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Improving Street Reconstruction Projects in City Centers Through Collaborative Practices

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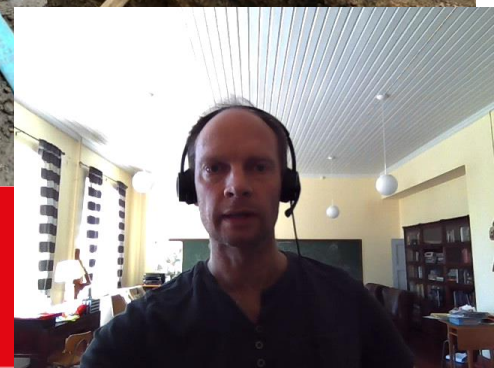
Introduction

- Renovation and relocation of underground utilities and renovation of streets cause harm to citizens
- Frequently delayed
- Uncertainty in conditions
- Public owners tend to use Design-Bid-Build
- Many stakeholders

AIM: Diagnose and construct a practical solution to street renovation projects to minimise delays and harm to citizens

RQ 1: What are the root causes of long durations of street reconstruction projects?
RQ 2: How to implement lean and digital tools to develop these projects?



Research Method

- Research strategy: design science research
  - 1. Diagnosis
  - 2. Formulation of a solution and validation
  - 3. Contributions and future research
- Extensive diagnosis with the support of City of Helsinki– **"Common understanding of the problem"**

Data for diagnosis

Data type	Data collection period	Analysed materials
Interviews	2/2019-6/2019	55 interview sessions with 75 participants (15 City of Helsinki, 23 contractors, 10 designers, 20 utilities, 7 others)
Document analysis	5/2019-6/2019	Three projects – contracts, schedules and their updates, meeting minutes, site diary
Site Observations	11/2018-12/2018 and 5/2019-6/2019	Observations in four projects: situation picture, collaboration and trust, problems and their solutions
Survey	5/2019-6/2019	Survey related to communication in projects, conducted in one project, 29 respondents
Workshop	20.5.2019	33 participants (6 City of Helsinki, 6 contractors, 4 designers, 9 utilities, 7 others)

Diagnosis - Conflicting views from stakeholders

Stakeholder group	Main cause of street renovation project delays according to stakeholder group
Contractor	• Imbalanced distribution of risks • Coordination responsibility without commitment of all parties • DBB model forces contractor to maximize utilization of resources • City decision making slow – had to do changes at own risk
City of Helsinki	• Contractors don’t plan work properly • Contactors fail to justify change order requests • Contractors reactive, not proactive
Utility companies	• Multi-project environment • Individual scope is small, participating in every meeting is not efficient • Lack of transparency to project schedules and continuous delays – hard to plan resources
Designers	• Last minute change requests • Starting data for design inadequate (soil information, existing utilities)

Diagnosis – Observations and document study

- Lack of collaboration
- Shortcomings in schedules / planning – not updated
- First time extension request destroys trust – hostile environment
- Very slow handling of change order requests (months)
- "Surprises" on many days (19-66% of days in excavation phase)
  - Every "surprise" starts a change order process

- One project notably different
  - Similar contract but trust was achieved
  - Contractor was proactive at own risk and proposed solutions
  - Owner was happy and decided immediately - paperwork later
  - Contract not followed!
  - The only project of four that finished on time and without dispute!

Consensus on root causes achieved

1. Contract form
   - Successful delivery only when contractual process was not followed
   - Design-Bid-Build NOT A GOOD FIT
2. Continuous deviations (“surprises”)
   - Soil conditions, missing information, underground structures
3. Reacting to deviations and change management
   - Time and attention used on paperwork
4. Collaboration and trust
   - Reactive, not proactive. Documentation, not problem solving
5. Challenges related to schedules and logistics
   - Not enough time for planning. Lack of planning skills and resources
6. Lack of situational awareness for stakeholders
   - Several important parties are not on site at all times and need to know status of work

Model developed collaboratively based on three workshops

Design

Participants: All entities managing design (City + utilities), design consultants, construction managers participate in the final phase of design

Objective / changes
- Construction managers (City + utilities) participate in evaluating constructability already in design phase

New tasks
- Defining risks and uncertainties already in design phase (collaboration of design managers and construction managers)
- More soil investigations (including test excavations) already in design phase in risky areas

Preparation of Construction

Participants: All construction managers

Objective
- Selecting contractor with criteria which enables getting the right partner for development phase

Knowledge requirements of main contractor
- Planning skills
- Ability to recognize risks and opportunities
- Ability to propose alternative solutions
- Ability to minimize the harm of construction to environment

Tasks
- Deciding the selection criteria of main contractor
  - Price component (lump sum / unit price)
  - Quality component (evaluation of skills e.g. by scoring the project plan in addition to customary references)
- Preparing of tender / contract documents
  - In call for tenders, constraints for planning and the risk analysis created in design phase should be appended

Development phase

Participants: All design managers, construction managers, designers, main contractor, other contractors

Objective:
- Preparation for construction phase so that both the duration and extent of harm to third parties can be minimized.

Tasks
- Collaborative planning of work and commitment to work plan
- Common risk analysis, pricing of risks and risk management plan
- Defining metrics for success and conditions of satisfaction
- Additional investigations of starting data in risky locations.
- Planning temporary traffic arrangements
- Alternative solutions and innovations
- Decision making paths and times for different types of deviations in construction phase
- Defining requirements for situation picture
- Target price and bonus scheme for construction phase

Construction

Participants: All construction managers, main contractor, other contractors. When changes occur, also design managers and design consultants.

Objective
- All actors have a real-time shared situation picture
- Flexible process when deviations occur by utilizing the risk analysis of development phase

Tasks
- Continuous updates of schedule
- Real time situation picture for all stakeholders (main contractor procures the required systems).
- Quick decisions when there are deviations in cases when the deviation is related to a previously recognized risk.

Discussion of Design Science Research

- Detailed diagnosis resulted in common understanding of the problem and willingness to solve it
  - Long process with extensive evidence
- Convincing a public Owner to change their procurement from DBB was difficult – evidence from diagnosis critical
- Although results are familiar to most lean researchers and practitioners, this research showed the power of DSR to achieve research-driven process change
- Three projects currently ongoing with the new process
  - Two went well, one had major difficulties
  - City is committed to continue

Conclusions

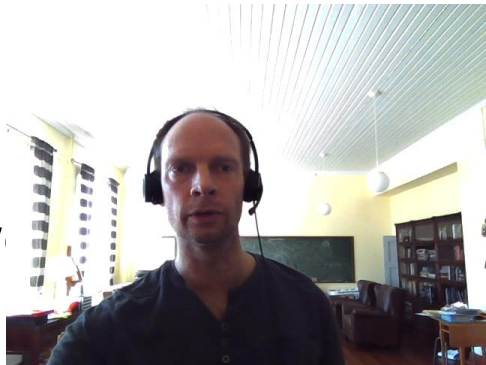
Answers to Research Questions:

RQ 1: What are the root causes of long durations of street reconstruction projects?

- High uncertainty
- Design-Bid-Build is too inflexible to deal with continuous change
- Better coordination required

RQ 2: How to implement lean and digital tools to develop these projects?

- New model developed with several lean elements
  - Collaborative development phase
  - More collaborative contract (target price with incentives associated with project objectives)
  - Collaborative planning with Last Planner System©
  - Digital situation awareness
- Interventions are not new but using DSR to kick off lean implementation w
  achieve real change



THANK YOU!

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