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21–25 October

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Truck Platooning Project in Japan

Transforming Freight Movements through ITS – Part II (SIS30)

Kenji UEKI
Ministry of Economy, Trade and Industry
JAPAN

AGENDA

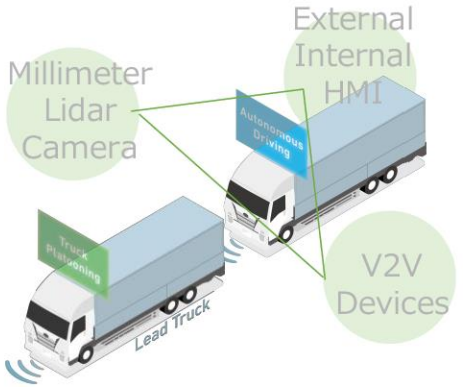
1. Concept
2. Project Contents
3. Truck Platooning Roadmap of Japan
4. Interim report,2018
5. Result of Interviews and Questionnaires, 2018
6. Plan 2019
7. Field Operational Test by private company in confined area

1. Concept

a concept of truck platooning system

Truck Platooning consists on several trucks driven by smart technologies and mutually communicating, forming a group in which the elements follow each other at short distances (less than 10 meters instead of 50 meters usually allowed). Truck platooning is full of potential for the road transport sector, involving improvements in traffic safety, costs saving in terms of fuel consumption and CO2 emissions, boosts of traffic flows and infrastructure capacity.

Internal HMI



Truck Platooning System

Platooning Operation Center

CACC Trial With drivers

CACC+Lead Truck Following without drivers Japan

※HMI：Human Machine Interface　CACC：Corporative Adaptive Cruise Control　V2V: Vehicle to Vehicle

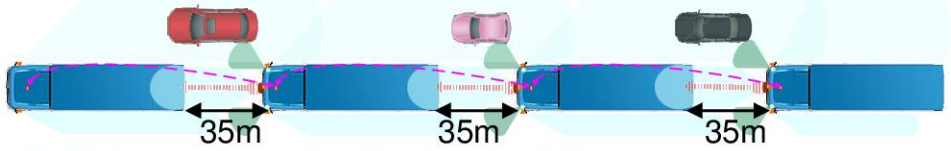
2. Project Contents

Working packages and Participants

Technical Dev. Truck Platooning System

CACC+LKA Truck Platooning w drivers

Time To Collision :1.6 sec 80km/h



CACC : Acceleration deceleration data transmission
LKA : Lane Keep Assist System by each OEM

HINO ISUZU FUSO UD TRUCKS

1. The world first 4 brands trucks CACC with LKA
2. LED light and painted body as External HMI
3. Total appx 3300km track record since 2017

CACC+ Lead Truck Following System

Time To Collision :0.5 sec 70km/h

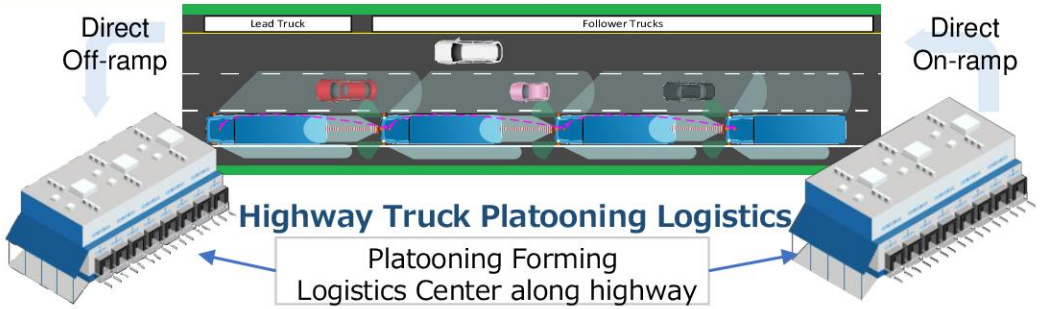
CACC + Steering information transmission as following system called electronic tethered convoys

HINO ISUZU Advanced Smart Mobility Co.,Ltd. DENSO JTEKT FUJITSU WABCO Nabtesco SoftBank

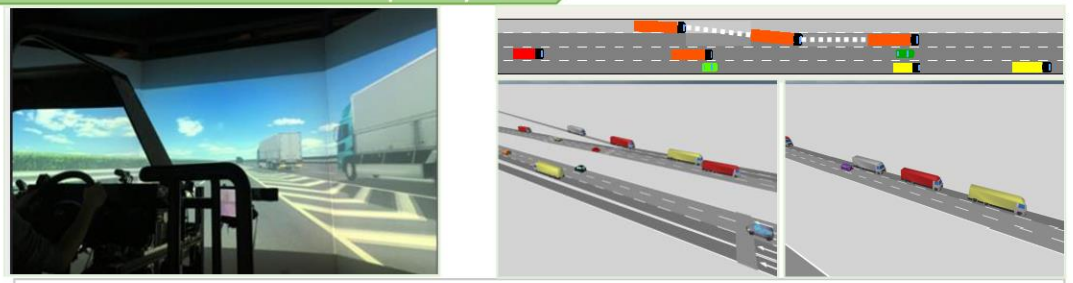
1. The world first demonstration of 3 trucks following system
2. Internal HMI, electronic mirror system as driver support
3. Total appx. 2200km track record in TOMEI expressway

Related Study

Business Model Study



Simulation: social receptivity



1. Driving simulation test for general drivers
2. Impact analysis by traffic microsimulation
3. Interview survey is conducted during demonstrations

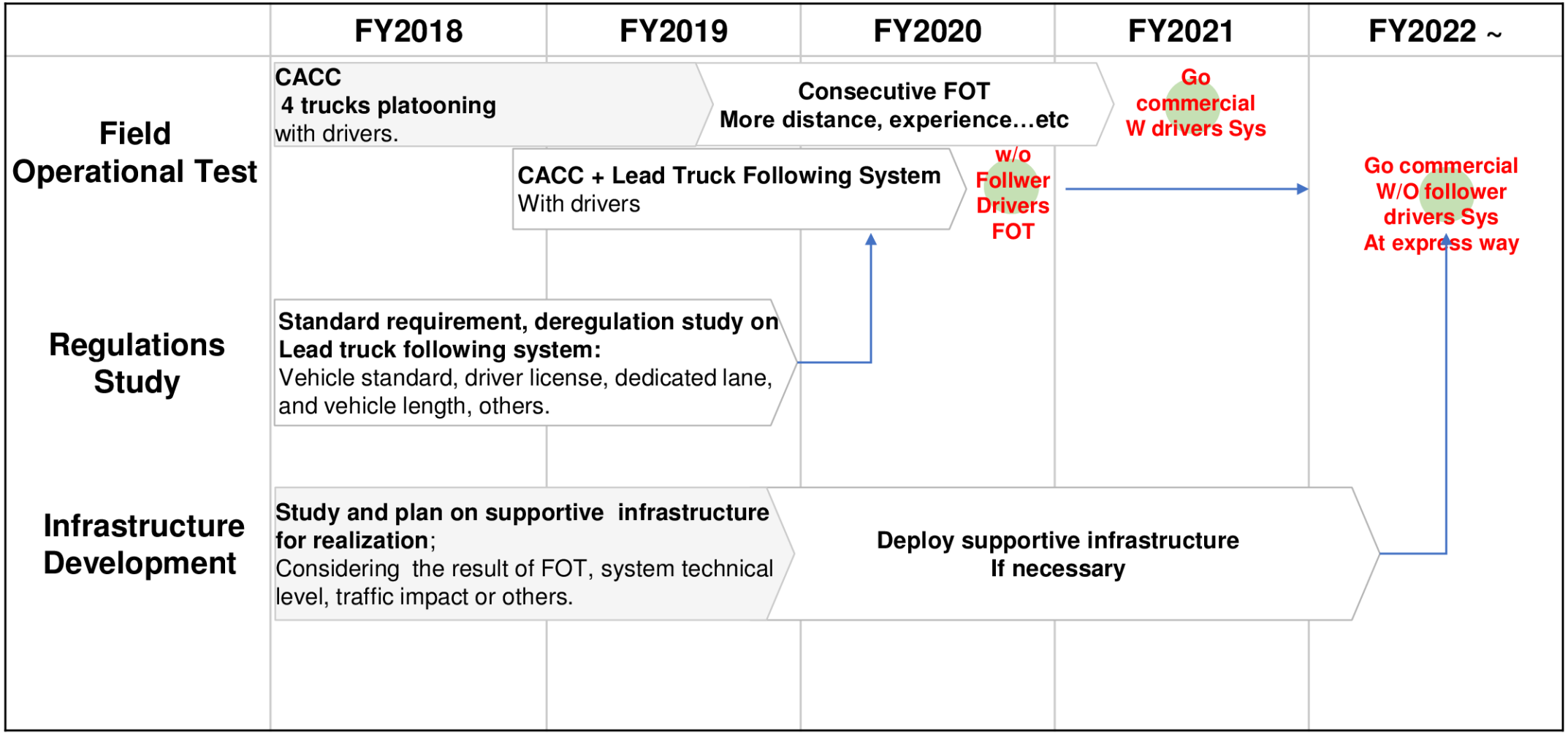
Legislation deregulation

Road Traffic Act	**Safety distance, Towing, Safety driving duty, Lane use control**
Vehicle Regulations Order	**Vehicle length**
Road Trucking Vehicle Act	**Safety Standard**
Radio Act	**V2V, V2I Communication**

Under discussion for actual implementation of platooning system

3. Truck Platooning Roadmap of Japan

Platooning development roadmap by Cabinet

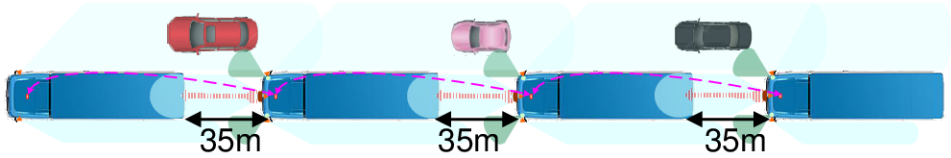


4. Interim Report, 2018

CACC 4 Trucks Platooning FOT

CACC+LKA Truck Platooning w drivers

Time To Collision :1.6 sec 80km/h



CACC : Acceleration deceleration data transmission
LKA : Lane Keep Assist System by each OEM

Participants

HINO ISUZU FUSO UD TRUCKS DENSO

1. The world first 4 brands truck CACC with LKA
2. LED light and painted body as External HMI
3. Total appx 3200km track record since 2017

2018 FOT Result –technical-

JOSHINESTU Expressway

Objectives	CACC System verification under severe conditions: road perspectives
Period	6th to 22nd,Nov, 2018
Location	Part of Joshin-etsu exwy: 120km
Record	3000km
Loading	Mixed




Result: CACC connection is stable under severe condition (gradient 6%, over 4km tunnel)

Identified Issues	Unstable vehicle distance
	How to deal with merging points

SHIN-TOMEI Expressway

Objectives	CACC with LKA operability
Period	4th to 6th,Dec, 2018
Location	Shin-Tomei exwy: 15km
Record	230km
Loading	Unloaded

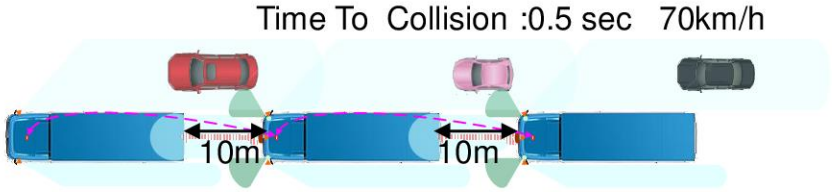

Result: Successful basic system operation

Identified Issues	Difficulties of detecting faded white lane or merging point of lanes
	more visibility is needed for External HMI at night

4. Interim Report, 2018

CACC +Lead Truck Following System FOT

CACC+ Lead Truck Following System



CACC + Steering information transmission as following system called electronic tethered convoys

Participants

HINO ISUZU Advanced Smart Mobility Co.,Ltd. DENSO JTEKT
FUJITSU WABCO Nabtesco SoftBank

1. The world first demonstration of 3 trucks following system
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2018 FOT Result –technical-

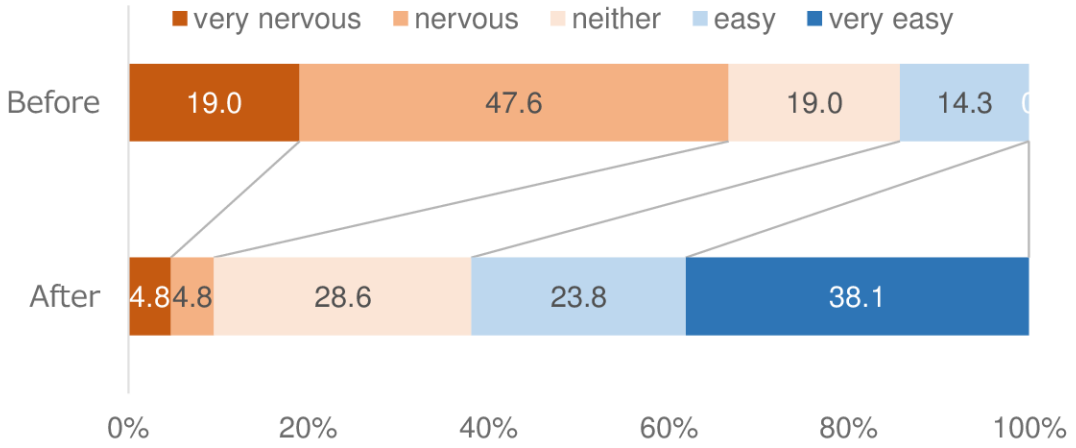
Objectives	CACC + lead truck following system operability on expressway
Period	22nd Jan, to 26th Feb, 2019
Location	Shin-Tomei exwy: 15km
Record	2200km
Loading	Unloaded

Result: As a first step of system realization at limited section of expressway, system functioned properly. 2 follower trucks kept 10m gap and followed the lead truck at all scene, including inside parking area and lane change control. However, system is still under developing, needs more validation in real environment

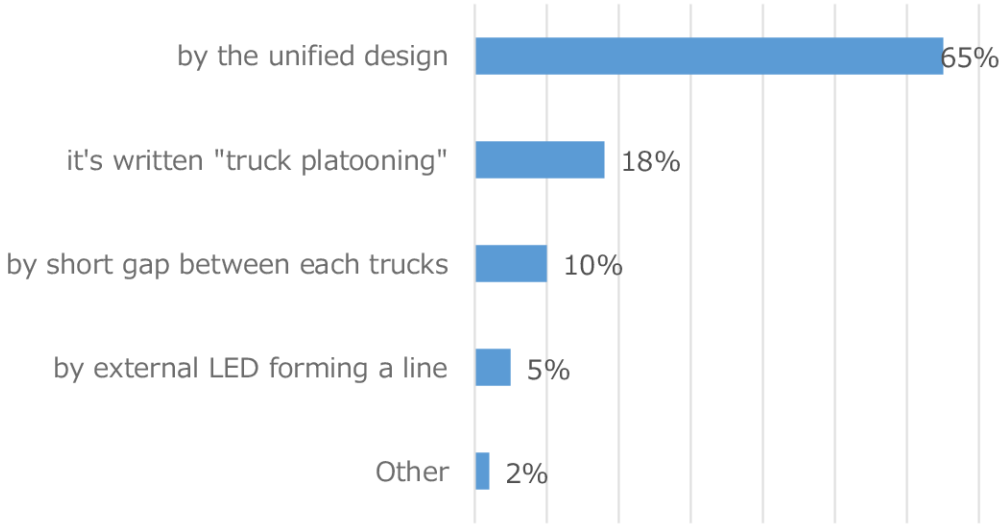
5. Results of Interviews and Questionnaires, 2018

Test Course, The site and WEB

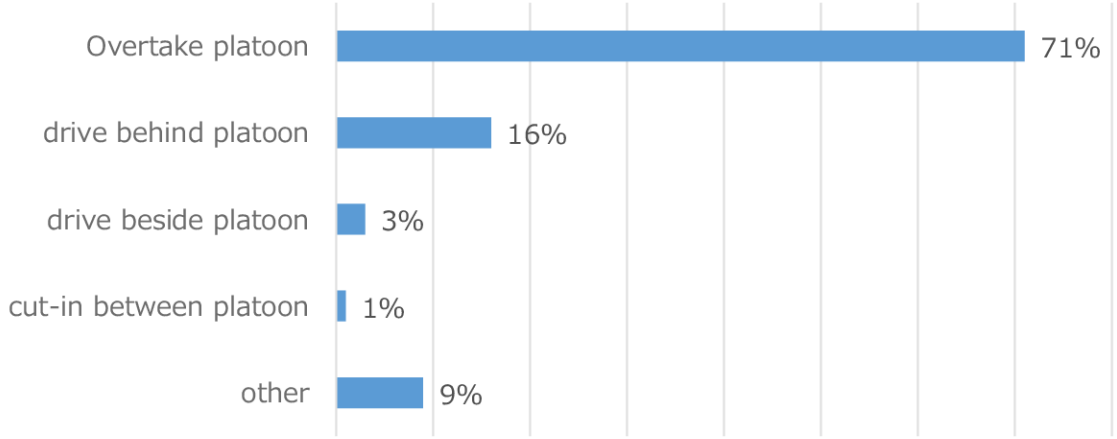
Changes of impression before and after watching actual truck platoon on highway.



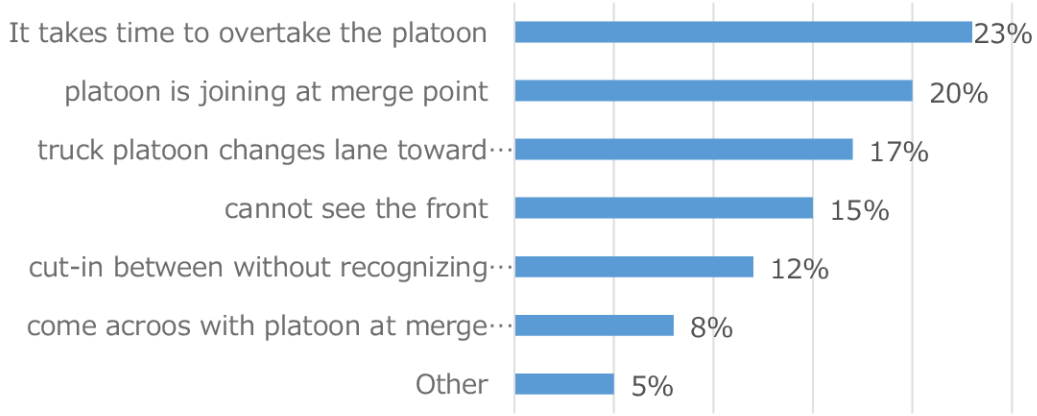
How did you recognize the truck platoon ?



What was your action taken after finding the truck platoon on highway?



What scene or behavior of truck platoon do your concern ?

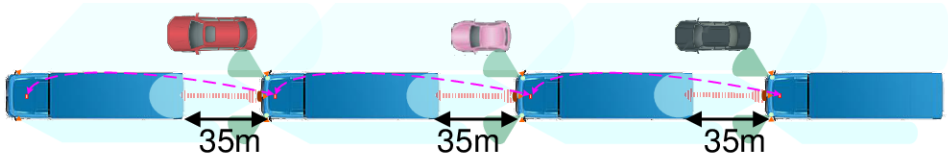


6. Plan 2019

Action items

CACC+LKA Truck Platooning w drivers

Time To Collision :1.6 sec 80km/h



Issued Focused 1	Unstable vehicle distance cause of performance differences of trucks
Issued Focused 2	How to deal with merging points, especially, encountering large sized vehicles

2019 Plan –Project Working Packages-

WP 1: V2V system improvement

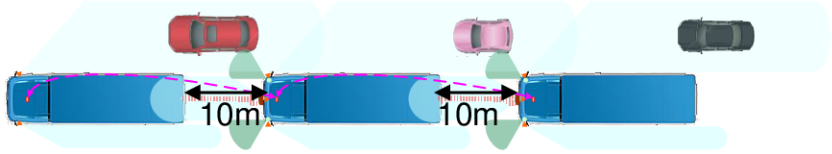
Improve system including V2V communication module for longitudinal control of multi-brand truck platooning.

WP 2: FOT at night time

FOT 2019 set night time since large sized vehicle ratio is higher than day time to manage encountering situation.

CACC+ Lead Truck Following System

Time To Collision :0.5 sec 70km/h



Issued Focused 3	Develop more matured system to adapt actual road condition/ environment

2019 Plan –Project Working Packages-

WP 3: System Development

Continuous technical development and verify technology.

WP 4: Continuation FOT

Proceed further FOT with longer period and distance in order to improve system reliability.

7. Field Operational Test by private company in confined area

UDT held a FOT of SAE-Level 4 automation in confined area with supported from Hokkaido Pref. Government.

UD TRUCKS

Object

- Verify a safety and reliability of Level 4 automation technologies under various environments.
  - ➔ Road condition, Weather, GPS reception…
- Extract an issue about a practical ODD design.
- Demonstrate Level 4 automation in confined area to apply to an agriculture transportation.

Hokuren Nakashari sugar plant

Outline

Date: Aug. 5th ~ 29th 2019

Venue: Hokuren Nakashari sugar plant
➔ Hokkaido, Shari-cho

Operational Design Domain (ODD):
- Simulate an actual pickup route of the sugar beets
- Confined area which is no vehicle and pedestrian
  - ➔ Closed public road & in the plant

Base truck : UDT Quon 6x4 (GVW-22t)

Level 4 Automation:
- Network RTK-GPS for positioning and navigation
- Safety driver is on board
- 20km/h (max speed)

https://www.youtube.com/watch?v=y7xO33RinaY&feature=youtu.be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