

« Construction Equipment in an Agile World »

Plenary Session, 16th October 2014, Crowne Plaza -Antwerp



CECE Congress 2014 - 15, 16, 17 October - Antwerp, Belgium



Trends & Challenges in Intelligent Construction Machines

Dr. Rikard Mäki, Volvo Construction Equipment



CECE CONGRESS 2014
Antwerp, Belgium



Challenges and Opportunities

Population and infrastructure growth is fueling construction equipment growth

The environmental stress require sustainable solutions

Largest growth coming from the emerging markets, as will new competitors

Dual markets to serve –complexity in products and manufacturing

Technology growing at exponential rate enabling numerous possibilities



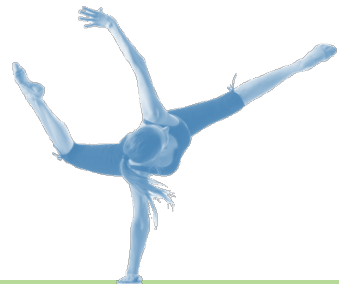
SAFETY



QUALITY



ENVIRONMENT



Fuel Efficiency Improvement Potentials

Example: Wheel Loader

$$FE [t/L] = \frac{\text{Productivity [t/h]}}{\text{FC [L/h]}}$$

Productivity increase potentials
Fuel consumption reduction potentials

- Site optimization
- Machine use optimization
- Machine optimization:
 - Reduction of losses
 - Optimizing the systems interactions
 - Decoupling of systems

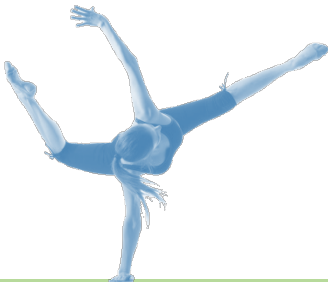
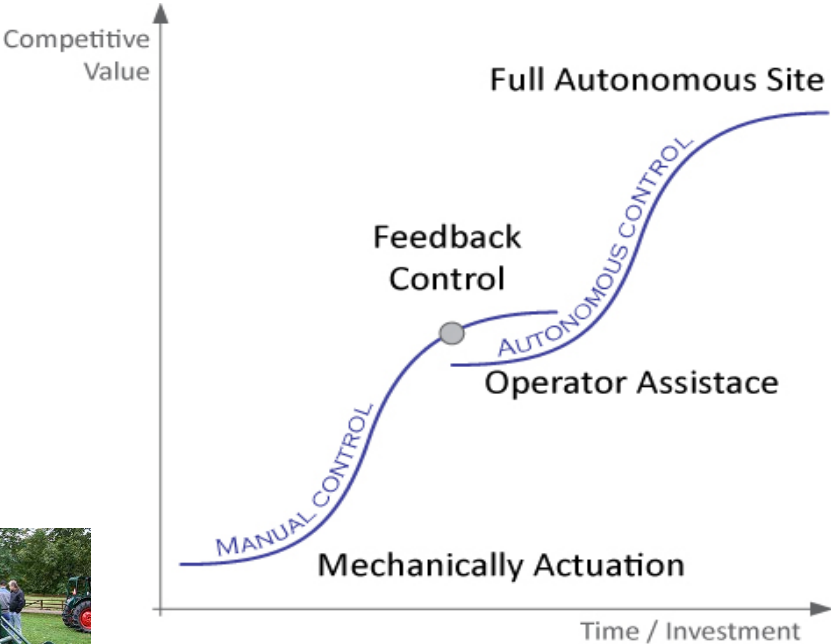
Up to 30% or more

-40% up to +40%

Up to 50%



Technology Paradigm Shift; Machine and System Intelligence



Communicating Machines

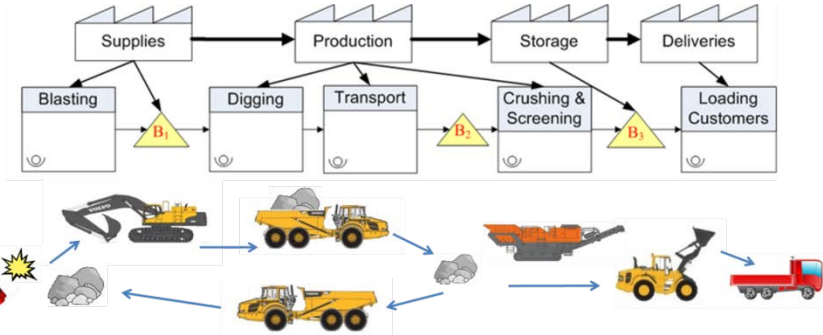
Real Time Communication is an Enabler for

- Active Safety
- Site Automation
- Site Resource utilization optimization
- Optimized energy consumption
- Machine awareness of surroundings



What is the potential then?

Quarry & Aggregates

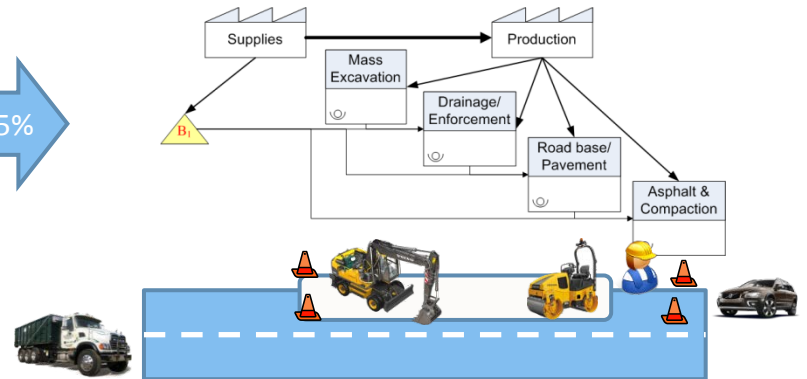


26630 sites in Europe
UEPG (European Aggregates Association)

In 2011, 3 898 000 000 ton aggregates was produced in Europe. Using 40 ton load trucks that is 100 000 000 transports/year. Twice as much considering both within quarry and towards the end customer.

Road Construction

35%



“For Freeways in USA, Road works increase the accident rate with 21.4%”

Process Variations in:

- Distances
- Traction
- Utilization
- Vehicle availability
- Stone quality/type
- Stops/speed

→ Uneven capacities → Wastes



Connected vehicles are coming soon...

Cadillac to Introduce Advanced 'Intelligent and Connected' Vehicle Technologies on Select 2017 - Windows Internet Explorer

http://media.gm.com/media/us/en/cadillac/news.detail.html/content/Pages/news/us/en/2014/Sep/0907-its-overview.html

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Cadillac to Introduce Advanced 'Intelligent and Connected' Vehicle Technologies on Select 2017 Models

Super Cruise and V2V technologies slated for production in about two years

2014-09-07

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DETROIT – Cadillac will begin offering advanced "intelligent and connected" vehicle technologies on certain 2017 model year vehicles, General Motors CEO Mary Barra said Sunday during her keynote address at the Intelligent Transport System (ITS) World Congress in Detroit.

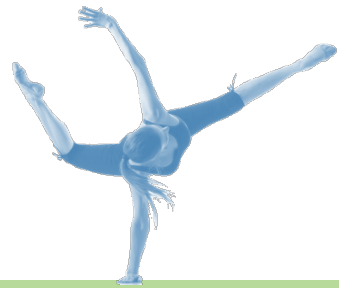
In about two years, an all-new 2017 Cadillac vehicle will offer customers an advanced driver assist technology called Super Cruise and in the same timeframe the 2017 Cadillac CTS will be enabled with vehicle-to-vehicle (V2V) communication technology.

"A tide of innovation has invigorated the global auto industry, and we are taking these giant leaps forward to remain a leader of new technology," Barra said. "We are not doing this for the sake of the technology itself. We're doing it because it's what customers around the world want. Through technology and innovation, we will make driving safer."

Super Cruise, the working name for GM's automated driving technology, will offer customers a new type of driving experience that includes hands-off lane following, braking and speed control in certain highway

A 2015 Cadillac CTS, equipped with V2V technology, notifies the driver of the approaching Cadillac SRX from the left before the driver could see the vehicle.

Video



What it looks like

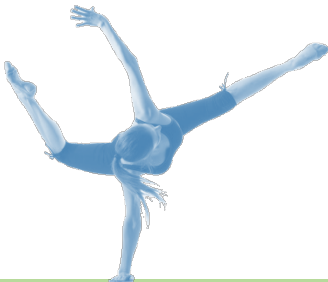
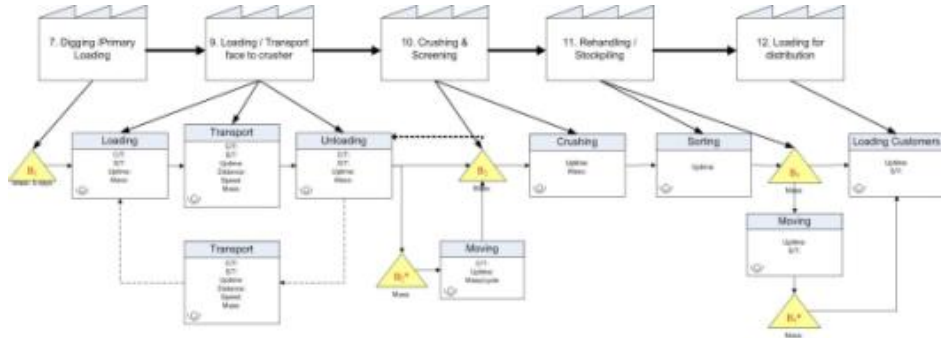
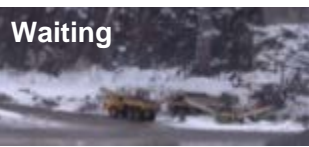
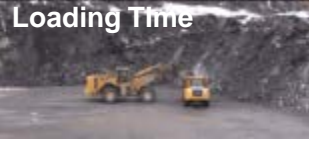
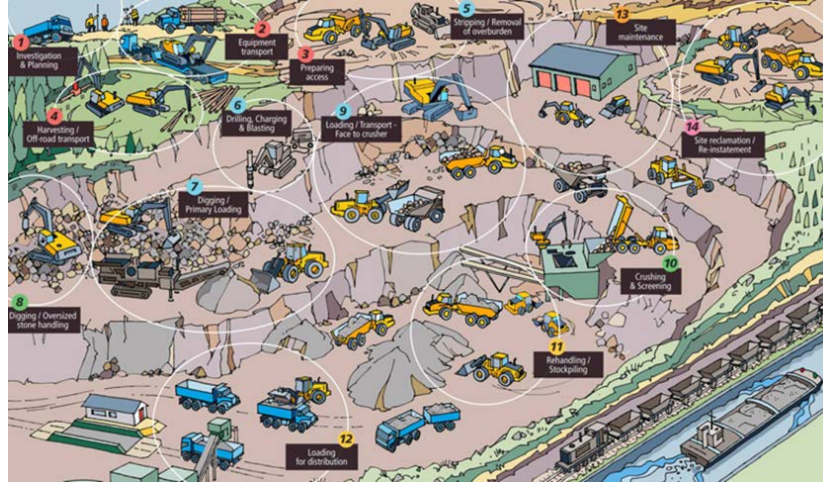


Communicating with the Site

Managing the Site;

Processes, Machines, Personnel and Tasks

The business potential - Deploy site management systems to eliminate waste in the process



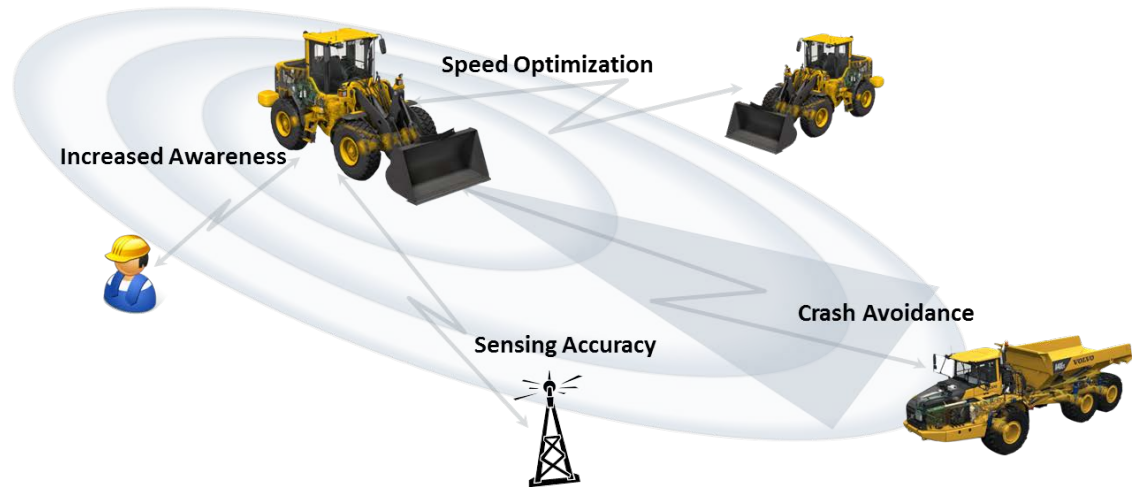
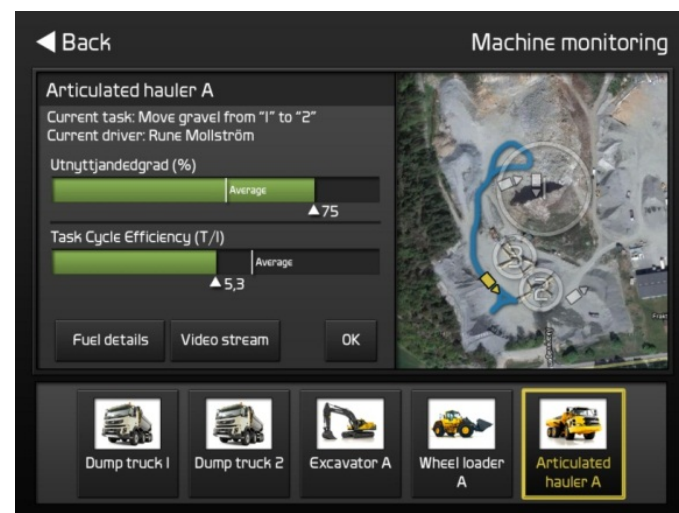
Communication Challenges

Reliable Ad-Hoc Communication

Accurate Positioning

Sensor and Data Fusion

Visualization and Trajectory matching



Automation of commercial vehicles

Where are the potential;

Safety

Environment

Productivity

Total Cost of Ownership



Driver



Driver
only

Assisted

Semi-
autom.

Highly-
autom.

Fully-
autom.

Automation



Two main application areas for highly automated vehicles

Public roads

Important factors;

Type of road networks

Automation – scenarios based

Regulatory framework - legal aspects

Public acceptance

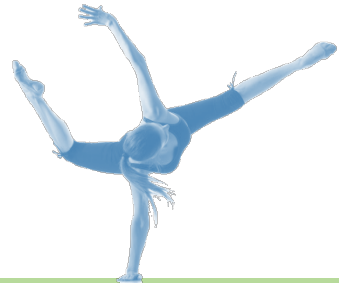
Controlled environments

Harbor areas

Goods terminals

Mine areas

Industrial and construction sites



Finding the synergies to make it happen

Volvo Trucks - One of the world's largest manufacturers of medium and heavy trucks for long-haul and regional transportation, as well as infrastructure projects.

Mack Trucks - One of the leading manufacturers of heavy trucks in North America; one of the strongest brands in heavy trucks in the North American market.

Volvo Bus - One of the world's largest manufacturers of heavy buses; also delivers chassis, transport solutions and telematic systems.



	Long-haul	Regional distribution	City distribution	Construction	Compact construction equipment	Heavy construction equipment	Road machinery
Volvo Trucks							
Renault Trucks							
UD Trucks							
Mack Trucks							
Eicher							

Vehicle Automation - two ways forward with many synergies

Volvo Construction Equipment - One of the world's leading manufacturers in equipment, such as crawler excavators, wheel loaders, compactors and pavers.

Crawler excavators from Lingong

Lingong wheel loaders

Pavers

Asphalt milling machines

Skidsteer loaders

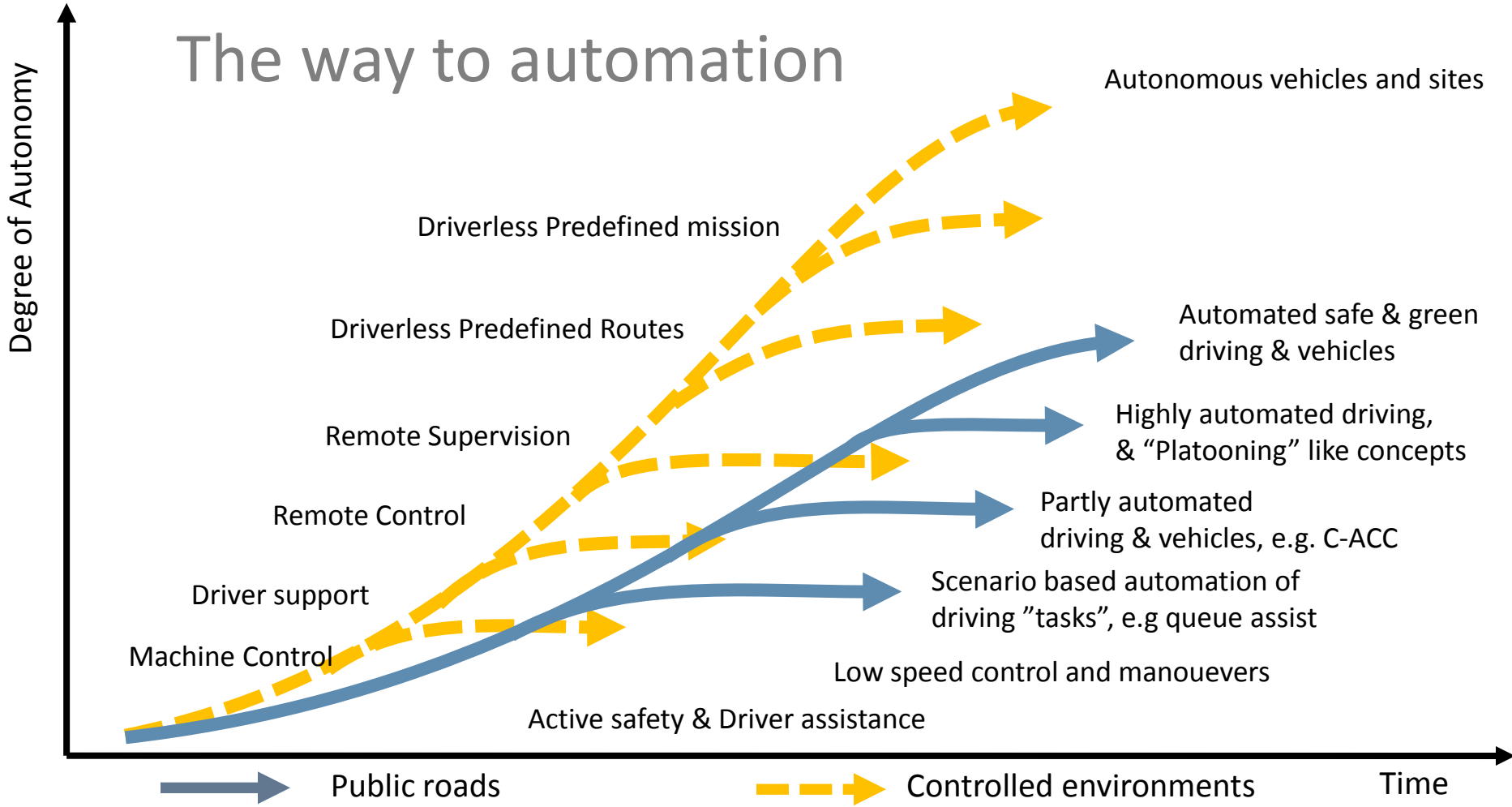
Compaction equipment

Crawler excavators

Articulated haulers

Motor graders

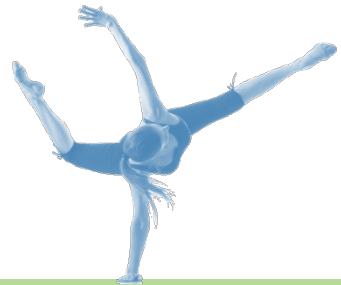
The way to automation



What it looks like



External Autonomous Production Asphalt Mill.mp4



Automation Challenges

Customer needs & application scenarios



User acceptance, liability & legal framework

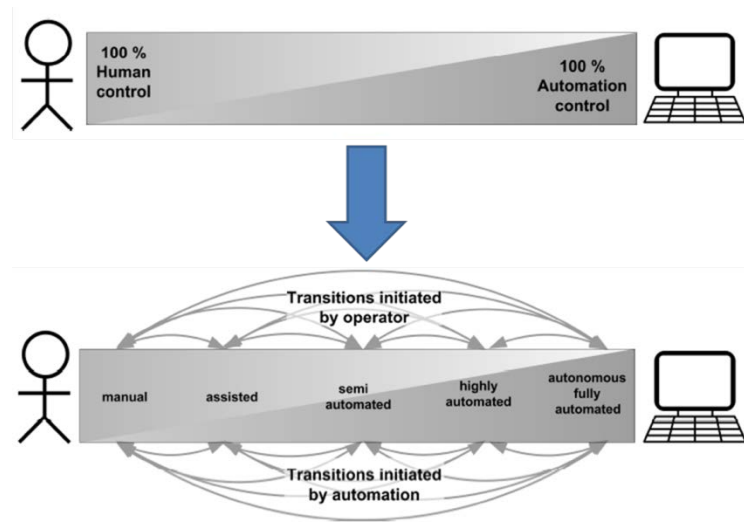
Technology, opportunities, limitations & dependability

Production / logistic & fleet management



From “either/or”-automation to shared control

- *focus on transitions*
- *driver or system initiated*
- *intended or unintended*



Flemisch et al, 2010

Challenges to Manage

Several areas require industry collaboration

Investment and product cost

System reliability

System compatibility (mixed fleets)

Standardization

Regulations



Construction Equipment will reshape the land and form the future sustainable society



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CONSTRUCTION EQUIPMENT