Use of Autonomous Vehicles in the Concrete Ready Mix Industry

Driving Toward the Future...

Mitchell Corbin - Ozinga Ready Mix - Milwaukee, WI

The Past

The Present

The Future...
The Past

The Present

Autonomous Vehicles!

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

Enhanced Safety

Autonomous Features!

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 of transportation.

That’s where Automated Slump Control comes in:
• Collects critical measurements
• Secures data storage
• Automatically adds water and admixture to reach target slump.
• Communicates relevant data to optimize operations.
• Stores a detailed record of each load’s quality

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

5 Levels of Autonomous Driving

• US Department of Transportation’s National Highway Traffic Safety Administration (NHTSA)
• Levels 0–4

Driving Toward the

Brian Goeken – Aggregate Industries – Lakewood, CO
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 3 – Why is Practical

- Safety
- Cost Efficient
- Driver Retention/Recruitment

Level 4 – New Legislation

- Trump’s “America Infrastructure First” Policy
- V2V Communication Regulations

Level 4 Not Practical
Cost Efficient

Driver Retention/Recruitment

Driving Toward the

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
• Reduced driver stress and allow him to rest and work while he is travelling.
• May reduce many common accident risks and therefore save costs, time and insurance premiums.
• May reduce fuel efficiency and reduce pollution emissions.

Cost/Problems
• Requires additional vehicle equipment, services and maintenance.
• May introduce new risks, such as software failure, for less safe under certain conditions, and even more risk may arise if additional risks.
•May be 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.
• May reduce many common accident risks and therefore reduce crash cost and insurance premiums.
• May reduce fuel efficiency and reduce pollution emissions.

Vehicle Technology Deployment Summary

<table>
<thead>
<tr>
<th>Name</th>
<th>Deployment</th>
<th>Initial Cost Premium</th>
<th>Market Saturation Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Bags</td>
<td>25 years (1973-98)</td>
<td>A few hundred dollars</td>
<td>100% due to federal mandate</td>
</tr>
<tr>
<td>Automatic Transmissions</td>
<td>50 years (1940's-90's)</td>
<td>$6000</td>
<td>80%+, i.e., 50% worldwide</td>
</tr>
<tr>
<td>Navigation Systems</td>
<td>30+ years (1985-2015+)</td>
<td>$500 and rapidly declining</td>
<td>Uncertain, probably over 80%</td>
</tr>
<tr>
<td>Optional GPS Services</td>
<td>15 years</td>
<td>$200 annual</td>
<td>0-1%</td>
</tr>
<tr>
<td>Hybrid Vehicles</td>
<td>25+ years (1990's-2015+)</td>
<td>$5000</td>
<td>Under 10%</td>
</tr>
<tr>
<td>Autonomous Vehicles</td>
<td>2016-?</td>
<td>Automation Level 9 Very</td>
<td>Less than 2%</td>
</tr>
</tbody>
</table>

Autonomous Vehicle Implementation Projections

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimate</th>
<th>Truck Rates</th>
<th>Truck Fleet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available with large premium</td>
<td>2010's</td>
<td>2-5%</td>
<td>2-7%</td>
</tr>
<tr>
<td>Available with moderate price premium</td>
<td>2010's</td>
<td>20-40%</td>
<td>10-30%</td>
</tr>
<tr>
<td>Available with external price premium</td>
<td>2010's</td>
<td>80-90%</td>
<td>50-60%</td>
</tr>
<tr>
<td>Standard feature included on no price basis</td>
<td>2010's</td>
<td>50-100%</td>
<td>50-60%</td>
</tr>
<tr>
<td>Standard feature included on low price basis</td>
<td>2010's</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Driver Retention, Optimization, and Job Creation

• Attract new and younger drivers
• Create new job opportunities for existing drivers
• Open the door to new job opportunities 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 change due 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 widespread they are depends on us
Questions

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