

TRUCKS

Overall Trends

1 Introduction

The global economy showed signs of recovery in 2021 as the spread of vaccination alleviated restrictions on economic activity imposed by the COVID-19 pandemic.

Recovery proceeded at a moderate pace in Japan due to factors such as repeated short term declarations of a state of emergency that continued until the end of September 2021. Restrictions on economic activity were gradually lifted starting in October, but the gross domestic product (real GDP) rate remained below its pre-pandemic level. In addition, automobile production decreased from mid-2021 until autumn due to the shortage of parts caused by the spread of the pandemic in Southeast Asia.

The 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 26) was held amid growing momentum for carbon neutrality. Stricter targets to mitigate global warming were set, and participating countries are expected to quickly implement measures to reduce CO₂ emissions. In 2020, Japan formulated its Green Growth Strategy to achieve carbon neutrality by 2050, and specific steps such as adding targets for commercial electric vehicle sales in addition to those for passenger vehicles were defined in 2021. Cooperation between Japanese manufacturers is becoming more common, with Toyota Motor Corporation, Isuzu Motors Limited, and Hino Motors, Ltd. setting up a new company called Commercial Japan Partnership Technologies, which has also been joined by Suzuki Motor Corporation and Daihatsu Motor Co., Ltd., to accelerate the adoption of CASE in commercial projects, solve transportation issues, and achieve carbon neutrality.

2 Recent Truck Market Trends

2.1. Freight Shipments in Japan

Freight shipments in Japan in 2020 amounted to 386.1 billion ton kilometers, a 4.5% decrease compared to 2019. This total breaks down into 213.4 billion ton kilometers

shipped by trucks, 18.3 billion ton kilometers shipped by trains, 153.8 billion ton kilometers shipped by ships, and 0.5 billion ton kilometers shipped by air. In terms of share, motor vehicles accounted for 55.3%, trains for 4.7%, ships for 43.7%, and air shipping for 0.1% (Fig. 1).

By truck type, ordinary trucks accounted for 77.5% of freight shipped by motor vehicles, light-duty trucks for 1.4%, special-purpose trucks for 20.9%, and mini-vehicle trucks for 0.2% (Fig. 2).

2.2. Number of Trucks in Japan

The number of trucks owned in Japan in 2021 was 14.3 million, an increase of 0.1%, or approximately 10,000 vehicles, compared to the previous year. The number of ordinary trucks has increased (Fig. 3).

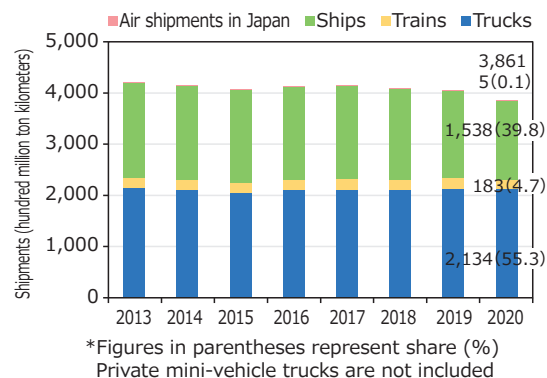


Fig. 1 Freight Shipments in Japan (Fiscal Year)

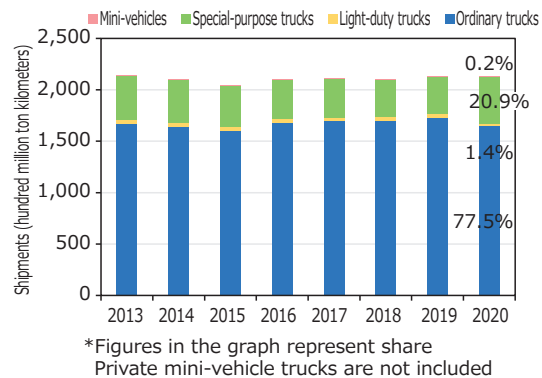


Fig. 2 Freight Shipments by Vehicle Type (Fiscal Year)

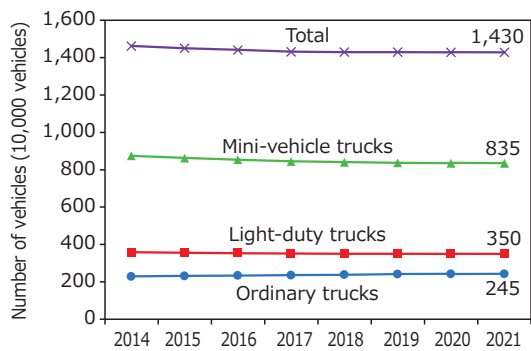


Fig. 3 Number of Trucks in Japan According to Vehicle Type

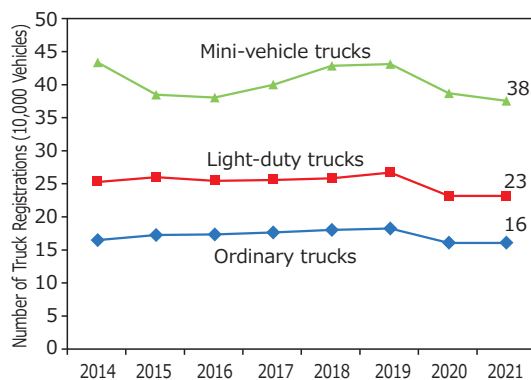


Fig. 4 Number of Truck Registrations in Japan According to Truck Type

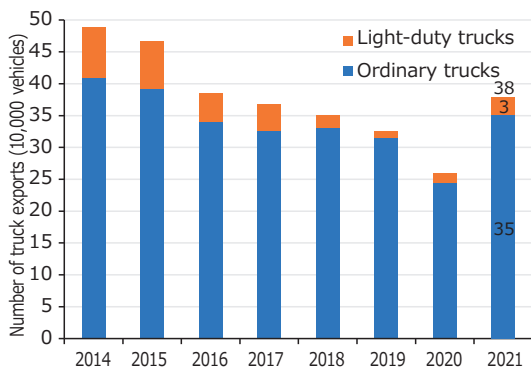


Fig. 5 Number of Truck Exports According to Truck Type

2. 3. Number of Truck Registrations in Japan

The number of truck registrations in Japan in 2021 was approximately 770,000, a decrease of 1.7%, or approximately 10,000 vehicles, compared to the previous year. By truck type, ordinary trucks fell by 1.8%, light-duty trucks by 0.2%, and mini-vehicle trucks by 2.6% (Fig. 4).

2. 4. Truck Exports

The number of exported trucks in 2021 was 380,000, an increase of 46%, or approximately 120,000 vehicles compared to the previous year (Fig. 5).

By destination, exports to Europe and North America

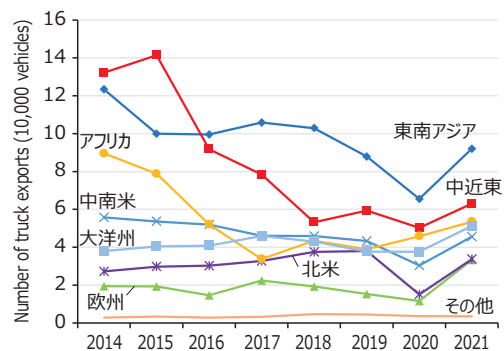


Fig. 6 Number of Truck Exports According to Destination



Fig. 7 Isuzu Giga

more than doubled over the previous year, exports to Central and South America, Southeast Asia, and Oceania increase by approximately 40 to 50%, and exports to other regions rose by approximately 15 to 25% (Fig. 6).

3 2021 Model Year Trucks and Special Characteristics

3. 1. Trucks Manufactured in Japan

(1) Heavy-Duty Trucks

In May, Isuzu added an emergency driving stop system (EDSS) as an option for all models in its Giga heavy-duty truck lineup. The safety systems available for the diesel truck in the line were also added to the Giga CNG heavy-duty CNG truck in July. Collision mitigation braking with pedestrian detection, variable light distribution LED headlamps, and a blind spot monitor were made standard equipment, enhancing the safety of the vehicle (Fig. 7). The first heavy-duty LNG truck by a Japanese commercial vehicle manufacturer, the Giga LNG, was launched in October. It emits approximately 10% less CO₂ than diesel vehicles in intercity transportation.

In June, Mitsubishi Fuso Truck and Bus announced and launched a new model of the heavy-duty Super Great truck featuring an expanded suite of safety systems. The newly added Active Drive Assist 2, an automated driving level 2 advanced driving support system, and Emergency Stop Assist, an EDSS that stops the vehicle inside its lane, not only reduce fatigue through sta-



Fig. 8 Mitsubishi Fuso Truck and Bus Super Great



Fig. 11 Mitsubishi Fuso Truck and Bus Fighter



Fig. 9 UD Trucks Quon



Fig. 12 Hino Ranger



Fig. 10 Isuzu Forward

ble driving, but also make the vehicle even safer. The addition of the collision mitigation braking system also led to the installation of the Active Sideguard Assist 1.0 driving support system with enhanced prevention of accidents when making a left turn. A short cab variant equipped with the 6R20 engine (displacement of 10.7 L) was added to the lineup in September (Fig. 8).

In July, UD Trucks installed the UD Active Steering electronically controlled steering wheel in the Quon heavy-duty truck. It offers a stable steering feel that remains unaffected by speed or road conditions, thereby contributing to reduce fatigue and greater safety for drivers.

(2) Medium-Duty Trucks

Isuzu Motors partially its Forward medium-duty truck in January. The installation of a system that detects pedestrians and emits an audible warning when making a left or right turn, and of a collision mitigation braking system expanded to also detect pedestrians, has made the vehicle even safer (Fig. 10).

In March, Mitsubishi Fuso Truck and Bus announced and launched a new model of medium-duty Fighter truck featuring enhanced safety systems. The Active Brake

Assist 5 collision mitigation braking systems is now standard on all models. An even more advanced safety system was realized by combining the already installed Attention Assist system that monitors driver distraction and emits a warning with the Active Sideguard Assist system that helps prevent accidents when making a left turn (Fig. 11).

In August, Hino refined its medium-duty Ranger truck, releasing it with an expanded suite of safety systems. It has been equipped with a Sight Around Monitor system featuring an extended range of detection speed to provide support to the driver checking that the area around the vehicle is safe in situations such as potential intersection collisions during right or left turns. In addition, EDSS was made standard equipment on some models to help prevent accidents (Fig. 12).

(3) Light-Duty Trucks

Complying with the various regulations that came into effect in 2021 led to expanded safety systems.

In March, Isuzu improved the safety performance of the Elf light-duty truck by expanding its safety systems. It has been equipped with the intersection warning system that provides support for avoiding intersection collisions or right or left turn accidents also found in the medium-duty Forward by the same manufacturer. The switch to LED headlamps improves visibility while driving at night (Fig. 13).

Hino announced the walk-through ultra-low floor front-wheel drive Dutro Z EV truck in April. It provides con-



Fig. 13 Isuzu Elf



Fig. 14 Hino Dutro Z EV



Fig. 15 Hino Dutro

tributes to both usability at logistics sites and carbon neutrality at a high level (Fig. 14). In July, a new Dutro variant with a 1.5-ton class carrying capacity was added to the lineup. It distinguishes itself with its full range of 6-speed AT variants that make it easy to carry out urban transport and freight as envisioned. Safety systems on par with those of the 2-ton and higher classes, including a collision mitigation braking system and a forward false start prevention system were made standard equipment (Fig. 15).

Toyota refined its light-duty Dyna 1-ton series to make safety systems such as a collision mitigation braking and lane departure warning systems standard equipment on all models.

In November, Mitsubishi Fuso added an MT variant to the 1.5-ton series of its light-duty Canter truck. The resulting two-model lineup consisting of a 5-speed manual transmission variant and a Duonic 2.0 6-speed dual clutch



Fig. 16 Mitsubishi Fuso Truck and Bus Canter



Fig. 17 Suzuki Carry



Fig. 18 Daihatsu Hijet Truck

transmission addresses a greater variety of driving needs (Fig. 16).

(4) Mini-Vehicle Trucks

Suzuki launched a version of its Carry mini-vehicle truck with partially modified specifications in August. In addition to Mud Escape Assist (brake LSD traction control) and hill hold control, some models have been equipped with reinforced springs (4-leaf springs) as standard equipment (Fig. 17).

In December, Daihatsu partially redesigned its Hijet mini-vehicle truck. A CVT for front-engine, rear-wheel drive vehicles was adopted, improving basic areas of performance such as fuel efficiency, quietness, and standing starts (Fig. 18).

3. 2. Trucks Manufactured outside Japan

Daimler Truck unveiled the heavy-duty eActros truck in June, and began production at its Wörth am Rhein plant in Germany in August.



Fig. 2 Interior Pillar of the Isuzu Forward



Fig. 3 Interior Stereo Camera of the Isuzu Elf



Fig. 4 Interior Pillar of the Isuzu Elf

The Isuzu Elf uses the pre-collision braking system stereo camera set in the upper part of the instrument panel (Fig. 3) to improve the performance of the forward detection of cyclists, pedestrians, or other objects. The system has been made standard equipment on all models. As in the Forward, the intersection warning system sets short-range millimeter wave radars at two locations in the cab, and uses a warning lamp fully embedded in the pillar (Fig. 4) and a warning sound to alert the driver, thereby enhancing safety.

The design of the Hino Dutro Z EV emphasizes the ease of getting in and out of the vehicle, access to the cargo area, and facilitation of loading tasks that characterize an ultralow-floor walk-through van (Fig. 5). The ultralow structure sets the floor only 400 mm above the ground, mitigating the physical weariness of the driver when getting on or off and reducing the risk of falls. The walk-through structure also enhances usability in actual delivery situations. The roof is shaped to ensure drivers do not hit their head when they stand up in the vehicle

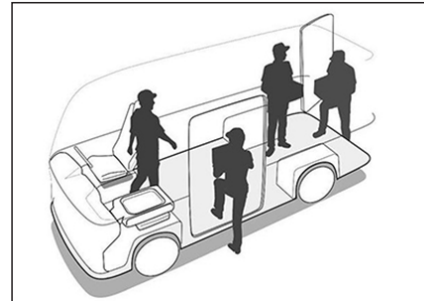


Fig. 5 Hino Walk-Through Dutro Z EV



Fig. 6 Interior of the Dutro Z EV



Fig. 7 Dial Shift Lever in the Interior of the Dutro Z EV

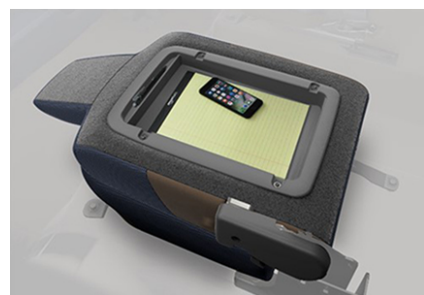


Fig. 8 Seat Back Tray in the Interior of the Dutro Z EV

(Fig. 6). The dial shift control has a compact (Fig. 7) designed to improve legroom when drivers move to the cargo area. The back of the passenger seat is designed with a folding structure that enables the tray on the back side to be used as a space to set down parcels (Fig. 8).



Fig. 9 Exterior of BrightDrop EV600: Front



Fig. 10 Exterior of BrightDrop EV600: Rear



Fig. 11 Interior of BrightDrop EV600



Fig. 12 Exterior of Arrival Electric Van



Fig. 13 Exterior of Arrival Van by Arrival



Fig. 14 Interior of Arrival Van by Arrival

2 Truck Design outside Japan

In January 2021, GM launched BrightDrop, a new venture offering an EV and connectivity ecosystem for corporate customers, and announced the EV600 (Fig. 9). It contrasts a black tone for the cab and white for the cargo area, and the use of low gloss plastic to protect the vehicle body from the bumper to the side sill results in a functional design that prevents scratches from standing out. The single horizontal straight line pattern of the headlamps and vertical rear combination lamps present a simple style (Fig. 10). As with the exterior, the interior adopts a straight line pattern that give a simple and functional image (Fig. 11).

In March, the UK-based Arrival followed up its 2019 announcement of the Electric Van (Fig. 12) with the new light-duty EV walk-through Arrival Van (Fig. 13). The exterior design consists of a simple and solid structure with a color scheme that uses white around the side

body panels and black from the front mask to the roof, and continuing from the roof to the back door to create a clean and distinctive image. The use of electronic cameras for the side mirrors contributes to the sense of sleekness. The interior design follows a simple pattern of straight line and circular tones (Fig. 14).

In June, DAF announced the XF (Fig. 15), XG (Fig. 16) and XG+ (Fig. 17) series of heavy-duty trucks, which received the 2022 International Truck of the Year Award at the SOLUTRANS event held in France in November 2021. The new cab design with a large rounded windshield and smooth body shape significantly improve aerodynamic performance. The XG and XG+ also replace the side mirrors with electronic cameras (rear view and front underview) to give a further boost to aerodynamic performance (Figs. 18 and 19). At the same time, the large windshield and side windows that push the belt line down to improve the direct field of view. The combination of the folding passenger seat and auxiliary win-



Fig. 15 Exterior of DAF XF



Fig. 16 Exterior of DAF XG



Fig. 17 Exterior of DAF XG+



Fig. 18 Exterior of DAF XG: Rearview Mirror



Fig. 19 Exterior of DAF XG: Front Underview Mirror

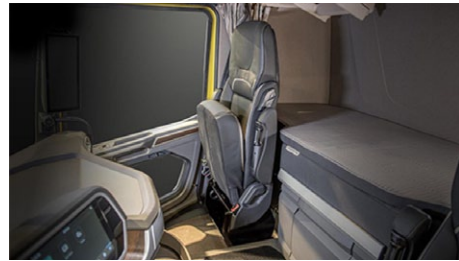


Fig. 20 Interior of DAF XF: Passenger Seat



Fig. 21 Exterior of DAF XF: Auxiliary Window

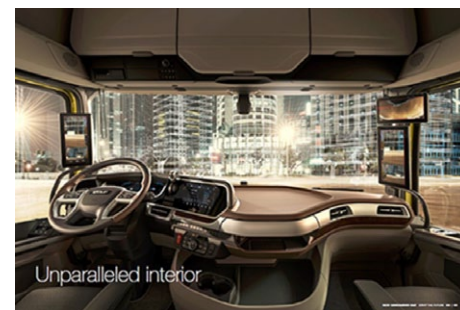


Fig. 22 Interior of DAF XG

dow in the passenger side door result in a design that helps provide better visibility toward the sidewalk (Figs. 20 and 21). The grille features the company name logo on the main silver tone crosspiece, with the remaining crosspieces using silver to accentuate the outer frame of the grille to establish a formidable presence and sophisticated style. All lamps use highly energy-efficient LEDs, with headlamps that embeds the cornering lamps. The side guard exhibits variations, with body color on the XF, silver decoration on the side marker lamp on the XG, and additional silver decoration over a wide area extending to the rectangular portion up to the rear wheel on the XG+. The interior design (Fig. 22) takes advantage of the use of electronic cameras for the side mirrors to place monitors showing the rear view and front underview in the left and right pillars. The steering wheel that tilt ups and the seat that rotates 90 degrees, the storage tray in the pull-out instrument panel (Fig. 23)



Fig. 23 Interior of DAF XG: Toilet



Fig. 24 Interior of DAF XG: Overhead Console



Fig. 25 Exterior of Nikola Tre BEV



Fig. 26 Exterior of Iveco S-Way

and large overhead console storage (Fig. 24) offer a comfortable interior space for the driver.

In September, Nikola announced the Tre BEV heavy-duty EV truck (Fig. 25). Nikola has partnered with IVECO to open a heavy-duty truck manufacturing plant in Germany, and will use the same assembly line as the IVECO S-Way heavy-duty truck (Fig. 26). The cab design has a sharp and rigid structure with an integrated design featuring a black pattern that runs from the side windows and windshield to the front grille. As with the cab, black is used around the headlamps and the outer



Fig. 27 Interior of Nikola Tre BEV



Fig. 28 Exterior of Nikola Tre FCEV Cabover



Fig. 29 Exterior of Nikola Two FCEV Sleeper

periphery of the bumper in a simple, consolidated pattern. The interior features a flush surface that sets the various functions in a simple basic block to provide an uncluttered, sophisticated configuration (Fig. 27).

3 Concept Truck Design

In February 2021, Nikola announced the Tre FCEV Cabover (Fig. 28) and Two FCEV Sleeper (Fig. 29) as part of its North American fuel cell electric vehicle (FCEV) commercial truck program. Production is scheduled to start in the second half of 2023 for the Tre FCEV Cabover, and in the second half of 2024 for the Two FCEV Sleeper.

The Tre FCEV Cabover targets a maximum range of 500 miles and is anticipated to respond to situations calling for fleet operators, in particular, to ensure sufficient transport capacity for freight owners through fast fueling in most regional markets in North America. The design is carried over from the Tre BEV, but with simpler, more sophisticated styling. Dot-shaped holes in set in the

All manufacturers also took measures against left-turn accidents, which rank among the top traffic accident causes. Installing systems that use a radar mounted in the cab to detect objects, alert the driver, and avoid collisions when making a turn has become common. In addition to a warning lamp and alarm, a function that activates the collision mitigation braking system when the risk of a collision during a turn is detected has been added to the Active Sideguard Assist 1.0 system newly installed in the Super Great.

The UD Trucks Quon (Fig. 9 in the *Overall Trends* section) has been equipped with the new UD Active Steering electronic steering system. The system uses sensors to scan the driving environment 2,000 times per second, determines the driving course and driver intent, and supports driving operations via an electric motor installed at the top of the hydraulic steering gears. That system control applies an appropriate level of steering wheel torque to achieve a stable steering feel that is not affected by factors such as speed, cargo, or road surface conditions, thereby helping to reduce fatigue and contributing to safety.

Manufacturers are also developing systems to reduce the environmental burden. Isuzu has launched the Giga LNG. Switching to LNG fuel, which has the lowest CO₂ emissions among fossil fuels, decreases CO₂ emissions by approximately 10% compared to diesel vehicles during inter-city transport. Refueling time is more or less the same as in diesel vehicles, and it has a cruising range of over 1,000 km on a full tank.

(2) Medium-Duty Trucks

Table 2 shows the medium-duty trucks announced in Japan in 2021, and the main product technology trends. Efforts to improve safety were observed as essentially the same safety systems as in heavy-duty trucks were added. Each truck has been equipped with a turn collision-avoidance assist system that alerts the driver with a lamp and an alarm when making a left turn. The already installed collision mitigation braking systems were upgraded with a function enabling pedestrian detection. In the Isuzu Forward (Fig. 10 in the *Overall Trends* section) and Hino Ranger (Fig. 12 in the *Overall Trends* section), visibility during nighttime driving was improved by making LED headlamps standard equipment. The Ranger has also been equipped with automatic headlamps that automatically switch on when it gets dark outside the vehicle.

Table 1 Main Product Technology Trends for Heavy-Duty Trucks in 2021

Month of launch	Name of vehicle model	Main characteristics
May	Giga (Isuzu Motors)	Variants Added (Improved safety system functions)
June	Super Great Mitsubishi Fuso Truck and Bus	Redesign Equipped with advanced safety systems.
July	Quon UD Truck	Variants Added (Added driving support systems)
	Giga CNG (Isuzu Motors)	Redesign Equipped with advanced safety systems.
September	Super Great Mitsubishi Fuso Truck and Bus	Variants Added (Added a short cab model)
October	Giga LNG (Isuzu Motors)	Announced an LNG truck

Table 2 Main Product Technology Trends for Medium-Duty Trucks in 2021

Month of launch	Name of vehicle model	Main characteristics
January	Forward (Isuzu Motors)	Redesign Equipped with advanced safety systems.
March	Fighter Mitsubishi Fuso Truck and Bus	Redesign Equipped with advanced safety systems.
August	Ranger (Hino Motors)	Redesign Equipped with advanced safety systems.

(3) Light-Duty Trucks

Table 3 shows the light-duty trucks announced in Japan in 2021, and the main product technology trends. As in medium-duty trucks, systems such as left turn collision-avoidance assist systems and collision mitigation braking systems expanded to detect pedestrians were added to expand safety systems. In additions, vehicles were made compliant with various tightened regulations, including advanced OBD, rear mirrors, and rear under-run protection devices.

In April Hino announced it was developing the Dutro Z EV (Fig. 14 in the *Overall Trends* section), a walk-through, ultralow-floor, front wheel drive light-duty EV truck. Last mile deliver is currently grappling a shortage of drivers as well as issues such as the physical burden of loading and other delivery tasks, the growing number of parcels due to the growth of e-commerce, and the need to address diversification. A new EV chassis optimized for last mile delivery was developed to solve those issues. It not only contributes to carbon neutrality through electrification, but also features greater ease of use. The walk-through model as a length of approximately 4.7 m, a width of approximately 1.7 m, and a height of approximately 2.3 m. It is designed for the less than 3.5 tons GVW class, which can be driven with an ordinary driver's license to help hire a pool of drivers. The newly

Table 3 Main Product Technology Trends for Light-Duty Trucks In 2021

Month of launch	Name of vehicle model	Main characteristics
March	Elf (Isuzu Motors)	Redesign (Installation of advanced safety systems, compliance with regulations)
	Canter Mitsubishi Fuso Truck and Bus	Compliance with regulations
April	Dutro Z EV (Hino Motors)	Announced a walk-through light-duty EV model
July	Dutro (Hino Motors)	Added a 1.5-ton class carrying capacity model
	Dyna (Toyota)	Redesign Equipped with advanced safety systems.
November	Canter Mitsubishi Fuso Truck and Bus	Added a 1.5-ton class carrying capacity MT model

developed EV chassis places the motor and electric unit under the cab, and adopts a front-wheel drive layout. The battery is mounted on the inside of the frame in the underbody. Compared to the previous rear-wheel drive model, the height above the ground was reduced by half to 400 mm, achieving an ultralow-floor that significantly improves freight handling operations and the ease of getting in and out of the truck.

(4) Mini-Vehicle Trucks

Table 4 shows the mini-vehicle trucks announced in Japan in 2021, and the main product technology trends.

The Suzuki Carry (Fig. 17 in the *Overall Trends* section) added Mud Escape Assist as standard equipment on models without a differential lock. If either the left or right drive wheel spins, applying the brakes to the spinning wheel transmits drive power to the opposite wheel.

The Daihatsu Hijet Truck (Fig. 18 in the *Overall Trends* section) has been equipped with a newly developed CVT for front-engine, rear-wheel drive systems. It achieves a fuel economy performance of 16.5 km/L in WLTC mode (21.0 km/L in JC08 mode). The gear ratio coverage has been expanded, improving vehicle start performance. Continuous variable speed with no drive power disruption enables smooth acceleration when driving uphill.

(5) Trucks Manufactured outside Japan

Daimler Truck announced the eActros heavy-duty truck, which is equipped with the eAxle which integrates two motors and a two speed transmission. It has a maximum output of approximately 550 ps. The model equipped with four batteries has a cruising range of 400 km. Charging accepts output of 160 kW, and it takes a little over one hour to charge the four batteries up to

Table 4 Main Product Technology Trends for Mini-Vehicle Trucks In 2021

Month of launch	Name of vehicle model	Main characteristics
August	Carry (Suzuki)	Redesign (Appearance, expanded systems)
December	Hijet (Daihatsu)	Redesign (Added a CVT model, installed safety systems)

80% capacity.

1. 2. Interior Comfort

The ongoing driver shortage has also led to efforts to improve working conditions in terms of cabin comfort. In heavy-duty trucks, further comfort improvements are pursued in high roof models. Examples include the release of trucks that have an interior height of 1.8 m or more and high capacity storage boxes. Suspension seats with adjustable damping and an embedded seatbelt, bed air conditioning, as well as storage with cooling and heating capabilities, that do not rely on an air conditioner, USB ports, and other amenities reflect the consideration given to spending a long time in the cabin.

1. 3. Operability

Japanese society is aging rapidly, with 28.4% of the overall population aged 65 and over. Employee age is also rising in the land transportation sector, which is facing a shortage of drivers. Securing a diverse workforce calls for interiors that facilitate operation and reduce fatigue for women and elderly drivers. Manufacturers are working to make driving easier through functional human interface layouts based on ergonomics, the use of multi-information monitors that enhance visibility using stylish displays and larger screens, and the use of driving support systems such as lane-keeping assist or blind spot information systems.

1. 4. Noise and Vibration

The demand for both greater quietness and improved fuel efficiency stemming from electrification and improvements in comfort is driving efforts to balance weight reduction and noise and vibration performance. Combining low sensitivity body structure designs with optimal placement of sound absorbing and acoustic materials, and interior material structures and quality with excellent sound insulation performance is being studied. Similarly, flush surface designs and better sealing performance against noise entering the cab are being applied to reduce wind noise or air-borne noises such those from the engine, motor, or drive system.

1. 5. Safety

Safety is broadly divided into passive and active safe-

ty. Passive safety involves protecting occupants and securing a safe space through the use of higher rigidity and reinforcements to mitigate the deformation of the cabin in a collision. In addition, to reduce damage to the other vehicle, trucks feature front and rear underrun protection structures designed to restrict sliding under the front or rear of the vehicle in the event of a collision between a truck and a passenger car. Active safety involves using millimeter wave radars and image sensors to ascertain surrounding conditions to, for example, help prevent rear-end collisions, mitigate impact damage.

Trucks are also increasingly equipped with driving support systems such as forward and rear erroneous start prevention systems, lane-keeping assist systems, driving monitors that mitigate driver distraction or drowsiness, and systems that use a warning lamp or alarm to alert the driver when objects such as automobiles, motorcycles, bicycles or pedestrians are detected and the risk of a collision increases, thereby mitigating right or left turn accidents and intersection collisions.

In addition, field tests of platoon driving, which links several trucks, shares their driving status in real time, and automatically maintains following distances have been initiated to enhance safety and transportation efficiency, as well as provide a better working environment for drivers. Research and development on automated driving is underway to realize higher levels of safety and coexistence between all vehicles, motorcycles, bicycles, and pedestrians who make use of roads.

1. 6. Aerodynamic Characteristics

Aerodynamic characteristics improvements to increase driving fuel efficiency are playing an important role in preparing for the introduction of the heavy-duty vehicle fuel economy standards (JH25). As with passenger cars, trucks are also equipped with many items aimed at improving aerodynamic characteristics, such as setting a spoiler on the bottom edge of the front bumper (Figs. 7 to 12 in the *Overall Trends* section). Among items unique to trucks, the addition of spoilers on the cabin roof (Figs 7 to 11 in the *Overall Trends* section) or side (Figs. 7 and 11) minimize the gap between the cabin and rear body. Manufacturers are also devising means of adapting to cargo areas with different specifications through the use of spoilers with different heights or variable spoilers. Various means are also used to improve the aerodynamic characteristics of the cargo area, including the setting of aerodynamic sideguards between the front and rear

wheels (Fig. 8 in the *Overall Trends* section) or setting a spoiler at the rear end of the cargo area. Heavy-duty trucks, which are primarily used for long-distance transportation, also require a comfortable interior space to reduce driver fatigue, and roof shapes that accommodate both comfort and aerodynamics are becoming necessary as high-roof design needs continue to grow.

1. 7. Corrosion Prevention

The year after year rise in vehicle service life, in conjunction with the increasing use of snow melting agents, is creating demand for higher levels of corrosion prevention. Therefore, pickled materials with good coating film adhesion are used in more and more locations in chassis steel sheets, and powdered paints with high corrosion resistance are applied on a growing number of parts to improve overall corrosion resistance. In cabins, plastic is notably used in exterior parts at the front of the vehicle, to prevent damage from flying rocks and counter corrosion spreading from the edges.

1. 8. Transport Support

Commercial vehicle and other manufacturers have been releasing various telematics products to manage operations and provide driving support in commercial vehicles. These products are contributing significantly to reducing driver burden, enhancing safety, and improving fuel efficiency. At the same time, container-based coordinated railway and truck transport is experiencing a surge in the use of dedicated trains by major transport operators as part of measures to decrease CO₂ and mitigate the shortage of drivers. The Japan Freight Railway Company has released an application that sends freight train position and delay information, information on container location at terminals, changes in on-site tasks due to deviations from the timetable, and other information in real time to the driver's smartphone. Trial operations have begun for this application which reduces driver loading times, makes it unnecessary to drive around vast container terminals and regularly get in and out of the truck to look for the desired container, and not only saves labor, but also helps enhance safety and reduce fuel consumption.

2 Rear Body

Rear bodies are expected to provide improved transport efficiency to address diversifying logistics and the shortage of drivers. Swap body containers, which allow the cargo bed to be detached from the vehicle body and

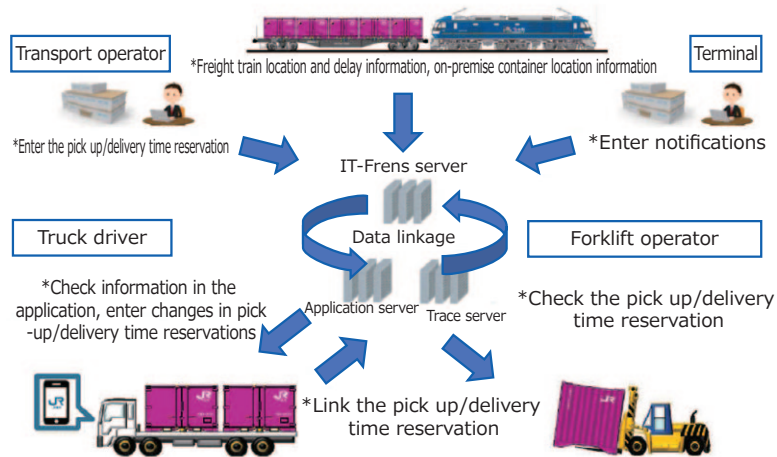


Fig. 1 Railway and truck coordinated transport application

make it possible to carry out loading tasks in that state are becoming more widespread, and raising the productivity of logistics. Transport relying on double articulated trucks has been increasing since the length limit on full trailer articulated trucks was raised to 25 m. This enables the transport of higher freight volumes, and helps improve transport efficiency and solve the severe shortage of drivers. Trucks that facilitate loading tasks and getting on or off by adopting a low-floor structure or a walk-through structure enabling direct access to the cargo area from the driver's seat have been developed and produced to reduce the burden on the driver (see Section 1.1. *Product Trends*).

3 Trailers

The trailers pulled by tractors have neither drive

power or a power source, and therefore cannot activate GPS sensors or communication units on their own, making it impossible to apply the location information management and other measures that have become standard in trucks. Nippon Fruehauf Company, Ltd. has released the Fruehauf Connect system, which uses a compact battery that can be recharged while driving and a low energy consumption GPS terminal to retrieve parking location information for trailers on their own, and even combine that information with driving history to ascertain their operation rate. A dedicated smartphone applications makes it possible to ascertain the location of the trailer itself in real time, making it easy for the driver to find the desired trailer in ports, logistics terminals, or other places where many vehicles are parked.