Sporveien - The future signalling system for the Oslo tram
Dialogue conference, Oslo November 13th, 2025

Laila S. Kristoffersen
Technical Director Railways, COWI AS
Project manager for Sporveien AS

Agenda

09:00 - 09:15 Coffee and registration
09:15 - 09:20 Welcome and introduction
09:20 - 09:50 Sporveien: Vision and Aspirations for the Future
- The future Signalling System for the Oslo tram network, what do we want included in this?
- What's to be continued?
- SPV's future plans and aspirations
- Timeframe and Guidelines

09:50 - 10:25 Plenary session with suppliers and SPV/COWI
Themes:
- Possibilities for turnouts (switch) control
- Redirection/switching of the turnouts position
- Conveying/displaying the turnouts position (the «tip» of the switch´s position)
- Communication
- What can be placed in the Tram/SL18 and what must be in the infrastructure?
- Driver assistance

10:25 - 10:35 Coffee break
10:35 - 11:20 The plenary session continues
Themes:
- Autonomy (future strategy and development with automation and Autonomy for trams)
- Use of standards/specifications/methodology for safety
- Smart maintenance
- Economy and Life Cycle Cost (LCC)

11:15 - 11:30 Summary of plenary session
11:30 - 12:15 Lunch
12:15 - 16:00 One-to-one meetings with suppliers and coffee

One-to-one meetings

- 12:15 – 12:45 Supplier 1 - **Efacec**
- 12:35 – 12:50 Supplier 2 - **CAF Signalling** (teams)
- 12:55 – 13:10 Supplier 3 - **Hitachi Rail** (teams)
- 13:20 – 13:35 Supplier 4 - **Siemens Mobility**
- 13:40 – 13:55 Supplier 5 - **Swarco Norge**
- 14:00 – 14:15 Supplier 6 - **Alstom** (teams)
- 14:20 – 14:35 Supplier 7 - **SNIC Techn.** (teams)
- 14:45 – 15:00 Supplier 8 - **Frauscher Sensor Tech.**
- 15:05 – 15:20 Supplier 9 - **Enyse** (teams)
- 15:25 – 15:40 Supplier 10 - **Voestalpine**
- 15:45 – 16:00 Supplier 11 - **Rolfsen & Juell**

One-to-one meetings - 19 november

Adresse: COWI AS, Karvesvingen 2, 0579, Oslo

- 13:00 - 13:10 Klargjøring og oppkobling til 1. leverandør
- 13:10 - 13:25 One-to-One 1. leverandør **Amparo Solutions**
- 13:25 - 13:35 Klargjøring og oppkobling til 2. leverandør
- 13:35 - 13:50 One-to-One 2. leverandør **Malthe Winje Automasjon**
- 13:50 - 14:00 Klargjøring og oppkobling til 3. leverandør
- 14:00 - 14:15 One-to-One 3. leverandør **Cactus Rail**
- 14:15 - 14:25 Klargjøring og oppkobling til 4. leverandør
- 14:25 - 14:40 One-to-One 4. leverandør **Prover Technology**
- 14:40 - 14:50 Klargjøring og oppkobling til 5. leverandør
- 14:50 - 15:05 One-to-One 5. leverandør **Tinex** (Schaltbau Group 1)
- 15:05 - 15:15 Klargjøring og oppkobling til 6. leverandør
- 15:15 - 15:30 One-to-One 6. leverandør **Rosenfelt West Engineering**

(Possibly moved to week 48)

On track for tomorrow – Sporveien's vision and future direction

Peder Hansson
Technical manager Infrastructure Tram
Sporveien

Tone Manum
Head of Infrastructure Tram
Sporveien

Purpose of the dialogue conference

- Provide helicopter view on *Sporveien's* position
  - Upcoming renewals and upgrades to the signalling system
  - Future requirements for signalling system

- Understand *Suppliers* position
  - Current capabilities and philosophies
  - Development pipeline
  - Visions for the future

- Start a market *dialogue* on how functional requirements can be met
  - Our *current* thoughts
  - Your thoughts!

Legal note

- This meeting is not part of any tender. It should solely be regarded as part of SPV request for information.
- Any shared information is non-binding, and will not give any supplier an advantage in possible future tenders
- We are not to discuss specific technical solutions in plenary session

The split view…

Two simultaneous thoughts and needs:

- Short/medium term needs – change out of some existing installations
- Future proofing – open up for future requirements and opportunities

A flexible and popular tram system

- Passengers are back after pandemic
- Embedded in city identity
- High customer satisfaction
- Popular mode of transportation

- Several modes of transport in a single journey
  - Light rail, separate tracks, part of urban traffic, across public squares…

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Signalling system current needs

Minimum functionality:

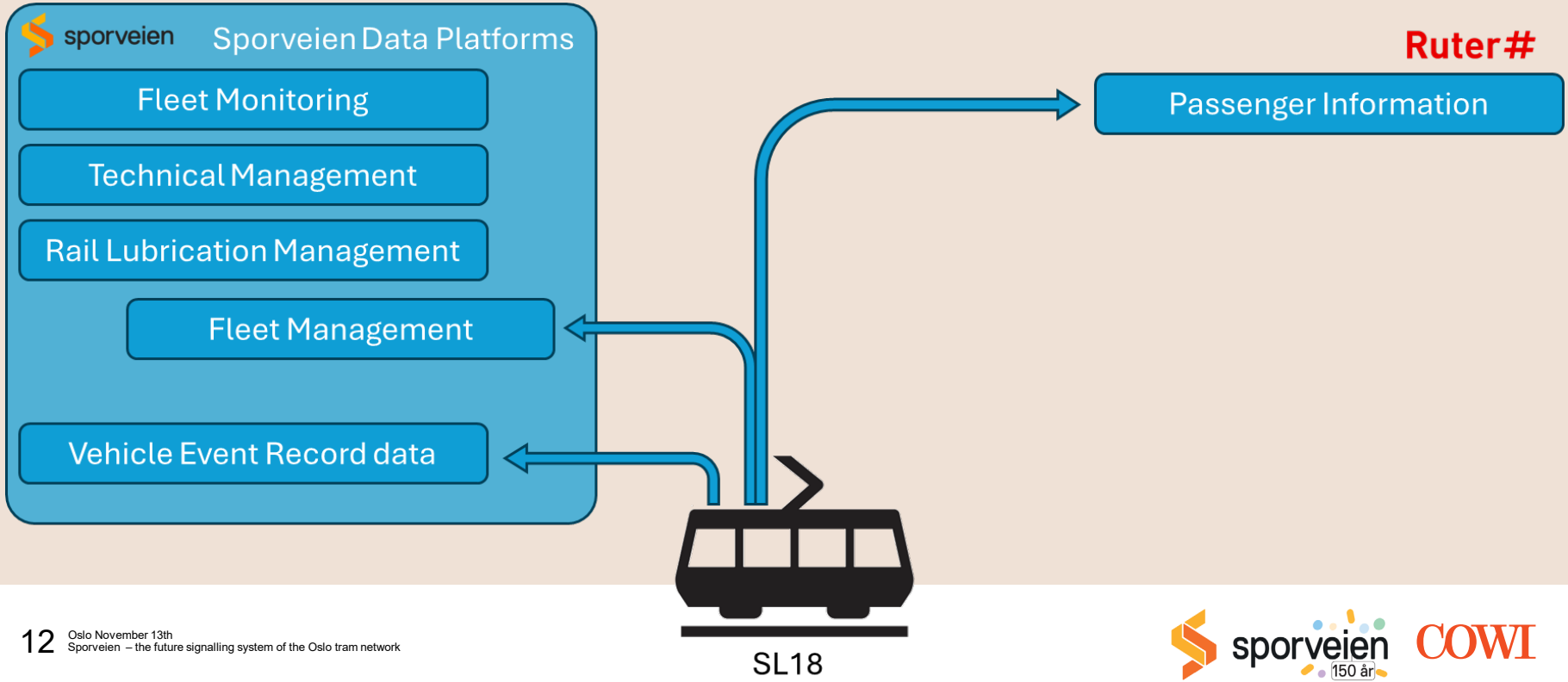
- “Sufficiently safe” passage across turnouts/switches – no switching whilst tram is passing
- Turnouts control from the tram (right/left selection)
- Interoperability with existing light rail systems (level crossing systems with lights and barriers) as well as existing turnouts, point machines and other infrastructure elements
- Information to driver on point position

What’s to be continued?

- SL18 tram fleet
- Existing infrastructure and interfaces
- Urban traffic conditions in Oslo
- Driving on sight – for general traffic awareness

- Sporveien’s data platform (next slide)

Sporveien’s data platform



Future proofing the signalling system

What we hope for / areas of interest:

- Communication interfaces
  - with SL18
  - Urban signalling systems for tram and other traffic
- Centralized monitoring
- Prepared for route distribution via SL18
- Interoperability for the infrastructure

- Speed monitoring, *Note 1*
- Curve speed monitoring, *Note 1*
- Flank protection, *Note 1*

Note 1: Can be implemented in SL18 regardless of signalling system

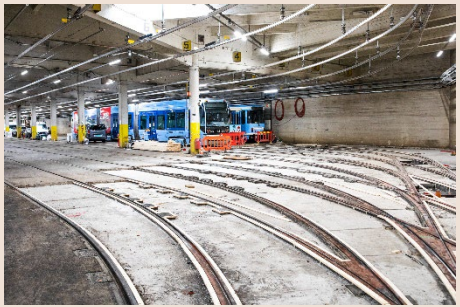
The tramsystem in Oslo and scope

Facts

- 6 lines
- 87 trams
- 56 million passengers
- 2 depots
- 59 km of urban track and 21 km of light rail
- 220 switches (16 controlled switches on light rail, 69 controlled switches on urban track, 35 controlled switches in the depot and 15 caution and block signals on light rail

Timeframe for the upgrading project for tram/urban track systems

- **Period one (2–5 years):**
  20–25 track switch systems to be replaced
- **Period 2 (5–7 years):**
  35–40 track switch systems to be replaced
- **Period three(10–15 years):**
  40–60 track switch systems to be replaced



Timeframe for upgrading project light rail systems

- **Block signals / “V” signals:**
  5–7 in the first period (7–10 years)
- **Level crossing systems:**
  10–15 in the first period (7–10 years)

Nordic climate

- Snow 4 months a year
- Ice
- Brine and heat on the switches
- Braking sand
- Large fluctuations in temperature (from -15 to + 5 in 2 days)
- Mixed traffic in the city
- Reinforcement in the superstructure and substructure

Plenary session

Laila S. Kristoffersen
Technical Director Railways, COWI AS
Project manager for Sporveien

Plenary Session

The aims:

- Dialogue with suppliers
- Gather input from suppliers
- Get ideas and inspiration
- Clarifying challenges
  - Technological
  - Regulations and approval process

→ Supplier- and technology-independent functional requirements

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Possibilities for turnouts (switch) control

- Right or left switching from driver's panel (minimum requirement)
- Button for switch operation/changing switch position (current solution)
- Signal indicating (current solution):
  - The turnouts position
  - Turnout in control
- Route-based switching of the turnout:
  - The turnouts communicates with SL18
  - The turnouts communicates with the central system

Suppliers: What possibilities for control of turnouts do you offer?

Redirection/switching of the turnouts posision

Urban tracks:

- Today: conductive material in concrete → physical limitations due to type of detection.
- Adapted to heavy traffic over turnouts
- Regulated by Sporveien Technical regulations
- The tram tracks have been upgraded for NOK 6-7 billion last 8 years

Drainage issues:

- Conditions in Oslo: rain, snow, ice, turnout heating and tram sanding system
- The tram routes have largely been upgraded.

Functional requirements:

- Ensure turnouts/switches do not relocate when the tram passes over («sufficiently safe» passage across turnouts/switches.

Suppliers:

- Which detection methods can suppliers deliver?
- How is the safety ensured during switching position on the turnouts?
- Does the supplier see it as realistic to use SL18's systems for detection?

Conveying/displaying the turnouts position for Urban Track (the «tip» of the switch´s position)

Today:

- Displaying the turnouts position is normally shown on a cube beside the tracks, but not always

Suppliers:

- How to convey information about the turnouts position?
  - To the tram driver (possible to move functionality from cube into SL18)
  - To central monitoring centre (via tram or directly to centralized location)

Communication

Fiber-based Network

- Fiber-based communication is available in the entire tram network

Wireless network

- The entire tram-network has excellent 5G-coverage from several providers. (CBTC for Metro in Oslo utilizes 5G-communication)

Standardized Protocols

- The use of standardized protocols and interfaces are desirable
- It is desirable to avoid proprietary solutions

Focus:

- Future flexibility in relation to communication with traffic signals in Oslo, driver assistance systems and development towards autonomy

Suppliers:

- What do you think will come next, opportunities, solutions, protocols, etc.?

What can be placed in the Trams/SL18 and what must be in infrastructure

Important developments for Sporveien in relation to driver assistance systems:

- Desirable to avoid setting limitations.
- Desirable with a supplier-independent interface to the Tram.
- The tram's on-board equipment can use V2X interfaces and perception technology, as well as the ability to decision-making.

Suppliers:

- What are the suppliers able to deliver?

Plenary session Autonomy

Mehdi Khakpour
Associate Digital Director
COWI AS

Humanoids: A $5 Trillion Market in 2050, Morgan Stanley

Autonomy and future strategy for the tram in competition with buses

Strategic Competition

- Trams in Oslo will compete with buses to offer improved accessibility, service and operational efficiency
- The trams will continue to operate in mixed traffic with buses, cars, bicycles, and pedestrians, and must meet requirements from the Road Traffic Authority

Significance of Autonomy

- We expect that autonomous trams in the future will enable driverless systems that improve efficiency and transform tram operations.

Technology and Regulation

- Addressing technological readiness and regulatory challenges is essential for a smooth transition to autonomy.

Operational Scope

- Near-term: **SAE 2+** assistance in depots and selected line segments; mid-term: **SAE 3** in geo-fenced corridors; align with **GoA** targets.

Standards & Compliance

- Reference **IEC 62290**, **CLC/TS 50701**, **IEC 62443**, **ISO 27001**; compatibility with Oslo city rules.

Questions for the suppliers

- How do you work with autonomy today (SAE/GoA mapping) and what is your 3–5-year roadmap?
- Which use-cases can you deliver first in Oslo (e.g., depot parking, platform approach, turnback)?
- What are your dependencies (sensors, maps, positioning integrity) and fallback strategies?
- Show Safety Case structure and prior references (esp. Nordic conditions).

Driver assistance

Important developments for Sporveien in relation to driver assistance systems:

Enhancing Tram Safety:

- Driver assistance systems can improve the safety of the tram product by providing real-time alerts and preventing accidents.

Supporting Driver Decision-Making:

- Systems offer automated controls and information to assist drivers in making better decisions.

Suppliers:

- How can your products improve the safety of the tram product and help drivers make better decisions?
- What experience do you have with driver assistance systems?

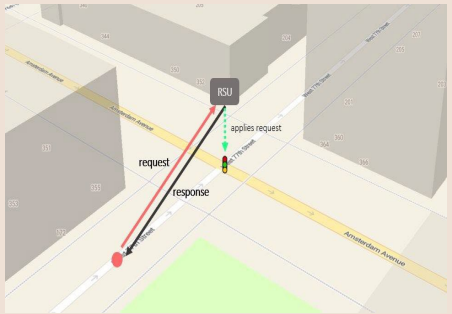
Communication - Autonomy

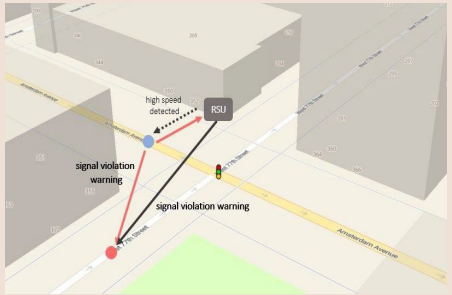
Interfaces and Protocols:

V2I: Comms between Tram and RSUs (Road Side Units)
V2V: Comms between Tram and emergency vehicles, Tran to tram

Scenarios:

- Green light priority
- Green Light Optimal Speed Advisory (GLOSA)
- Warning on emergency vehicle approach
- Warning on roadblocks/construction
- Warning on hazardous situation
- Warning on signal violation





Communication – Autonomy: Questions

- Which protocols and data models do you support out of the box (turnouts, speed advisories, alarms)?
- What QoS can you guarantee (latency/jitter/availability) on 4G/5G with failover?
- How do you secure tele-assist links end-to-end (crypto, key management, monitoring) and handle loss of comms?
- How will you integrate with urban/city traffic signals (TSP/GLOSA) and OCC/TLS—interfaces, V2I/V2V, certifications? Any pilot show cases?

Plenary session

Ole-Henrik Dag Olsen
Project Manager/Specialist RAMS
COWI AS

Oskar Arnesen Dønnum
Advisor in Economics
COWI AS

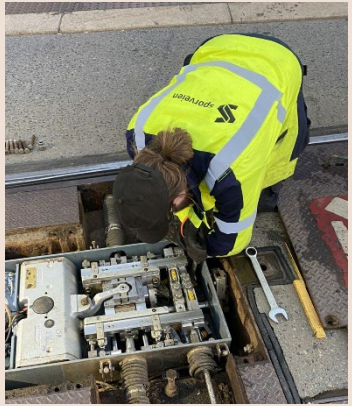
Use of standards/specifications/ methodology for safety

New functionalities – new/updated safety requirements

Suppliers:

- Which standards/regulations/guides for the safe operation of trams on urban tracks/suburban lines do suppliers *normally* use as a basis when preparing **"Safety Cases"** for their equipment/system?

Smart maintenance



Suppliers:

- Do you have solutions/systems that provide predictive/smart maintenance or real-time monitoring of the infrastructure's status?
- Experience in meeting regulatory requirements for condition monitoring of safety-critical infrastructure

Economy and Life Cycle Cost (LCC)

Suppliers:

- How do you work to reduce life cycle costs (LCC)?
- Are there conditions in Norway such as winter, de-icing, sanding and ice that are challenging to manage?
- How does it affect punctuality, operation and maintenance?

Summary of Plenary session

Laila S. Kristoffersen
Technical Director Railways, COWI AS
Project manager for Sporveien

Summary of Plenary Session

Agenda:

09:00 - 09:15 - Coffee and registration

09:15 - 09:20 Welcome and introduction

09:20 - 09:50 Sporveien; Vision and Aspirations for the Future

09:50 - 10:25 Plenary session with suppliers and SPV/COWI
10:25 - 10:35 Pause

10:35 - 11:20 The plenary session continues

11:15 - 11:30 Summary of plenary session
11:30 - 12:30 Lunch

12:30 - 16:00 One-to-one meetings with suppliers and coffee

One- to One Session

Laila S. Kristoffersen
Technical Director Railways, COWI AS
Project manager for Sporveien

One-to-one session with supplier

Time frame of 15 minutes for each supplier.

We would like the suppliers to prepare a presentation that addresses the topics below:

The suppliers are welcome to include **relevant** supporting information as attachments to their presentation

Overarching themes:

- The supplier´s key strengths, solutions, and technologies
- How the supplier can meet Sporveien´s requirements and wishes, including any potential challenges. (Sporveien´s Technical regulations: Eksternweb)
- The supplier´s plans and strategies for driver assistance and autonomy
- The supplier´s vision for the future
- Any additional ideas or input the supplier wish to share

Specific questions we would like feedback on:

- What detection methods for turnouts control does the supplier offer that will work in Oslo's environment?
- Has the supplier delivered solutions adapted to Nordic conditions?

Thank you for participating!