The Cross-ministerial Strategic Innovation Promotion Program (SIP) Phase 2／Automated Driving for Universal Services／Field Test and evaluation for improving logistics efficiency based on architecture utilizing vehicle information such as probes

Summary report

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Overview of the verification survey project

For the purpose of exploring the possibility of effectively utilizing vehicle information such as probes in truck logistics operations, we conducted a verification survey, sorted out issues and considered countermeasures for implementation, using three use cases.

Use case 1 : Understanding the status of cargo waiting time and sharing among related parties

⇒Providing information for measures to reduce cargo waiting time

Use case 2 : Confirmation of daily inspection items using information such as probes

⇒Improving working hours by streamlining daily inspections

Creation of labor-saving methods for daily inspections after implementation of automated driving

Use case 3 : Understanding load weight/tire data for ensuring safety

⇒Ensuring compliance
Pursuit of safe driving

Verification surveys of 3 use cases

Use case 1：Understanding the status of cargo waiting time and sharing among related parties

【Purpose of this use case】

- Improvement of cargo waiting time by utilizing information obtained from operation management data

【Current situation】

- Trial calculation of cargo waiting time for drivers who are waiting for cargo
  - ✓ Cargo waiting time per operation in operations with cargo waiting: 94 minutes (Composition ratio of time during one operation: 12.6%)
  - ✓ Annual cargo waiting time for drivers with cargo waiting: Estimated 310 hours (assuming 200 days of operation per year)

【Goal】

- Reduce the waiting time for cargo at one location to within 30 minutes

(Waiting for more than 30 minutes due to the shipper's circumstances will be recorded as a long waiting time in the "crew record")

【Analysis of current situation and verification survey】

- Analyze the occurrence of waiting time for cargo from the operation management data of the digital tachograph and provide information to the trucking companies and its shipper companies.
- By providing this analysis data, we aim to share the recognition of both trucking companies and shipper companies regarding the occurrence of waiting times for shipments and promote understanding of the causes of long waiting times, consideration of improvement and reduction measures through discussions between them.

Use case 1：Understanding the status of cargo waiting time and sharing among related parties②

【Method of verification】

Explain the purpose to the target trucking company and shipper company, request provision of operation management data related to cargo of the shipper company, and obtain approval.

▽

After the transportation company corrects the operation management data of the digital tachograph using shipping results, etc., the data is provided to our company.

▽

Data analysis and documentation at our company

▽

After explaining the details of the analysis to the trucking companies and shipper companies, the three companies including our company exchanged opinions on the actual situation of waiting times and target sites.

▽

Validate the effectiveness of analysis of causes of waiting time for shipment and consideration of improvement measures

<Materials for confirming the status of waiting times at bases where long waiting times often occur>

(Specific site names are not disclosed)

Place	Stopover	Day	Waiting start time	Waiting time
A	3/2	Wed	9:38	1:14
	3/4	Fri	10:41	0:10
	3/7	Mon	9:43	1:34
	3/8	Tue	10:02	0:05
	3/8	Tue	11:06	2:09
	3/10	Thu	9:19	0:14
	3/11	Fri	10:36	0:13
	3/24	Thu	9:42	0:10
	4/12	Tue	13:53	0:07
	4/19	Tue	8:48	2:03
B	3/1	Tue	11:42	0:44
	3/2	Wed	9:55	1:51
	3/5	Sat	7:48	2:50
	3/7	Mon	10:14	0:14
	3/11	Fri	8:46	1:58
	3/14	Mon	9:27	1:09
	3/29	Tue	9:02	0:47
	4/1	Fri	10:56	1:54
	4/2	Sat	8:56	0:08
	4/6	Wed	11:39	0:10
	4/8	Fri	9:12	2:14
	4/25	Mon	7:10	1:27

Use case 1：Understanding the status of cargo waiting time and sharing among related parties③

【Verification/confirmation items】

- By utilizing the operation management data of the digital tachograph corrected with related data (shipment data, etc.), we were able to analyze the sites and time zones with frequent waiting times.
- We were able to promote understanding of the causes of waiting for cargo at sites where long waiting times occur and examination of improvement measures by trucking companies and shipper companies.
- It was confirmed that the correction and analysis of operation management data is a heavy burden for the operation manager of the trucking company.

【Hypothesis】

- Expected effect of reduction of waiting times for drivers

<The total number of vehicles surveyed this time, the number of vehicles with long waiting times, the number of long waiting times, and the average waiting time>

No. of vehicles	No. of vehicles with waiting
656	374

No. of vehicles with long waiting time	No. of long waiting times	Average waiting time (minutes)
157	179	68

✓ A total of 157 vehicles (24% of the total) were waiting for a long time (30 minutes or more).
✓ Of the 179 cases of long waiting times, the average waiting time was 1 hour and 8 minutes (68 minutes).

(Continued on next page)

Use case 1：Understanding the status of cargo waiting time and sharing among related parties④

(Continued from previous page)

- ✓ If all long waiting times can be suppressed within 30 minutes, an average reduction of 38 minutes per case (68 minutes - 30 minutes)
  - ⇒ Reduction of 6,802 minutes (38 minutes x 179 cases) for the total number of hours of long waiting times confirmed in this survey
  - ⇒ Of the 157 vehicles that were waiting for a long time in this survey, long waiting times can be reduced by 43 minutes per vehicle.(6,802 minutes ÷ 157 units)

→Assuming that the number of days of truck operation per year is 200 days, and that the vehicles that are waiting for a long time have the same number of hours of waiting every day.

Expected effect of reduction in annual cargo waiting time per vehicle: 143 hours(43 minutes x 200 days ÷ 60 minutes ≒ 143 hours)

* It is assumed that the trucking companies and the shipper companies can work together to understand the causes of waiting times and formulate improvement measures.
* This trial calculation is a trial calculation of the average reduction effect of long waiting times for vehicles with long waiting times (157 vehicles (24%) out of the total number of 656 vehicles surveyed this time), and it is not the average reduction effect of waiting times of all vehicles

Trucking companies use materials that can confirm the actual cargo waiting situation by numerical values and specific site names, so that the shippers/consignees can objectively understand the actual situation of cargo waiting, aiming to eliminate long waiting times, being able to acquire "benefits" that it will lead to the promotion of consultations.

Use case 2:Confirmation of daily inspection items using vehicle information such as probes①

【Purpose of this use case】

- Improving the working hours of truck drivers by streamlining daily inspections
- Standardization of daily inspection work for truck drivers
- Creation of a labor-saving daily inspection method in anticipation of the implementation of automated driving

【Current situation】

- Required time for daily inspection, etc. (trial calculation estimate)
  - ✓ 25 minutes/time per service (From a 2021 survey by MLIT)
    ⇒Time required for daily inspection annually 83 hours
    (25 minutes x 200 days ÷ 60 minutes ≒ 83 hours, assuming that the driver's annual operating days are 200 days)

【Goal】

- Shorten the time required for daily inspections by half
- Standardization of daily truck inspection work

【Analysis of current situation and verification survey】

- In confirming daily inspection items, we will verify the possibility of using vehicle information such as probes.

Use case 2:Confirmation of daily inspection items using vehicle information such as probes②

【Method of verification】

Select daily inspection items that can be expected to be confirmed using vehicle information such as probes (Refer to the left table on the next page)

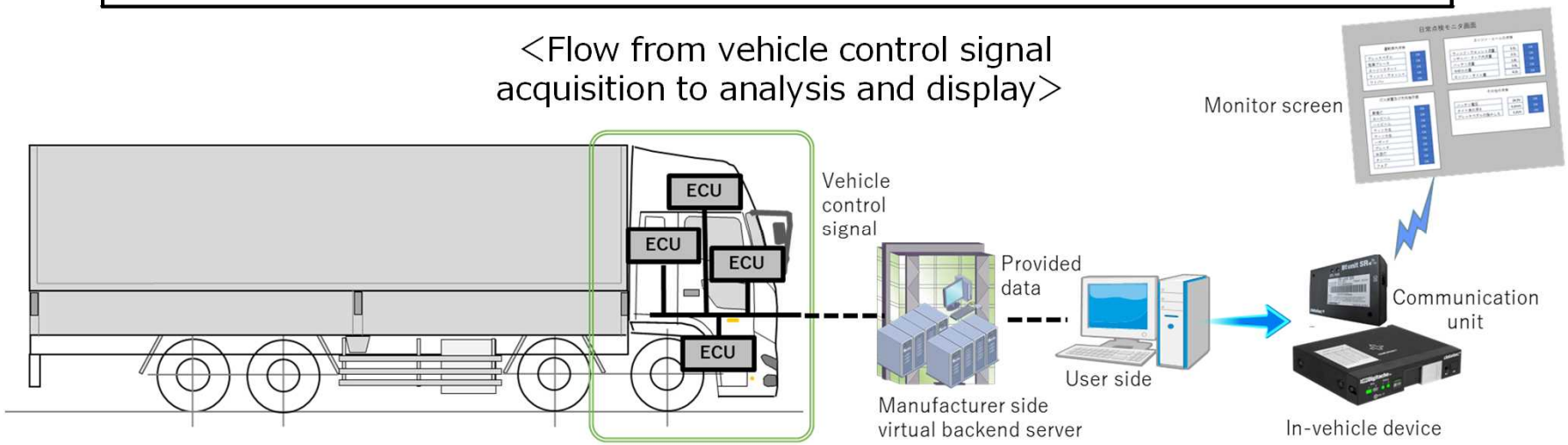
▽

Among the above selected items, vehicle control signals that can be extracted from the test vehicle model are filed and acquired (see right on next page)

▽

Reproduce the filed vehicle control signals and check the vehicle status related to the daily inspection items corresponding to the signals on the monitor screen.

<Flow from vehicle control signal acquisition to analysis and display>



Use case 2:Confirmation of daily inspection items using vehicle information such as probes③

<Daily inspection items and vehicle control signals targeted for verification this time>

Inspection point		Inspection item	Direction of utilization of vehicle information such as probes
Abnormal location during operation		Abnormality of the relevant parts	Not applicable as they are visually inspected.
Inspection in the driver's seat	Break pedal	Stepping margin, brake effect	Items that do not require inspection for large trucks (air brake vehicles).
	Parking Brake Lever	Pull margin (stepping margin)	Use of pneumatic pressure signals can be considered. Alternative utilization can be considered by checking the change in air pressure instead of the air discharge sound.
	Prime mover (engine)	*Condition of the engine, abnormal noise	Utilization of engine tachometer signal and accelerator opening signal can be considered.
		*Low speed, acceleration condition	Same as above
	Wind washer	*Injection condition	The use of windshield washer switch signals can be considered.
	Wiper	*Wiping condition	For actuation, the use of wiper switch signals can be considered.
			The wiping condition is out of scope as they are visually inspected.
	◎Air pressure gauge	Rise in air pressure	Use of the air tank pressure signal can be considered.
	◎Brake valve	Exhaust sound	Use of the air tank pressure signal can be considered. Alternative utilization can be considered by checking the change in air pressure instead of the air discharge sound.
Inspection of the engine room	Wind washer tank	*Liquid volume	If there is a warning light for insufficient liquid level, alternative use of the warning light can be considered.
	Brake reservoir tank	Liquid volume	Items that do not require inspection for large trucks (air brake vehicles).
	Battery	*Liquid volume	If there is a warning light for battery voltage, alternative utilization of the warning light can be considered.
	Cooling devices such as radiators	*Water volume	If there is a cooling water warning light, alternative use of the warning light can be considered.
	Lubricator	*Engine oil quantity	Same as above
	△ Fan belt	*Tension, damage	In the case of the auto-tensioner type, it is not possible to check the deflection.
Inspection from around the vehicle	Lighting device, direction indicator	Lighting/blinking condition, dirt, damage	It is possible to consider using signals such as headlights (Low), headlights (Hi), taillights, brake lights, width lights, direction indicators, hazards, number lights, etc.
			Dirt, damage, etc. on lenses, etc. are out of scope as they are visually inspected.
	Tire	Air pressure	Tire inspections are out of scope as they require visual inspection and work.
		□Mounting condition	
		Crack, damage	
		Abnormal wear	
		Extraneous objects such as metal pieces and stones	
		*Groove depth	
	◎Aire tank	Condensation in the tank	Confirmation by vehicle signal is not possible. These are items that actually need to be manipulated.
	◎ (Brake pedal)	*(Stepping margin, brake effect)	Confirmation by vehicle signal is not possible. These are items that actually need to be manipulated.

Acquired vehicle control signal

①Parking brake signal

②Engine speed signal

③Accelerator pedal opening signal

④Wind/washer/switch signal

⑤Wiper/switch signal

⑥Air tank pressure signal

⑦Low cooling water signal

⑧Lighting signals

(Car width lights, headlights, taillights, number lights, direction indicators, emergency flashing indicator lights, reversing lights)

Use case 2:Confirmation of daily inspection items using vehicle information such as probes④

【Verification/confirmation items】

- By using the eight vehicle control signals provided by the experimental truck, the vehicle status related to the target daily inspection items could be displayed and confirmed on the monitor screen.
  ⇒By doing this, it was verified that there is a possibility that truck vehicle control signals can be used to confirm daily inspection items in the future.

【Target vehicle control signal】

【Target probe data】

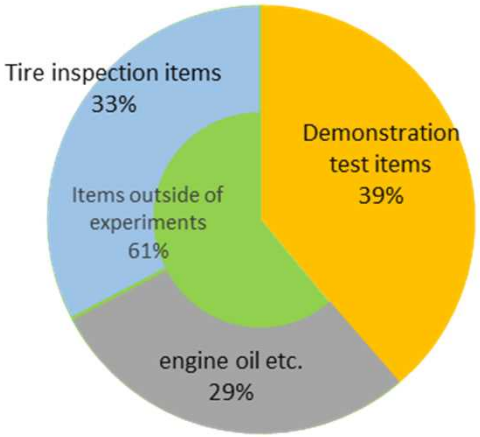
①Parking brake signal
②Engine speed signal
③Accelerator pedal opening signal
④Wind/washer/switch signal
⑤Wiper/switch signal
⑥Air tank pressure signal
⑦Low cooling water signal
⑧Lighting signals
(Car width lights, headlights, taillights, number lights, direction indicators, emergency flashing indicator lights, reversing lights)

Use case 2:Confirmation of daily inspection items using vehicle information such as probes⑤

【Hypothesis】

- Expected effect of reducing working hours for truck drivers
  - Driver's annual daily inspection time required 83 hours (see P7)
- Percentage of time required for inspection of 8 target items: 39%
  ⇒Expected annual reduction in hours per person:
  83 hours x 39% = 32 hours

<Percentage of FOT (field operational test) items in daily inspection time>



(According to our survey of transportation companies who cooperated in this FOT and survey)

It was confirmed that trucking companies will be able to streamline the time required for daily inspections and get the “benefits" of shortening the working hours of drivers. In addition, it was also confirmed that it will be a foothold for labor saving in daily inspections when implementing automated truck driving.

Use case 3:Understanding load weight/tire data for ensuring safety①

【Purpose of this use case】

- Prevention of overloaded operation
- Reducing the occurrence of accidents caused by tire abnormalities / Reducing the impact on driving operations when tire abnormalities occur

【Current situation】

- Occurrence of overloaded operation (in some cases, the number of violations among the number of vehicles pulled in during traffic enforcement exceeded 40%.)
- Large number of vehicle failures caused by tires (transportation companies also have a very strong awareness of the problem)

【Goal】

- Eliminate the occurrence of overloaded operations
- Eliminate tire failures caused by poor air pressure maintenance (excluding those caused by sudden events or force majeure)

【Analysis of current situation and verification survey】

- We will verify that truck drivers and operation managers can grasp the load weight measurement data in real time.
- We will also verify that trucking companies can monitor and manage tire pressure data while driving.

Use case 3:Understanding load weight/tire data for ensuring safety②

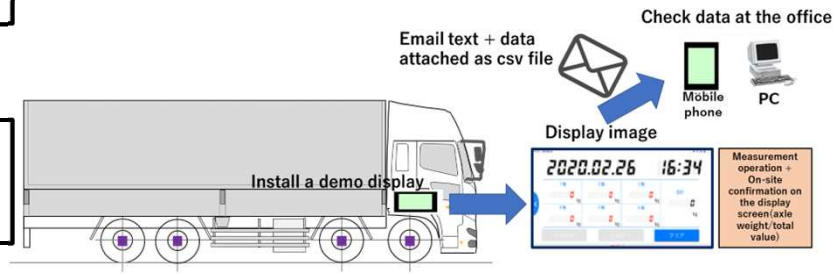
【Method of verification】

Load weight measurement

Installation of axle load sensors and equipment for checking and transmitting load weight data on actual large trucks

▽

Verifies whether the load weight can be measured and confirmed by the driver, and whether data can be sent to the administrator.

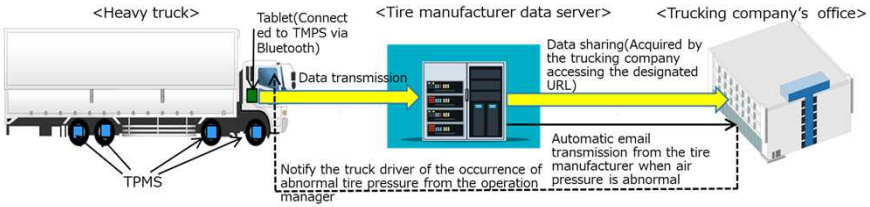


Tire data measurement

Install TPMS-equipped tires on the above truck and measure tire pressure and internal temperature data while driving

▽

The operation manager grasps the air pressure data transition etc. from the tire manufacturer's special site (*)
E-mail notification is sent to the operation manager when an abnormality occurs



(※) In this verification study, the data was provided to the transportation company via the tire manufacturer, but at the time of implementation, it is assumed that the abnormality information will be transmitted directly to the driver.

Use case 3:Understanding load weight/tire data for ensuring safety③

【Verification/confirmation items】

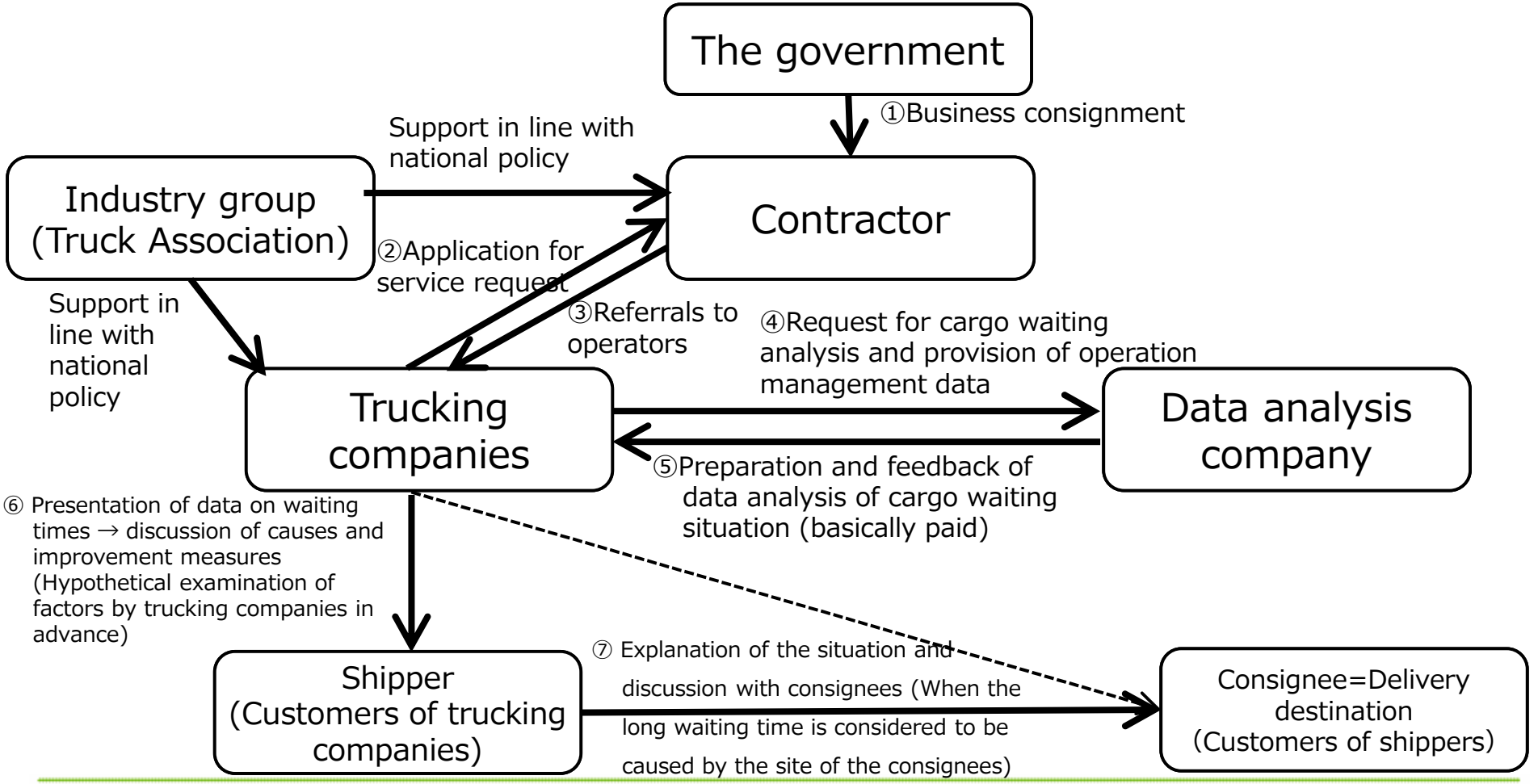
Grasping the load weight	➢ It was verified that it is possible to measure a roughly accurate load weight. ➢ We verified that the driver could check the measured load weight data on the display each time, and at the same time, that the operation manager can also receive the data. ➢ It was confirmed that the operation manager side has a need to transmit load weight data to the digital tachograph for the convenience of managing a large number of vehicles.
Understanding tire data	➢ It was confirmed that the tire pressure remained within an appropriate range while driving on trucks that had been properly inspected daily. ➢ It was confirmed that in the event of a sudden air pressure decompression due to a puncture, the driver can be notified not only to prevent further damage but also to shorten the time required to return to service. ➢ We confirmed that there is a need for the operation manager to consolidate normal tire pressure measurement data into the digital tachograph, as well as load weight data.

While there are shipper companies that do not know the weight of the consignment cargo in advance, we confirmed that understanding the load weight data will lead to “benefits" such as preventing overloaded operations in advance and leaving evidence on the load weight. In addition, it was also confirmed that the alert information to the driver when a sudden drop in tire pressure occurs provides “benefits" such as preventing accidents, preventing damage from spreading, and shortening the time required to return to operation.

Implementation image and challenges for each use case

Case 1: Understanding the status of cargo waiting time and sharing among related parties (1) Image of the overall service at the time of practical application

- Suppose that the government has taken a proactive stance to recommend this measure, and in line with that policy, industry groups have provided support to trucking companies, such as introducing companies that analyze and document operation management data, and the business operators responsible for data analysis creates and feeds back the analysis materials for the waiting occurrence situation.



Case 1: Understanding the status of cargo waiting time and sharing among related parties (2) Architecture

In this report, we used the "Society 5.0 Reference Architecture" proposed by the Cabinet Office as a framework to get an overview of the overall picture for the implementation and practical use of services for each use case from the perspective of service construction approaches.(same for other cases)

Strategy/policy(Purpose)	➢ Reduced working hours for truck drivers by shortening waiting times for cargo ➢ Improving productivity in trucking operations →Suppression of long waiting times for cargo (suppression of waiting times for cargo at one location within 30 minutes)
Rule	➢ Standards for improving working hours of truck drivers (improvement standard notification)
Organization	➢ The government (Ministry of Land, Infrastructure, Transport and Tourism) ➢ Industry group (Truck Association)
Service business	➢ At the request of a trucking company, a data analysis company analyzes and documents the occurrence of long waiting times using operation management data acquired by the trucking company from a digital tachograph, and provides it to the trucking company.
Functions	➢ By analyzing the location information of locations where long waiting times have occurred, we will clarify the locations where long waiting times occur, the number of occurrences, the date of occurrence, etc. (matching with shipping data if necessary)
Data	➢ Operation management data / location information data ➢ Data for confirmation of operation management data (shipment data, etc.)
Data linkage	➢ Matching of location information data for long-time waiting areas and operation management data
Assets	➢ Digital tachograph

Case 1: Understanding the status of cargo waiting time and sharing among related parties (3) Challenges for practical application

Challenges	Situation
Establishment of service promotion and management body	➢ The trucking industry association pointed out that “there is an extremely high need for this use case, and that information and support can be provided when it is put into practical use”. ➢ However, there was an opinion presentation that it is difficult to plan detailed measures and act as a management promotion body.
Creation of business operators responsible for organizing and analyzing operation management data and the documentation	➢ In reality, it is difficult for trucking companies to analyze operation management data and create materials by themselves. ➢ For this reason, it is necessary to create an external company that will be responsible for these analyzes and document preparation.
Promoting recognition and understanding of shippers and consignees for the problem of long waiting times	➢ The direct scope of this service is up to the provision of data analysis materials (Up to ⑤ on p16). The effect of reducing long waiting times will depend on subsequent discussions with shippers and consignees. ➢ We plan to make a statement to shippers and consignees at the "Study Group for the Realization of Sustainable Logistics" organized by MLIT and MAFF.

Case 1: Understanding the status of cargo waiting time and sharing among related parties (4) Implementation outlook

In order to implement this use case, it is necessary for the government to plan detailed measures and to consider and promote an operational system.

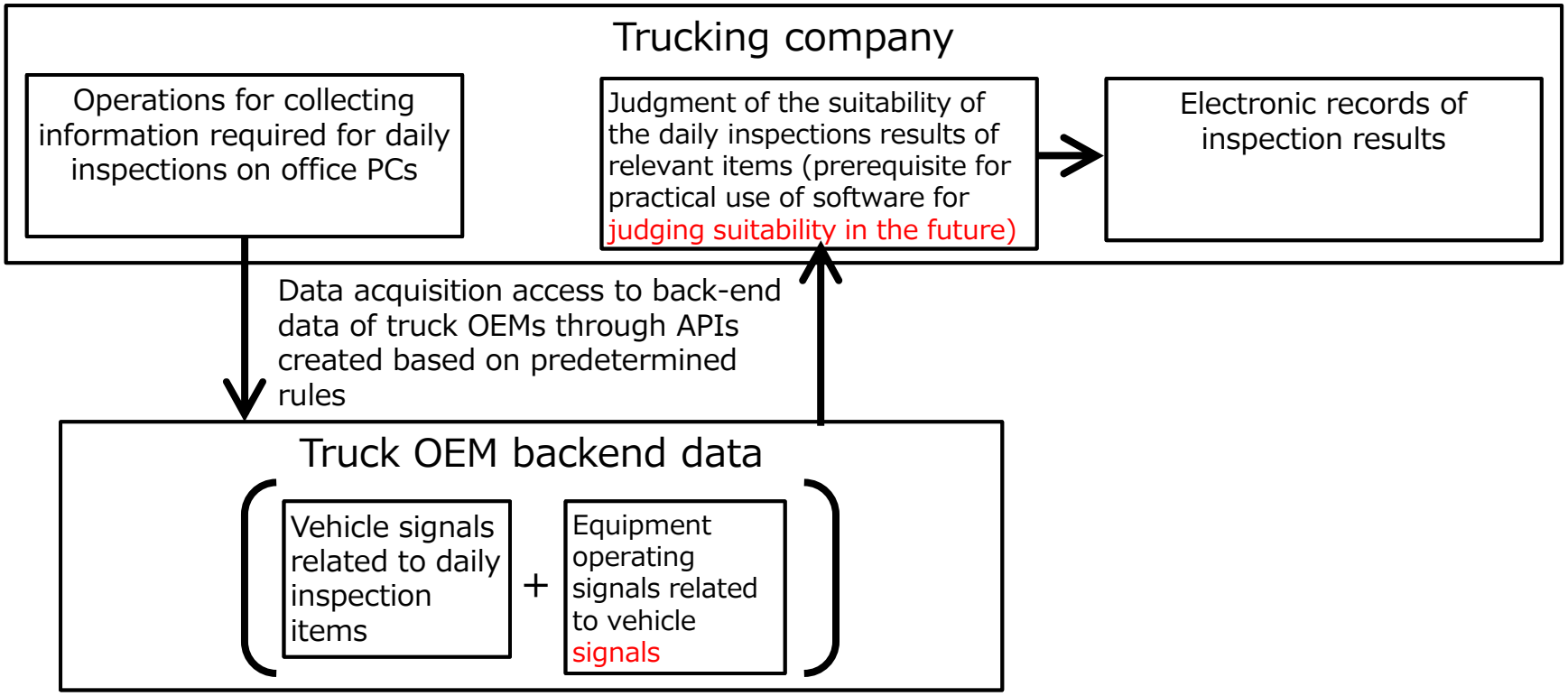
- This use case does not have any particular technical problems or difficulty, so whether or not it can be implemented depends on "establishment of service promotion and management body".
- In the case of initiatives led by the government, it is assumed that the planning and drafting of specific policy details, consideration of operational systems, etc., implementation promotion and management, etc., will be outsourced to the private sector. At that time, it is also necessary to create business operators who organize and analyze operation management data and document it.
- Shortening working hours in response to the “2024 problem of logistics” and the revised improvement standard notification is an urgent issue. There is also an increasing need for data materials that clarify the recognition and actual situation of long waiting times like this use case. We will also try to approach relevant government agencies such as the Ministry of Land, Infrastructure, Transport and Tourism and the Ministry of Economy, Trade and Industry at every opportunity.

<Draft roadmap for service implementation of “understanding the occurrence of waiting times for cargo and sharing among related parties”>

	1st year				2nd year				3rd year			
Operation procedure design, formulating measures to utilize analysis materials for cargo waiting	■	■										
Concrete specifications for data organization and analysis work	■	■										
Feasibility study	■	■	■									
Formulation of commission guidelines for data organization and analysis work		■	■									
Recruitment of contractors for data organization and analysis work			■	■								
Phased pilot operation in specific regions					■	■	■	■				
Bug fixes					■	■	■	■				
Nationwide deployment									■	■	■	■
Promoting recognition and understanding of shippers and consignees	■	■	■	■	■	■	■	■	■	■	■	■

Use case 2:Confirmation of daily inspection items using information such as probes (1) Image of the overall service at the time of practical application

- This FOT is to verify that the vehicle status of daily inspection items can be confirmed on the monitor screen using vehicle information such as probes, and it is an initiative at the very early stage toward implementation.
- For implementation, it will be necessary to "determine the status of equipment operation signals", "develop an algorithm to automatically determine the suitability of daily inspection results", and "construct a mechanism for electronically recording inspection results."

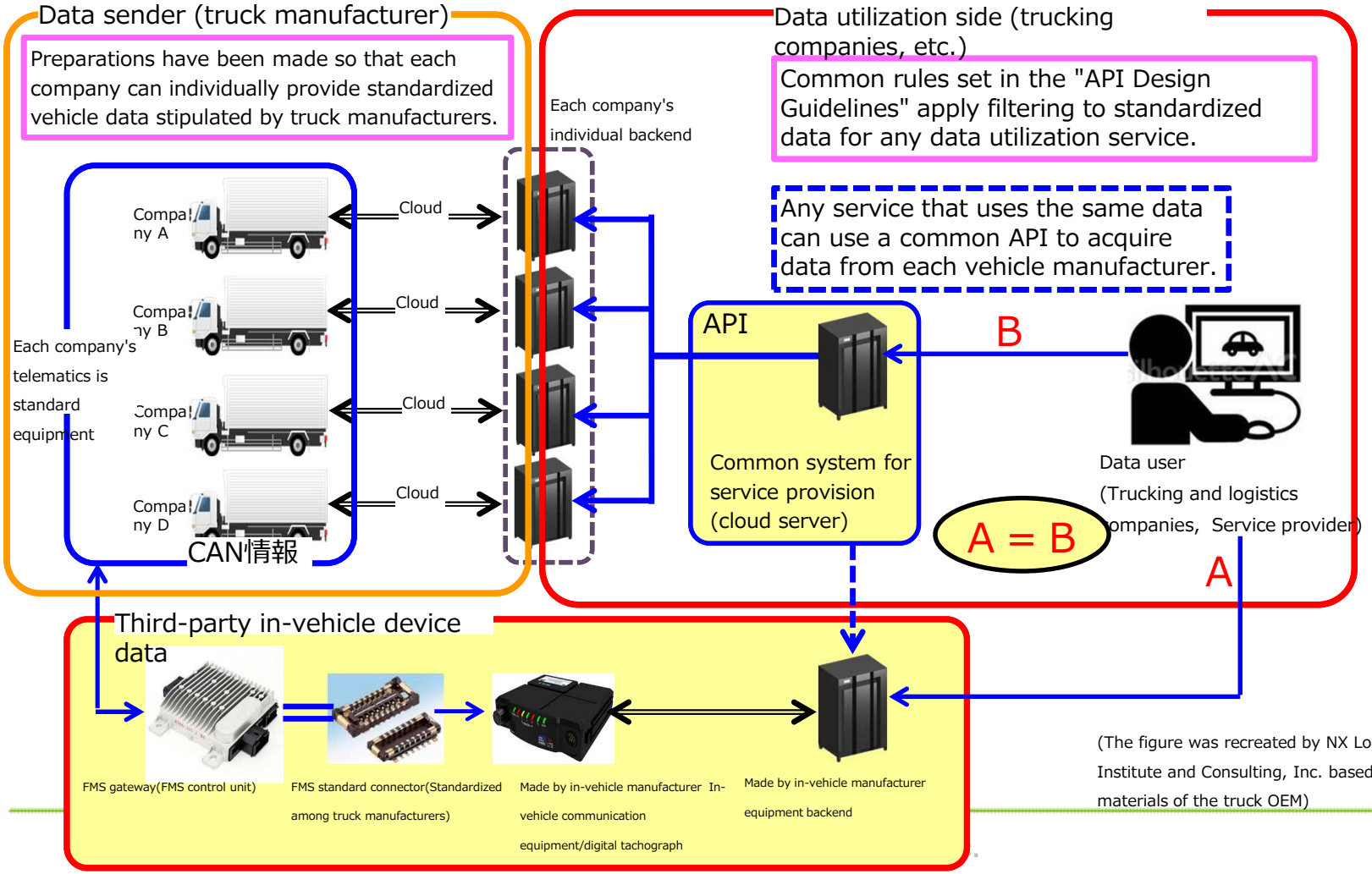


Use case 2:Confirmation of daily inspection items using information such as probes (2)Architecture

Strategy/policy(Purpose)	➢ Reduced working hours for truck drivers by streamlining daily inspections ➢ Creation of a labor-saving daily inspection method in anticipation of the implementation of automated driving
Rule	➢ Road Transport Vehicle Act (Automobile Inspection Standards/Guidelines for Vehicle Inspection and Maintenance)
Organization	➢ The government (Ministry of Land, Infrastructure, Transport and Tourism) ➢ Related subcommittees of the Japan Automobile Manufacturers Association, truck OEM companies ➢ “Logistics MaaS” - Subcommittee for establishing a system for linking truck data
Service business	➢ Among the daily inspection items for commercial trucks, those that can be confirmed by vehicle information such as probe of the truck will be provided with a mechanism to check the maintenance status using vehicle information such as probe.
Functions	➢ A mechanism that allows data users to obtain and use the same data items using the same API for truck OEM vehicles (under consideration by the Japan Automobile Manufacturers Association, see next page)
Data	➢ Vehicle information such as probe, including equipment operation signal, that contributes to confirmation of daily inspection items for trucks
Data linkage	➢ Utilization of APIs created based on common production rules for APIs used to acquire data from the backend of heavy-duty truck OEMs
Assets	➢ Trucking companies’ office PCs, truck vehicle ➢ Software equipped with daily inspection results suitability judgment algorithm(Future challenges)

(Reference) Flow of user acquisition of data from the back end of heavy-duty truck OEM using API

By standardizing "standardized data items" and "API production rules for acquiring data from truck OEMs", truck OEM companies are currently considering a mechanism that allows data users to obtain and use common data items from truck companies using the same API, for the same service and the same user. It was proposed to include data that contributes to confirmation of daily inspection items in the scope of this common data item.



(The figure was recreated by NX Logistics Research Institute and Consulting, Inc. based on the explanation materials of the truck OEM)

Use case 2:Confirmation of daily inspection items using information such as probes (3) Challenges for practical application

Challenges	Situation
Development of a system for providing vehicle information such as probes necessary for checking daily inspection items	➢ The Japan Automobile Manufacturers Association (JAMA) and truck OEMs are working together to implement the mechanisms for providing vehicle signals, such as probes for trucks, on the previous page. ➢ Some of the 8 vehicle signal items, such as the probes covered in this case, are outside of the data items agreed upon within the JAMA, but we received an answer that there is a possibility that they may become standardized items when targeting trucks with automated driving specifications. However, it was pointed out that there are issues that require expensive system changes, such as inspections for dead lights.
Ensuring consistency with current laws and regulations	➢ From MLIT, although ensuring safety and certainty is a major premise, it was evaluated that it is a necessary initiative with the major premise of ensuring safety and certainty in view of automated driving. ➢ On top of that, we were presented with the opinion that although revisions to the public notice are necessary, there would be no problem with consistency with the law.
Acquisition and utilization of equipment operation signals related to daily inspection items	➢ It was also confirmed that, in general, trucks do not have an environment for acquiring equipment operation signals, and that the development of mechanisms requires considerable cost and time.

Use case 2:Confirmation of daily inspection items using information such as probes (4) Implementation outlook

In discussions with truck OEMs, etc., we agreed that it was a necessary and important initiative for "improving daily inspection methods when implementing automated driving." However, for the purpose of "improving the working hours of truck drivers", it is difficult to ask private companies and organizations to promote implementation, and it is recognized that the government should take the lead in considering and promoting the automation of daily inspections.

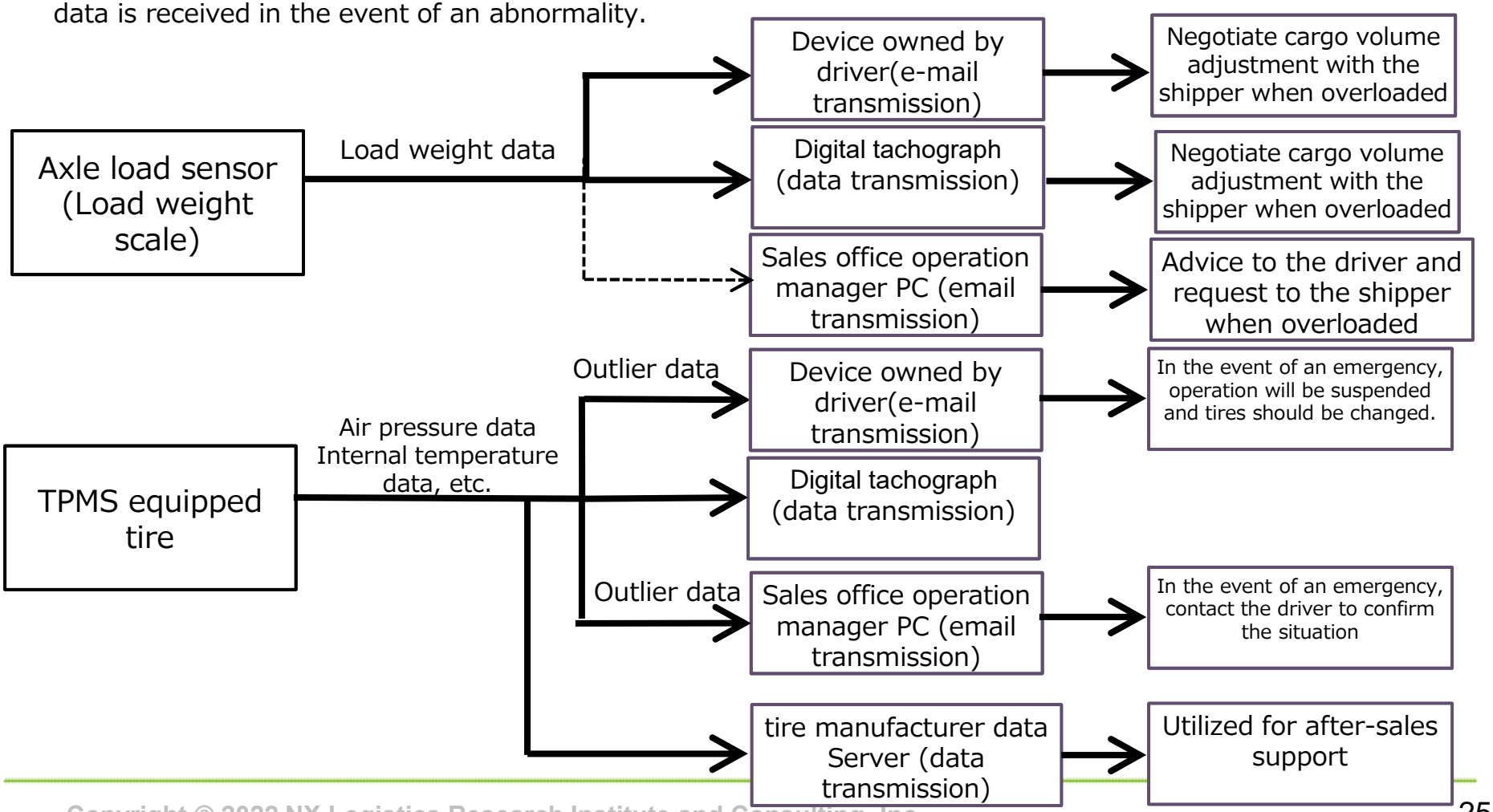
【Summary of opinions of truck OEM/logistics MaaS subcommittee promoting companies】

Purpose of inspection labor saving when implementing automated driving	➢ It becomes a problem directly related to the liability of the truck OEM. ⇒Incentives for implementation arise for truck OEMs
Purpose of improving working hours for truck drivers	➢ While truck OEMs do not have any merits or responsibilities, considerable development and support costs are incurred for implementation ⇒ There is no incentive for truck OEMs to implement ➢ It is difficult for the trucking companies to take the initiative in promoting the project, as they have little idea of bearing the costs themselves.

- ◆ The implementation of this use case needs to be treated as a long-term theme that corresponds to the trend of commercialization of automated truck driving.
- ◆ The mechanism for acquiring vehicle signals such as probes from trucks will be discussed in the logistics MaaS subcommittee in the future (in the logistics MaaS, this mechanism has not yet been agreed upon)

Use case 3:Understanding load weight/tire data for ensuring safety
(1) Image of the overall service at the time of practical application

- Each data is sent to the driver's terminal, etc., and the driver grasps whether there is a problem. Loading weight data is checked each time cargo is loaded and unloaded, but tire pressure data alert information is sent to the driver only when an abnormality occurs. As part of the operation management work, the operation manager also collects information using a digital tachograph, etc., and gives instructions to the driver when data is received in the event of an abnormality.



Use case 3:Understanding load weight/tire data for ensuring safety (2)Architecture

Strategy/policy(Purpose)	➢ Prevention of overloaded operations and associated accidents ➢ Reducing the occurrence of accidents caused by tire abnormalities / Reducing the impact on driving operations when tire abnormalities occur
Rule	➢ Road Traffic Law/Trucking Business Law ➢ Road Transport Vehicle Act (Automobile Inspection Standards/Guidelines for Vehicle Inspection and Maintenance/Safety Standards)
Organization	➢ Automotive equipment manufacturers ➢ tire manufacturers } Service developer will be the driving force
Service business	➢ Notifies the driver of the information on the weight of the cargo when it is loaded and unloaded, as measured by the weight scale, and the information on tire pressure abnormality alerts recognized by the TPMS. This will lead to the driver's situational awareness and the implementation of necessary countermeasures.
Functions	➢ We have created an environment that allows us to grasp the load weight measurement data in real time, and send the data to the driver terminal, digital tachograph, etc. ➢ TPMS measures tire air pressure while driving and sends abnormal value data to the driver terminal and sales office manager.
Data	➢ Load weight data ➢ Tire pressure/inner temperature data
Data linkage	–
Assets	➢ Axle load sensor (load weight scale) / TPMS ➢ Data transmitter (equipped with Bluetooth)/driver terminal, etc.

Use case 3:Understanding load weight/tire data for ensuring safety
(3) Challenges and prospects for practical application

Challenges	Situation
Target recipients and data transmission method of load weight and air pressure data	➢ The operation manager strongly desires information transmission to the digital tachograph because it is necessary to centrally manage a large number of vehicles. ➢ However, since the specifications are different for each digital tachograph manufacturer, both load weight scales and tire manufacturers are of the opinion that it is difficult to transmit data compatible with all manufacturers' digital tachographs.

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Although there are issues regarding operational convenience and usability, it is practically usable.

Use case 3:Understanding load weight/tire data for ensuring safety
(4) Supplementary information on tire data

With regard to tires, expectations are extremely high for alert information related to "wear“, "road surface conditions“, and "risk of derailment“, rather than air pressure data.

- Tire manufacturers are conducting research and development to understand and provide data on the above risks, but this requires the provision of vehicle signals such as probes from truck OEMs and the installation of wheel speed signal branch cables.
- The required probe data is as follows, but it may be difficult to put these data in the data provision system based on the p22 FMS standard due to the volume and communication frequency. In any case, it is required to provide the following vehicle signals such as probes in order to acquire data related to wear and derailment risk and issue alert information.

【Required vehicle signals such as probes】

① Wheel speed (FL/FR/RL/RR)
② G sensor value before and after report
③ Engine torque
④ Engine speed
⑤ Yaw rate sensor value
⑥ Outside temperature sensor value
⑦ Brake information

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