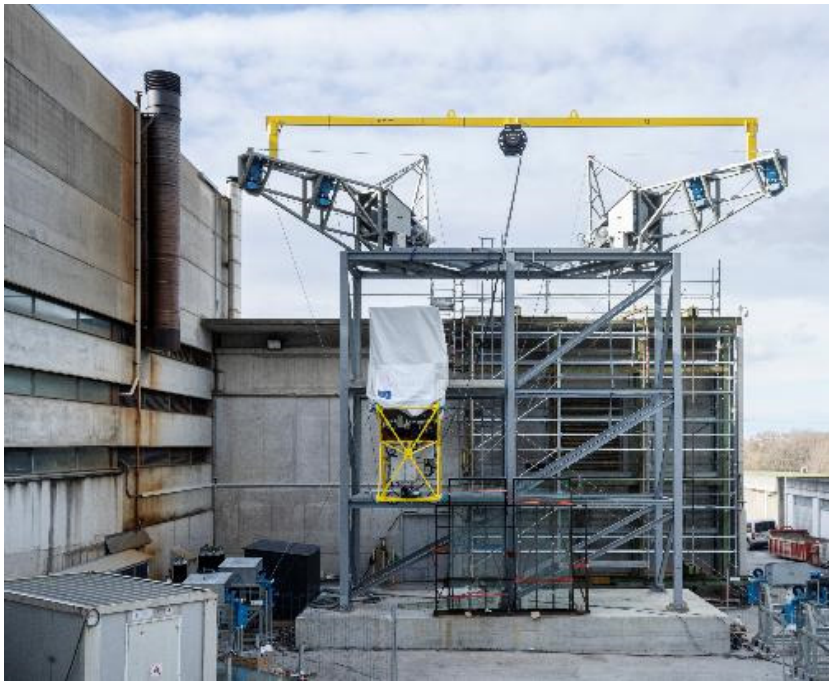


Making-of: increasing the speed of Munich's U-Bahn stations renewal with construction robotics

MA Project: 8 SWS/ 12 ECTS, Wed. 14:00 – 18:30
Hybrid course (online + in-person)

Chair of Building Realisation and Robotics in collaboration with:

- Munich City Utilities & Transportation Corporation (SWM)
- & the Chair of Construction Management (Prof. Nübel)

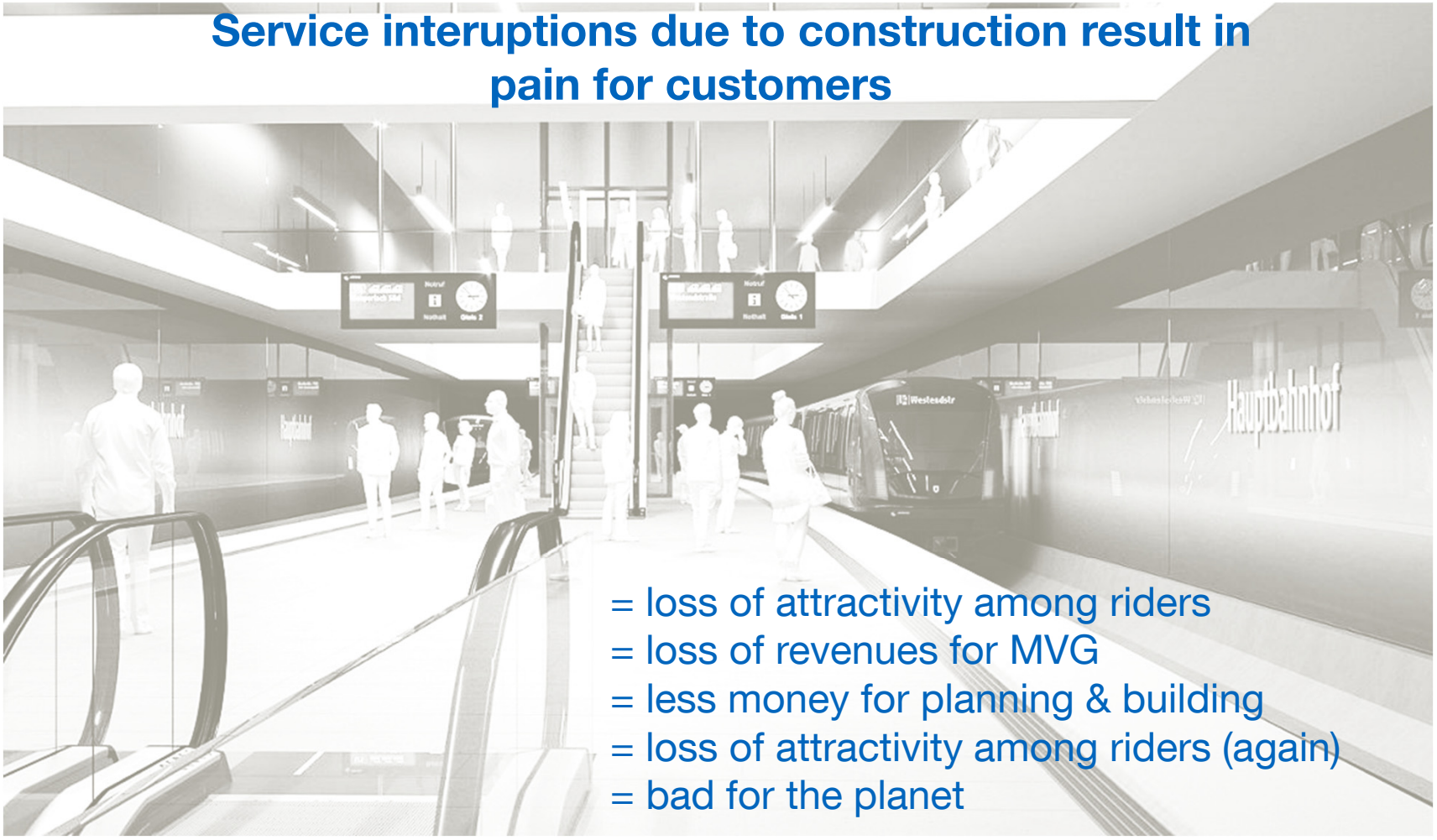
The Problem

Rights: Dorian Zapp, Münchner Verkehrsgesellschaft

The Goal:
Exciting infrastructure protects the planet

Rights: Münchner Verkehrsgesellschaft

What's so difficult?

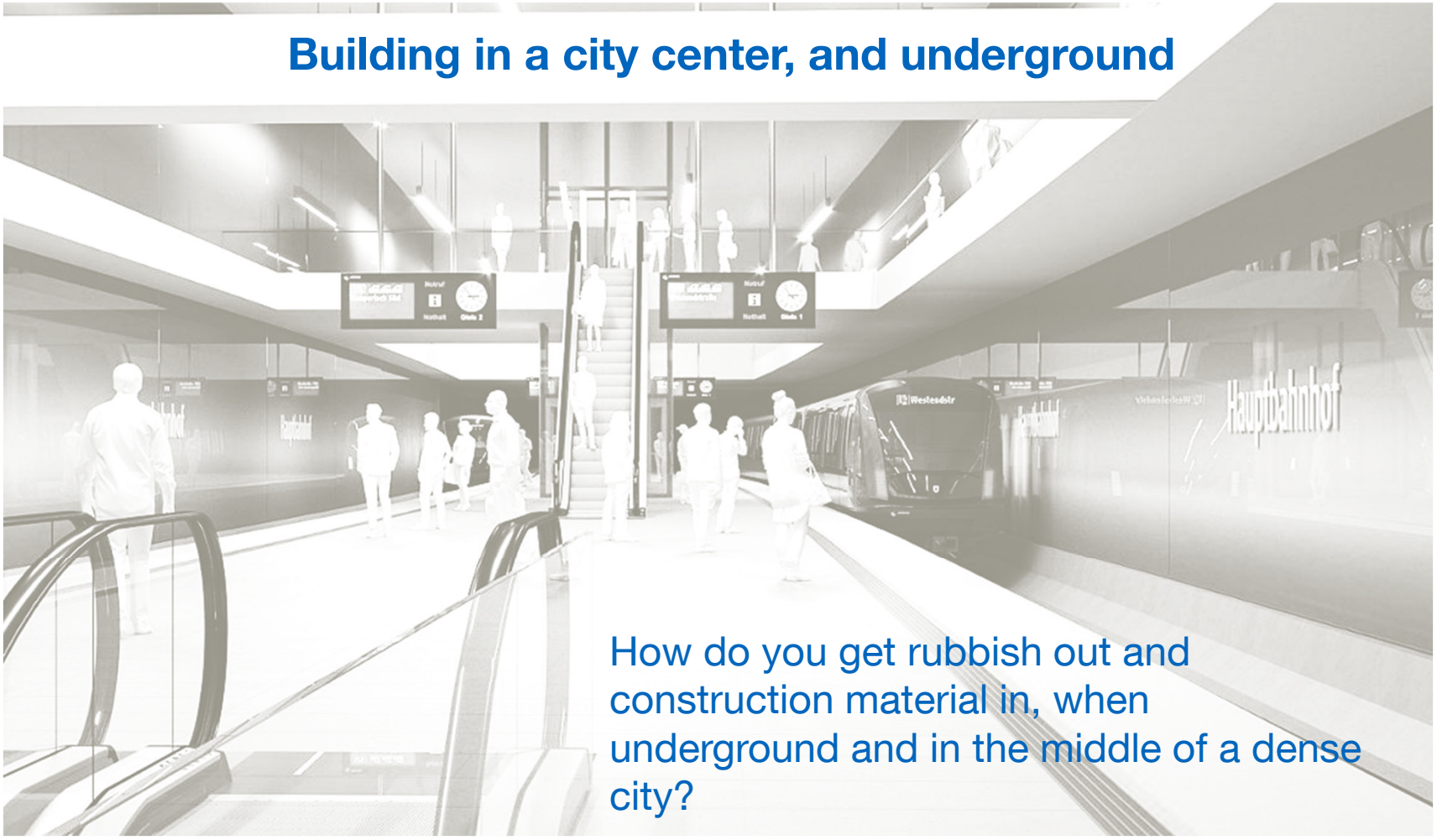


Service interuptions due to construction result in pain for customers

= loss of attractivity among riders
= loss of revenues for MVG
= less money for planning & building
= loss of attractivity among riders (again)
= bad for the planet

What's so difficult?

Building in a city center, and underground



How do you get rubbish out and construction material in, when underground and in the middle of a dense city?

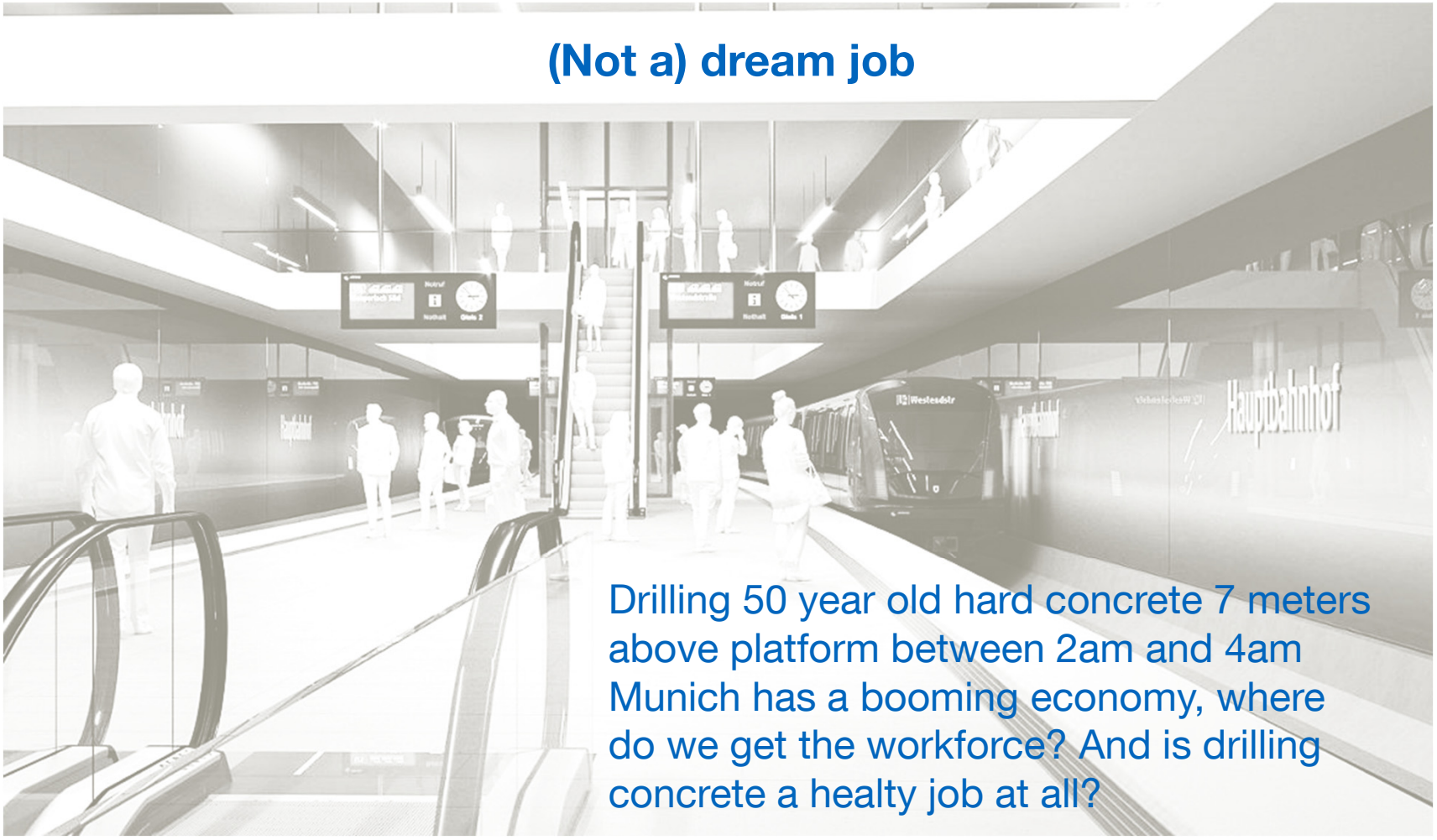
What's so difficult?

Pay 8, get 2!
(what a deal…)

We operate 22/7, so we have 2 hours per night to work. But are billed 8 hours by construction companies.

What’s so difficult?

(Not a) dream job



Drilling 50 year old hard concrete 7 meters above platform between 2am and 4am
Munich has a booming economy, where do we get the workforce? And is drilling concrete a healty job at all?

Help us!

We want to make the renderings reality, help us find solutions to bypass the problems that stands between renderings and reality.

We believe construction automation is one key element to make it happen.

Let‘s develop some construction robots together.

Façade painting robot developed by TUM + CIC Hong Kong

HEPHAESTUS cable robot for façade installation

Robotized subway construction as a solution

- Get to know the realities of the construction process and develop construction robot concepts on three focus topics (see next slide) to solve the issues.
- The Chair and the Munich City Utilities & Transportation Corporation give you input and guidance.

Shimizu concrete leveling robot

Taisei façade painting robot

nLink drilling robot

Transportation & logistics of Sekisui Heim

Focus on 3 key tasks and get wild!

- Drilling concrete: is dangerous, dull and unhealthy, while requiring precise execution (do not harm the reinforcement bars) and an individual documentation is required: depth, torque, touched reinforcement bar, … Drilling makes construction sites dirty, requiring extensive and expensive work safety and cleaning measures.

- Site progress monitoring and management: at any moment, you need to know if you are on schedule, and if there is any potential risk for train traffic. You also need to ensure how construction was made. We need to build more and more at the same time at night, but can't get our hands on enough site managers.

- Site logistics: this is a major bottle-neck. Getting construction material in and out, in the heart of the city, up to 10 stories underground. Imagine how fast and how much cheaper we could build, with an Amazon-like construction logistics.

Course timeline

- Week 1 (Nov 2-8): introduction of topic and problems/tasks (lead: SWM); type: recorded lecture
- Week 2 (Nov 9-15): introduction to potential solutions (lead: br2); type: recorded lecture
- Week 3-6 (Nov 16 - Dec 13): desk critique (in elective courses: individual program by lecturers)
- Week 7 (Dec 14-20): intermediate presentations 1
- Week 8-10 (Dec 21 - Jan 10): desk critique (in elective courses: individual program by lecturers)
- Week 11 (Jan 11-17): intermediate presentations 2
- Week 12-14 (Jan 18 - Feb 7): desk critique (in elective courses: individual program by lecturers)
- Week 15 (Feb 8 - Feb 14): final presentations

Linked (non-mandatory) courses

- Robot Oriented Design (ROD) – **Drilling concrete**
  2SWS/ 3ECTS, Thurs. 13:15– 14:45, Mode: Online

- Design of Robots in Architectural Context (DoRiAC) **– Site progress monitoring and management**
  2SWS/ 3ECTS, Mond. 08:00– 09:30, Mode: Online

- Automation & Robotics in Construction (ARC) **– Site logistics**
  4SWS/ 6ECTS, Thurs. 9:45 – 12:45, Mode: Online

- Selected courses of the Chair of **Construction Management**, TUM Department of Civil, Geo and Environmental Engineering

Summary

Title:	Making-of: increasing the speed of Munich's U-Bahn stations renewal with construction robotics
Chair:	Chair of Building Realization and Robotics, in collaboration with: • SWM: Stéphane Schneider, head of subway construction • Guest critics from start-ups and industry
Language:	English, English support (i.e. lecture/learning materials in English, group work/individual reviews in English)
Study level:	Master
Kick off:	See course timeline
Meetings:	Wed. 13:15 – 17:45; Room: virtual per Moodle
Interm. Reviews:	See course timeline
Final Presentation:	See course timeline
ECTS:	12 ECTS (+3 ECTS)