Platooning: Real Safety, Real Savings

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How Safe is “Safe”

Goal: Safer after pushing button than before
Foundation in Safety

Goal: Not Just Safer Overall, but also:

- Safer even than trucks equipped with CMS/AEB
- Safer in key types of situations:
  - Lead truck hard braking
  - Lead truck collision
Situation:  Front truck hard braking
Situation: Front truck collisions
How We Make Platooning Safe

- Safe Functionality:
  - V2V+V2Cloud
- Safe Design/HW/SW:
  - ISO26262
- Safe Driver:
  - UI, UX, Driver Study
Manual Following

- Safe following distance is many hundreds of feet
- Real world following distances much shorter → Collision rate significant
- Many collisions at high impact velocity
Radar/Lidar Following

- Reduces to ~300ft safe distance
- In real world, cut in vehicles frequently reduce following distance: Average of <200ft following distance
- Lower but still significant collision rate
- Mitigates impact velocity of many collisions
Platooning

- Brings following distance down to 30-50ft
- Reduces cut-ins → Maintain platoon most of the time
- Our data/analysis suggests:
  * Collisions can still occur, but lower rate
  * Impact velocity reduced in most cases
Power of V2V
Applying ISO 26262* to Platooning

ISO used to create traceable design requirements for V&V

- **Item Def**: specifies functional concept and Operational Design Domain (ODD)

- **HARA**: identifies hazardous scenarios based on Item Def and generates Safety Goals and ASIL ratings

- **Functional Safety Concept (FSC) and Functional Safety Requirements (FSRs)**: high level strategy, FSR and ASIL allocation to system components.

- **Technical Safety Concept (TSC) and Technical Safety Requirements (TSRs)**: Specification of Safety Mechanism into testable requirements

Ensure Design/EE issues are below safety goal threshold
How We Test

SIL  Closed Course

HIL  Road

All tied to ISO26262-Derived Requirements
Impact of platooning on drivers’ attention

Driver Stimuli

- Standard Driving Tasks
  - Steering, Awareness
- Platoon Control
  - Monitor, draw-in, dissolve
- Lead Truck Video Feed
  - Follow driver scan (similar to mirror)
- Driver Communication
  - Teamwork, sharing information, planning

Driver Attention?

- Peloton Experience
  + Formal Studies

Empirical evidence has shown no impact on the follow driver of long duration platooning.

Working with a university on simulator and on-road studies. Initial simulator results indicate steady attention factors during platooning such as heart rate, reaction time and eye gaze.
Real Savings
How do we get two trucks together?
Maximize Platooning Usage

Long-Term

Ubiquitous Platooning

- Density creates opportunities
- Cross-fleet, cross-shipper
- Opportunistic in addition to scheduled
Maximize Platooning Usage

Low Hanging Fruit

- Pairs (or more) of trucks from within the same fleet
- Typical in LTL, dedicated, linehaul, relay style operations

Long-Term

Ubiquitous Platooning
Maximize Platooning Usage

Low Hanging Fruit

- Intra-Fleet

Facilitated/Coordinated

- Major Shippers
- Brokerages/3PLs
- Peloton NOC
- Telematics Partnerships

Ubiquitous Platooning

Long-Term