Use of Autonomous Vehicles in the Concrete Ready Mix Industry

BUILD WITH STRENGTH

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Driving Toward the FUTURE

Mitchell Corbin - Ozinga Ready Mix - Milwaukee, WI

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The Past

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The Past

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The Present

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The Future…

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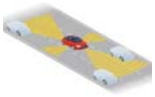
The Past

The Present

Autonomous Vehicles!

Autonomous Features!

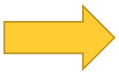


Autonomous Vehicles!

Present Day Features!

- Back-up Cameras
- Blind Spot Identifiers
- Emergency Braking
- Lane Detection
- Stability Control
- Self Slumping Drums

Enhanced Safety



Enhanced Safety

Enhanced Safety

Autonomous Vehicles!

Futuristic Possibility!

- Platooning
- Vehicle 2 Vehicle Communication
- Ready Mix trucks driving themselves (Driverless)
- Robotic Ready Mix trucks

Automated Water & Slump Control

Measure, Manage and Record Concrete Slump and Quality in the Truck

•Produce consistent quality concrete,
• Every step monitored and controlled.
•Tools needed to control the longest period… transportation.

That's where Automated Slump Control comes in:

•Collects critical measurements
•Securely stores that data.
•Automatically adds water and admixture to reach target slump.
•Communicates relevant data to optimize operations.
•Stores a detailed record of each load's quality

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Goals of the Program

Primary Goal: QUALITY

- Deliver quality concrete that meets the project specifications
- Deliver consistent quality concrete – every truck

Second Goal: OPTIMIZE MATERIAL USAGE

- Reverse the trend toward overdesign
- Reduce material usage costs

Third Goal: IMPROVE PRODUCTIVITY

- Arrive on the job site at target slump
- Visibility into Load to Gate, Wait Times, Washout Times
- Accelerate driver training time

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5 Levels of Autonomous Driving

- US Department of Transportation's National Highway Traffic Safety Administration (NHTSA)
- Levels 0-4

NHTSA
www.nhtsa.gov

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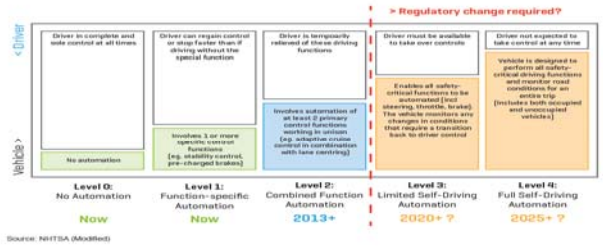
Levels of driving automation (NHTSA)



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Brian Goeken – Aggregate Industries – Lakewood, CO

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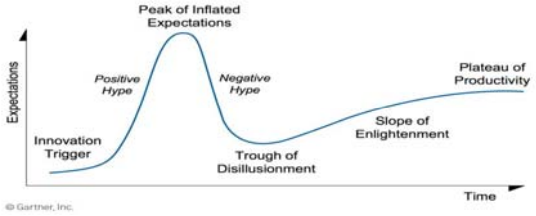
Practicality



Ready Mix Trucks and the Future of Autonomous Trucks

- Level 0-2 – Now (P)
- Level 3 – Near Future (P)
- Level 4 –Distant Future(NP)

Level 4 Not Practical

Level 4 – New Legislation

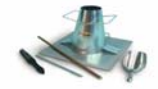
- Trumps "America Infrastructure First" Policy
- V2V Communication Regulations

Level 3 – Why is Practical

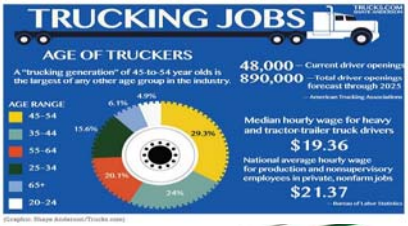
- Safety
- Cost Efficient
- Driver Retention/Recruitment

Safety

Cost Efficient



Driver Retention / Recruitment



Driving Toward the

David Williams – Ferrara Bros. US Concrete – Flushing, NY

Associated Cost & Implementation

Potential Benefits

- Significant user convenience
- Safety
- Fuel Savings
- Pollution Reduction benefits
- Driver optimization and retention

Potential Disadvantages

- With people feeling safer because of the technology they may become more complacent.
- Vehicle occupants may reduce seatbelt use
- The cost associated with implementation of this technology.

Implementation

- To get these autonomous vehicles on the road the cost are uncertain.
- Rigorous test need to be conducted on the sensors and vehicles components.

Benefits	Cost / Problems
• Reduced driver stress and allow him to rest and work while he is travelling. • Reduced cost of paid drivers. • May reduce many common accident risks and therefore crash cost and insurance premiums. • May reduce fuel efficiency and reduce pollution emissions.	• Requires additional vehicle equipment, services and maintenance. • May introduce new risk s, such as system failures, be less safe under certain conditions, and encourage road users to take additional risks. • Maybe used for criminal and terrorist activities (such as bombing), vulnerable to information abuse, and features such as GPS tracking and data sharing may raise privacy concerns. • Jobs for drivers could decline, and there may be reduced demand for vehicle repairs.

Vehicle Technology Deployment Summary

Name	Deployment	Typical Cost Premium	Market Saturation Share
Air Bags	25 years (1973-98)	A few hundred dollars	100% due to federal mandate
Automatic Transmissions	50 years (1940's-90's)	$1500	90% U.S., 50% worldwide
Navigation Systems	30+ years (1985-2015+)	$500 and rapidly declining	Uncertain; probably over 80%
Optional GPS Services	15 years	$250 annual	2-5%
Hybrid Vehicles	25+ years (1990's-2015+)	$5000	Under 10%
Autonomous Vehicles	2016-?	Automation Levels Vary	Less than 2%

Autonomous Vehicle Implementation Projections

Stage	Decade	Truck Sales	Truck Fleet
Available with large premium	2020's	2-5%	1-2%
Available with moderate price premium	2030's	20-40%	10-30%
Available with minimal price premium	2040's	40-60%	30-50%
Standard feature included on most new trucks	2050's	80-100%	50-80%
Saturation (everybody who wants it has it)	2060's	?	?

Driver Retention, Optimization, and Job Creation

- Attract new and younger drivers
- Create new job opportunities for existing drivers
- Open the door to new job oppertunities in the ready mix industry

Cost

- How much will it cost
- Is this cost efficient
- When and how would this be possible

Conclusion

- There is considerable uncertainty concerning autonomous vehicle benefits, cost and travel impacts
- Current automated vehicles can only self drive under limited conditions
- Vehicle innovations tend to be implemented more slowly than other technologies changes de to their high cost, slow fleet turnover and strict safety concerns
- Autonomous vehicles are the way of the future how fast they are implemented and how wide spread they are depends on us

Questions

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