhagen Light Rail will be commissioned in 2025 and will run between Ishøj and Lundtofte, north of Lyngby.
- 28 kilometres of Light Rail with 29 stops.
- Will run every 5 minutes during daytime hours and every 10 minutes in the evening, and on Sundays and public holidays.
- 13-14 million passengers per year.
- Transfer to S-trains at six of the coming stations.

Why have a Greater Copenhagen Light Rail?

Why have a Greater Copenhagen Light Rail?

- Up to 2030, the capital's population will increase by 200,000 people.
- Congestion on the roads in the Greater Copenhagen area will be exacerbated towards 2030.
- Public transport has a relatively low market share of traffic across the capital, and travelling across the S-train network is less flexible.
- A Light Rail will support urban development in the municipalities.

What was Ramboll's task

Consultant to Hovedstadens Letbane from concept to contract, construction and commissioning:

- Conceptual Design
- Tender Documents
- Tender Evaluation and Contracting
- Design, Implementation and Testing support

On the transportation system, which is:

- Light Rail Systems (all fixed parts, which makes it a light rail)
- Rolling Stock (passenger vehicles, service vehicles)
- Operation & Maintenance
- Control and Maintenance Centre

Finances

- The total cost of the Greater Copenhagen Light Rail will be DKK 7.4 billion (2019 prices).
- One-off State grant equivalent to 40% of the capital expenditure.
- Creates income from 2025, sees a profit after only a few years of operation.

The Greater Copenhagen Light Rail as a procurement organisation

- The Light Rail will be constructed by the Danish contractors Aarsleff, CG Jensen and M.J. Eriksson.
- The transport system (trains and rail infrastructure) will be delivered by Siemens and Aarsleff Rail.
- Operation and maintenance will be handled by Metro Service A/S.

Advantages of the Greater Copenhagen Light Rail

- High operational stability
- High punctuality
- High speed
- A reasonably priced solution
- High capacity and increased comfort
- Low-noise, environmentally friendly mode of transport
- Creating urban growth and urban development.

Who owns Hovedstadens Letbane I/S?

11 municipalities (57%)

Ishøj, Vallensbæk, Brøndby, Glostrup, Rødovre, Herlev, Gladsaxe, Lyngby-Taarbæk, Hvidovre, Albertslund and Høje-Taastrup

Copenhagen Capital Region (43%)

Who is paying for the construction?

- The Danish State (40%)
- 11 municipalities (34%)
- Capital Region (26%)

Stations

- Easily recognisable with countdown to the next train
- Furnished with lighting, information screens, benches, refuse bins and loudspeaker systems
- Easy access conditions for everyone
- Side platforms and island platform.

LRVs

- Siemens will deliver 29, 36m long vehicles of the Avenio make. Today, these trains run in The Hague, Munich and Bremen.
- Each vehicle consists of four sections and can accommodate around 260 passengers.
- Light Rail vehicles are supplied with 750VDC power via catenary lines.
- The trains are expected to run at very high operating stability, as they are tried and tested.
- The trains have four flex areas, floors without level changes, a low entry height and information screens.
- The top speed is 70 km/h, but the trains will travel at an average of around 30 km/h, including stops.
- The trains can make sharper turns (25m), brake faster (BOStrab) and handle steeper (>5%) inclines than ordinary trains.
- Each flex area will be able to accommodate prams, wheelchairs or bicycles.

First vehicle

- Due to leave the factory in Serbia this week
- Initial testing (type testing) in the Siemens test center Wildenrath, Germany
- Delivery scheduled for August 2023 to Copenhagen

Control and maintenance centre in Glostrup

- The Light Rail will be operated from the control and maintenance centre.
- The centre will be located around halfway along the Light Rail's alignment and will house administration and facilities for Light Rail staff.
- The centre will comprise around 7,000 m^2 of buildings plus a train washing hall of around 400 m^2.
- Activities at the control and maintenance centre will take place 24/7.

Control and maintenance centre in Glostrup

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Who is building the Light Rail?

Civil Works

Three Danish companies are undertaking the actual construction work:

M.J. Eriksson A/S
Ishøj

Aarsleff
Vallensbæk, Brøndby,
Glostrup and Lyngby-Taarbæk

CG Jensen
Rødovre, Herlev, Gladsaxe
and CMC in Glostrup

- Who is supplying the transport system?

SIEMENS

AARSLEFF RAIL

Transportation System

CMC

- Who is handling maintenance and operation?

Metro Service

SIEMENS

Operation and Maintenance

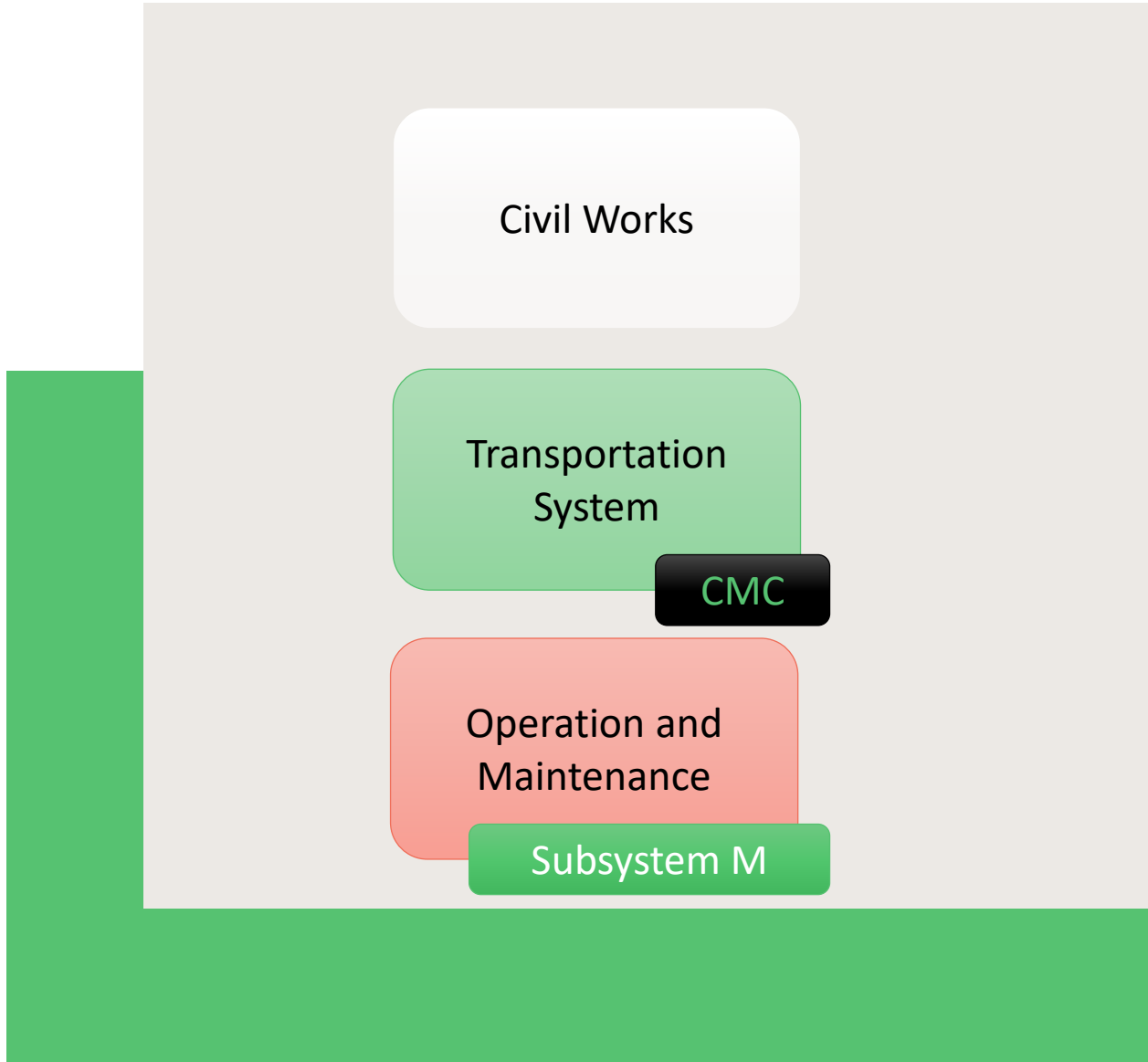
Subsystem M

with mandated sub-supplier Siemens for “technically complex” sub-systems

Procuring the overall System

Splitting the contracts into three major parts

- Civil Works contract – split into a number of individual (geographical) contracts
  - Providing the base (infra)structure(s)
- Transportation System Contract
  - Delivering the light rail system
  - Rolling Stock, Power Supply, ITS, Track
  - CMC building by a separate contractor
- O&M contract (15 years)
  - Operator and Maintainer with some maintenance subcontracted to TS Supplier



How the Light Rail is being built

- Preparatory work
- Construction works
- Construction of the Light Rail
- Testing and trial runs

Traffic flows while the Light Rail is being constructed

- We take account of traffic patterns as we build.
- Traffic flows are mapped using sensors and data from traffic counts.
- 60 sensors and 4 counter radars have been set up along Ring 3.

Social responsibility

For the Greater Copenhagen Light Rail, CSR is a natural element of the company's core business, in terms of both the construction and operation of the Light Rail.

- Part of the UN Global Compact's voluntary CSR initiative.
- The UN's 17 Sustainable Development Goals.
- 2-3 specific focus areas each year.
- Working environment, communication with neighbours and pay and working conditions in focus.

Apprentices involved in the construction of the Light Rail

- Contractual requirement of a minimum number of apprentice FTEs for the Light Rail.
- 58 apprentice FTEs in the construction phase and 5 years in the operational phase.
- Continuous follow-up and reporting.
- Right now, 69 apprenticeships have been delivered, and more are on the way.

Our targets for operation

- Start of operation in 2025
- 5 min headways
- High priority at intersections (but there are nearly 60 of these…)
- Drive on sight, max speed: 70km/h; average speed 30km/h
- When possible no running in mixed traffic
- No operation on the “wrong side” (counter directional)
- No double unit operation
- Good integration with other public transport (incl. dynamic passenger information)

Aeschenplatz Basel

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A New Tramway for the City of Kiel

TRAM/BRT KIEL
MASTER PLAN FOR A SUSTAINABLE PUBLIC TRANSPORT SYSTEM ON SEPERATE LANES

Client
State Capital of Kiel
Location
Kiel, Germany
Period
2020 - 2022
Project Tasks
Development of a core network with 3 lines, 35 km including all technical aspects and cost calculation
Intensive support in public relations
Approval and financing
Creation of visualizations and illustrative videos

The final recommendation included:

- Recommendation for future mode (tram)
- Infrastructure design (incl. Depot)
- Cost estimation
- Operational concept, signalling
- Power supply
- Urban integration
- Construction planning
- Financial concept
- Approval concept
- Visualisisation and videos
- Environmental aspects
- Bus concept and inter-face to Cost-benefit-Analysis (CBA)

Support to light rail tender consortium

ADVISORY SERVICES TO THE LRT TENDER - TEL AVIV LRT GREEN AND PURPLE LINES

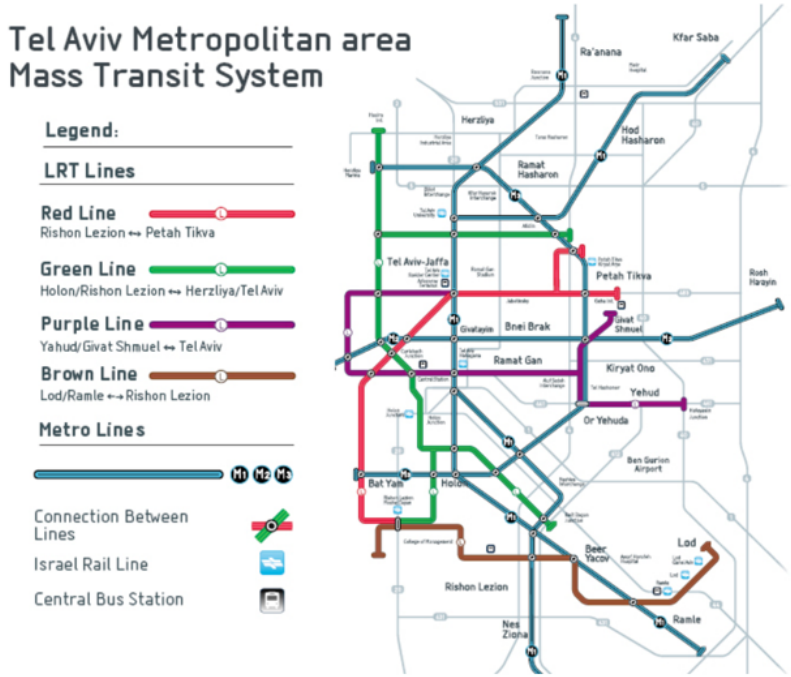
Bid project management and review of the technical bid deliverables

Tasks carried out:

WP 1: Review technical documents - review and analyse the Tender documents (as well as all plans and schedules, maintenance and operations, availability, safety and KPIs)

WP 2: Review bid deliverables and technical advisory - draft of all tender deliverables and final completion of bid-deliverables.

WP 3: Shadow evaluation of the final and complete technical proposal



CLIENT
Shikun & Binui – Egged – CRCCi - CRRC HK SPC

LOCATION
Tel Aviv, Israel

PERIOD
2020- 2021

New tram vehicles for Bonn

LOW-FLOOR VEHICLES BONN
SUPPORT FOR TENDERING AND PROCUREMENT

CLIENT
Stadtwerke Bonn Dienstleistungs-GmbH

PROJECT LOCATION
Bonn, Germany

PERIOD
2018-2020

TASK
Compilation of tender documents, support during tender process and contract award,
verification of contractor's design

Together with our client Stadtwerke Bonn Verkehr we:

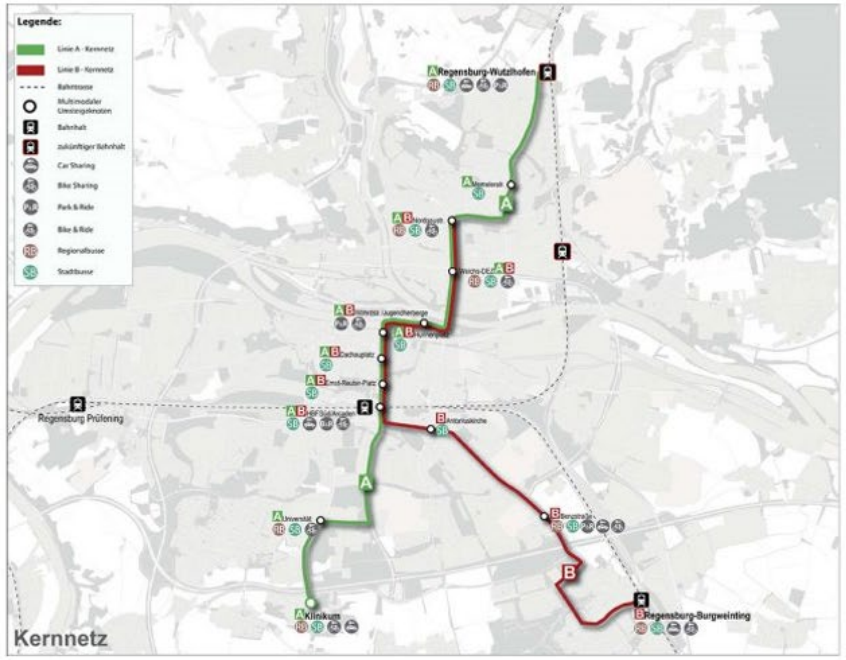
- Developed the technical specification for the new 26 (+12 optional) low floor light rail vehicles
- Supported formulating the prequalification
- Supported the call for tenders, tender negotiations and contract award
- Worked through the specification and detailed design phase and
- Supported SWB in the construction phase and construction support after award of contract

Defining a reference vehicle for a new tram in Regensburg

Parameters such as minimum curve radii, gradients, axle loads (also on bridges), etc. were defined for the following two cases:

- Case 1: Urban light rail operation according to BOStrab* (inner-city operation)
- Case 2: Urban light rail operation according to BOStrab (inner-city operation) and according to EBO (optional extension onto heavy rail tracks)

DEFINITION OF AN OPTIMUM GAUGE VEHICLE FOR THE FUTURE URBAN LIGHT RAIL IN REGENSBURG



CLIENT
das Stadtwerk Regensburg. Mobilität GmbH

LOCATION
Regensburg, Germany

PROJECT DURATION
2019-2020

Source:
https://www.regensburg.de/leben/verkehr-u-mobilitaet/bus-und-bahn/planung-zur-ein-fuehrung-einer-stadtbahn

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Conclusion, discussion and questions

Light Rail is a versatile solution for many public transport needs and sits between (high quality) bus and metro solutions.

As such it is a vital part of societies efforts to minimise climate change and bring forward the „Verkehrswende“ (turnaround in transport).

As a fully electric mode of transport it also moves us towards the net zero emissions goal.

Due to the possibility to operate on “line of sight” principles, it can be implemented less costly than other rail modes.

Utilising driver assistance systems (DAS) from the automotive industry will also allow light rail to become even safer and move towards higher grades of automation.

Bright ideas. Sustainable change.

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