

MoST



Trøndelag fylkeskommune  
Trööndelagen fylhkentjielte



NTNU

Norwegian University of  
Science and Technology

## **WP2 (Arbeidspakke 2)**

***Bærekraftig mobilitet som et integrert system (modellering og planlegging)***

***Sustainable mobility as an integrated system (modeling and planning)***

*MoST fagseminar*

*14th December 2023*

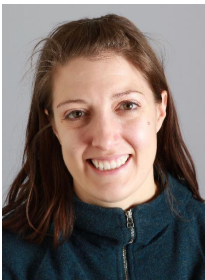
# Who we are:



*Trude Tørset*  
(IBM, Professor)



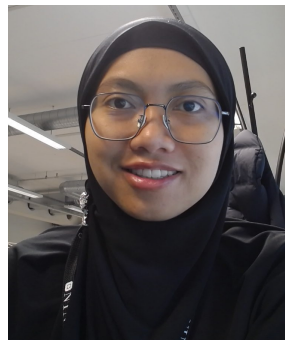
*Yngve Frøyen*  
(IAP, Professor)



*Kelly Pitera*  
(IBM, NTNU & OsloMet, Professor)



*Tsaqif Wismadi*  
(IAP, PhD student)



*Zakiya Pramestri*  
(IBM, PhD student)



*Zalalem Birhanu*  
(IBM, PhD student)



*Irene Hofmann*  
(IBM, incoming  
PhD student)



*Freyja Brandel-Tanis*  
(Fullbright recipient for 2022-23,  
term completed)



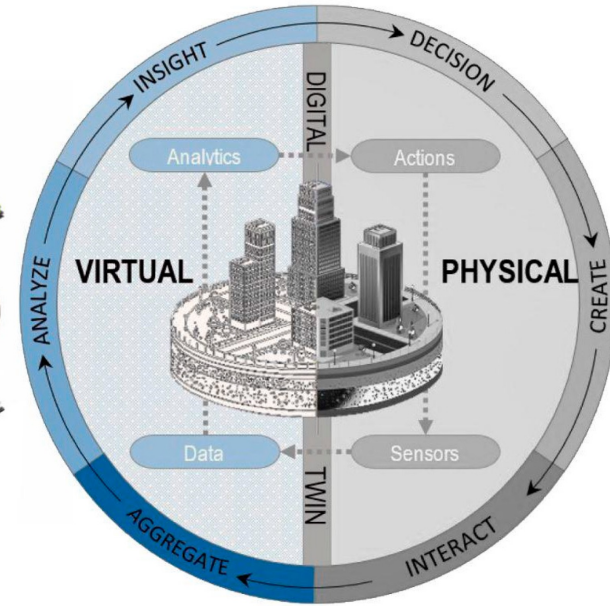
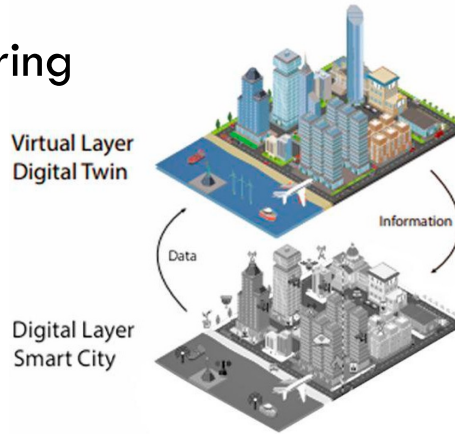
*Eline Hernes*  
(IBM, Student researcher)



*Dipanjan (Dip) Nag*  
(IBM, Post-doc)

# Mobility DT:

- DT comes from the manufacturing field
- DT for City → Mobility
  - Can communicate well
  - Capture many elements simultaneously
  - Many sources of data (ICT, IoT, etc.)
  - Is linked to other infrastructure (buildings, pipelines etc.)



Source: <https://doi.org/10.3390/su14106263>

- Help us in:
  - Testing scenarios
  - Providing reliable predictions

Motorized  
Passenger  
Transport

Non-motorized  
Passenger  
Transport

Freight  
Transport

Transport : within  
to/from  
through  
Existing and future modes

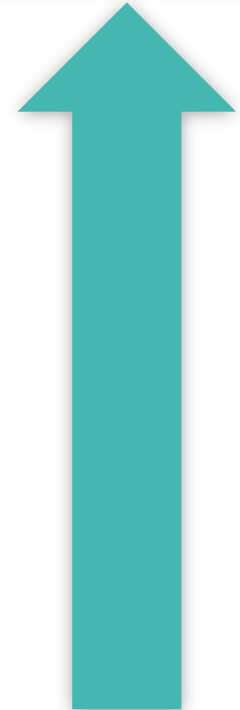
Evaluation of digital twins for mobility **decision making** (1. how do the decision makers understand/use the tool? 2. how is it scalable, managed, how is the data gathered/used?)

**Scenario assessment** for Elgeseter (determining possible innovative solutions, testing the digital twin to assess solutions)

**Digital Twin** Development (incorporating current (static and dynamic) modelled data with the modelled built environment)

**Transport model** development (tool that predicts future flows of traffic due to new measures)

Understanding the current situation: **knowledge-based** mapping and assessment (what is the mobility “problem”?)



# What we've been up to

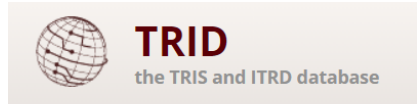
- Systematic Literature Review
  - How is DT used for mobility as discussed in the literature?
- Smart Travel Survey 2023
  - Data collection of travel patterns and trip habits of residents/ commuters in Trøndelag
- Needs based analyses
  - What are the Decision-makers' requirement for a 'tool' in mobility?

# Systematic Literature Review – Digital Twins within Mobility

- To understand how Mobility DT is defined in literature
- Find literature from various databases using search terms



ScienceDirect  
Scopus



Category	Search terms
Digital twin	"digital twin*" "3D city model" 4D visualization 5D BIM
City	city OR cities urban "built environment*"
transportation	transport* traffic "travel*" Mobility road OR roads OR roadway transit corridor street walking pedestrian rail* bicycle OR bike freight "goods movement*"

# Systematic Literature Review – Digital Twins within Mobility

- PRISMA (Preferred Reporting of Items for Systematic Review and Meta-Analyses)
- Screening relevant literature
- n=138 for full-text review
- Review Range: Jan 2000 to Sept 2022

## ^ Title and abstract screening

TEAM PROGRESS



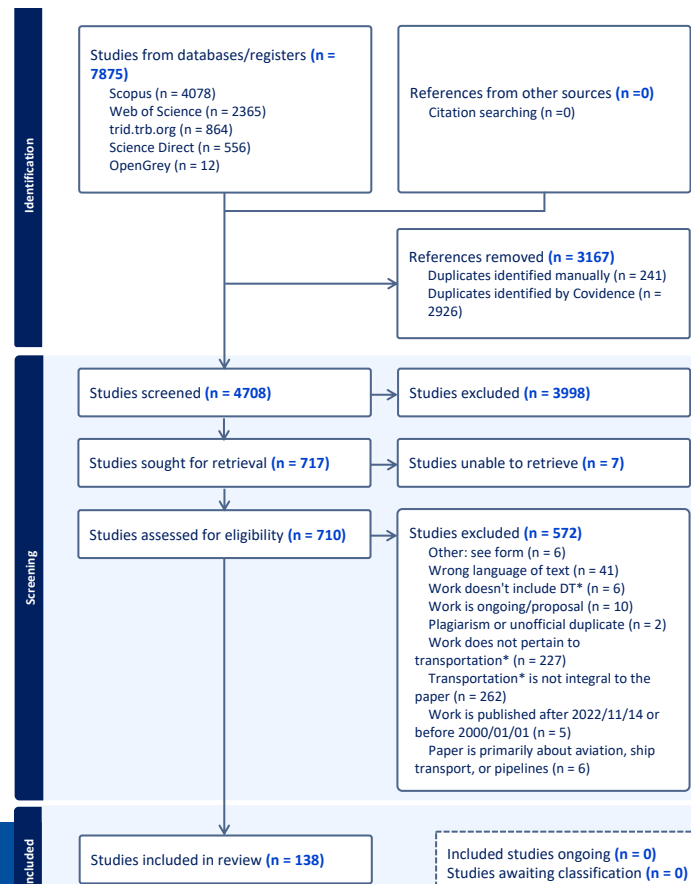
4709 ● DONE      0 ● CONFLICTS  
0 ● ONE VOTE      0 ● NO VOTES

## ^ Full text review

TEAM PROGRESS

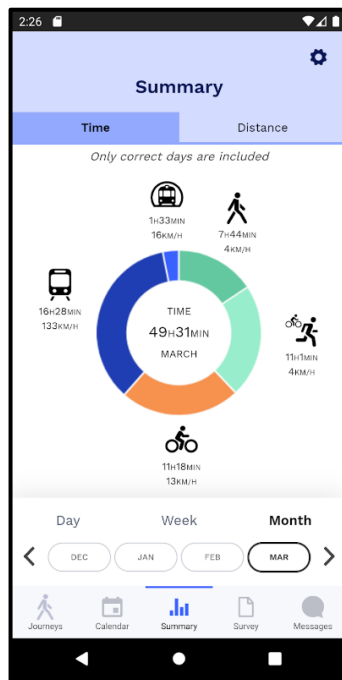


709 ● DONE      0 ● CONFLICTS  
0 ● ONE VOTE      0 ● NO VOTES



# Smart Travel Survey 2023

- Data collection through TravelVU—a mobile app
- Oct – Nov 2023
- > 300 respondents
- On average 10 days data collected per respondents
- On average 5 trips per day



NTNU MOST Mijepakken

### Improve the transport system?

We need to know how Trønders use the transport system. Join us! **New prizes and fun facts every day.**

**WHO:** Anyone living in Trøndelag aged 18 or older

**DURATION:** About one minute a day, as many days as you like

**HOW:**

1. Download the survey app **TravelVU** from Google Play or App Store, select the survey called **Trøndar**
2. Answer a few background questions
3. After each day: approve registered trips

**MORE INFO:** Project webpage: [www.ntnu.no/ntnetrou](http://www.ntnu.no/ntnetrou)  
E-mail: [smetrou@ntnu.no](mailto:smetrou@ntnu.no)

Do you want to participate in a research project about traveling in Trøndelag?

Have you wondered whether people travel differently after COVID? We want to learn more about how Trønders use the transport system, and for that we need help from you and all grown ups in your household!

Join an interesting study, learn more about transport and win exciting prizes.

**WHEN:** Fall 2023

**WHO:** You who live in Trøndelag, aged 18 years or more, and own a smartphone

**DURATION:** About one minute a day, as many days as you prefer

**HOW:**

1. Download the survey app **TravelVU** in Google Play or App Store, select the survey called **Trøndar**
2. Answer a few background questions
3. After each day: approve registered trips



**ABOUT THE PROJECT:**  
The project is carried out by NTNU in cooperation with Mijepakken. A lot of infrastructural projects are initiated in Trondheim and the surrounding areas, and this data collection will provide an important knowledge base for planning good transport solutions for the population. It is of course voluntary to participate but your participation would be greatly appreciated!

**MORE INFO:**  
The project web page is [www.ntnu.no/ntnetrou](http://www.ntnu.no/ntnetrou). You will find a lot of information about the project there, as well as our contact information if you have questions or comments. We will be pleased to hear from you.

With best regards,

Trude Terstøl  
Professor, Institute of civil and environmental engineering, NTNU.





# Co-Designing Digital Twin for Transport Planning

- Help us understand your views!
- Interviews with stakeholders (1 on 1) on Jan – March 2024
- Aim of interview:
  - To understand about each stakeholder's expectation regarding planning tool they need
  - To understand the process of planning they usually work on
  - To understand the pain point (challenges) of planning process they had
  - To understand the urgency of each process that they have
  - To understand the future needs for a planning tool

# We also would like to know more about

- Planning project that the stakeholders are planning to have
- Any dataset pertaining to mobility they usually use/ they are expecting to use
- Detail expectation regarding tools that can satisfy their needs

# We want to discuss with you

- Stakeholder's interview
  - Any relevant stakeholders we'd better to involve in our interview?
- Data sharing
  - Any other work package has data that might be worth it to explore together? How should we proceed the collaboration?
  - For stakeholders: Any potential data to explore together?
- Ideas for project collaboration, how should we proceed?
  - Stated Preference surveys for active transport
  - Integrated data stream for the planning tool