Improving the Efficiency of the Construction Industry by Means of Innovative GNSS-based AI Approaches
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Overview

1. Construction – Some Facts
2. Challenges
3. GNSS-based AI solutions
4. Benefits and Issues
5. Conclusions and Takeaways
1 Construction – Some Facts

- total construction output (EU) 1,211 bln. €
- > 3,000 k enterprises
- providing 14,166 k jobs in the EU

Source: European industry construction Federation 2015
1 Construction – Some Facts

Subcategories: examples

- earth works & road construction
- buildings
- industrial facilities
- demolition and deconstruction
2 Challenges

- very tight time scales
- avoidance of delays
- change requests or new requirements during the projects’ realisation
- low profit contributions of projects
- lack of intelligent planning and control tools
2 Challenges

- management of complex on- and off-site supply chain processes
- compliance with legal requirements
- being competitive/making profit
3 GNSS-based AI solutions

- Bulldozers
- Trucks
- Excavators
- Asphalt paver
- Demolition equipment
3 GNSS-based AI solutions: Bulldozers

- 1st experiments at Univ. of Nottingham in 2002
- comparisons of actual and planned performances
- machine guidance
3 GNSS-based AI solutions: Trucks

- truck control
- planning based on GPS data and AI software
- autonomous haulage systems

- benefits:
  - saving human resources
  - better utilisation rates
  - saving patrol
  - cheap documentation
  - quick reaction

- issues:
  - safety
  - robustness, for instance: dust and vibrations
  - investments
3 GNSS-based AI solutions: Excavators

- bucket wheel excavators
- satellite supported control to improve material planning
- optimisation of machine movements
- optimisation of material planning and related excavation processes
3 GNSS-based AI solutions:
Excavators for other types of earth work

- EPOS* System

- multi-layer closed-loop approach to analyze and control earthworks

*EPOS = Efficient process design by satellite supported software in the earth moving and road construction industry
3  GNSS-based AI solutions: Excavators for other types of earth work

- better quality of information/full transparency
- performance issues become visible
- increased basis of information for decisions (operational and strategic)
- continuous process improvements
- avoidance of future costs
3 GNSS-based AI solutions: Asphalt paver

- tracking movements by GPS
- measuring asphalt temperature by means of laser-linescanner, thermocouples and infrared cameras
- temperature contourplots
  - show the variability of the lay-down temperature
- compaction contourplots
  - show the number of roller passes
- controlling purposes
- further performance analysis
3 GNSS-based AI solutions: Demolition equipment

- in more than 80% of all cases demolition excavators and auxiliary products are applied

- hydraulic hammers and demolition shears
3 GNSS-based AI solutions: Demolition equipment

- tracking of demolition/deconstruction work
- controlling of work AND supply chain
- combined analysis, for instance to get better information for offers
- legal purposes
4 Benefits and Issues

benefits
- real-time information
- avoidance of delays
- compliance with legal regulations
- cheap documentation
  - e.g., geo-tracking results combined with data from noise or dust sensors
- saving costs

issues
- additional costs (hw, sw, training, …)
- organisational impacts
- legal aspects
- definition of appropriate key figures
5 Conclusions and Takeaways

Construction meanwhile full of AI technologies

great potential ...
- full transparency
- saving costs and resources

... and still some challenges
- investments & customising effort

but: benefits should surplus effort

AI as chance for Europe's industry to remain competitive