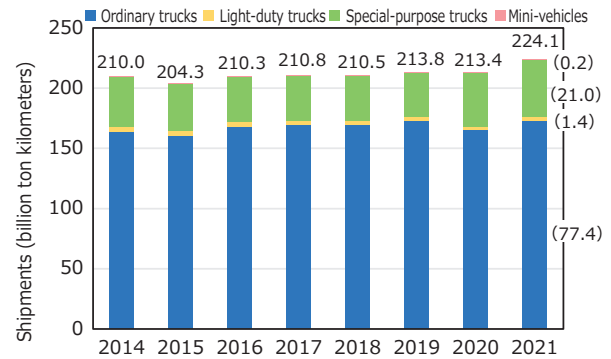


Figures in parentheses represent share (%)
Private mini-vehicle trucks are not included

Fig. 1 Freight Shipments in Japan (Fiscal Year)



Figures in parentheses represent share (%)
Private mini-vehicle trucks are not included

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

the areas of commercial vehicle development, procurement, and production. Daimler Truck and Toyota will hold equal shares in the (listed) holding company of the merged businesses.

Such reorganizations by major commercial vehicle manufacturers seeking to maintain their leading position while addressing various social issues are anticipated to continue.

2 Recent Truck Market Trends

2.1. Freight Shipments in Japan

Truck, railway, maritime and air freight shipments in Japan fell below 400 billion ton kilometers in 2020, when the spread of COVID-19 cut off the supply chain, but rose 4.7% compared to the previous year in 2021 to reach 404.4 billion tons, returning to the 2019 level. By means of transportation, truck shipments increased 5.0% to 224.1 billion ton kilometers compared to the previous year, while maritime shipments increased 5.2% to 161.8 billion ton kilometers over the same period, respectively accounting for 55.4% and 40.0% of shipping, and constituting 95.4% of all freight shipments in Japan. Train shipments decreased by 1.6% to 18.0 billion ton kilometers, falling below the previous year's level for a second consecutive year. Air shipments stayed at the same 0.5 billion ton kilometer level as the previous year, remaining at approximately half of their 2019 and earlier levels (Fig. 1).

The breakdown by truck type shows a 4.9% increase to 173.6 billion ton kilometers over the previous year for ordinary trucks and a 5.7% increase to 47.1 billion ton kilometers over the same period for special-purpose trucks, for respective shares of 77.4% and 21.0% amounting to 98.4% of total motor vehicle shipments. Light-duty truck

shipments were comparable to those of the previous year, while mini-vehicle truck shipments rose 13.3% to 0.4 billion ton kilometers, for respective shares of 1.4% and 0.2% (Fig. 2).

2.2. Number of Trucks in Japan

The number of trucks owned in Japan in 2022 increased by 0.5%, or approximately 70,000 vehicles, compared to the previous year. By truck type, mini-vehicle trucks enjoyed robust sales and increased by 62,000 units compared to the previous year, accounting for almost 90% of the increase in the number of trucks owned in Japan (Fig. 3).

2.3. Number of Truck Registrations in Japan

The number of new truck registrations in Japan in 2022 decreased 2.4% to 748,000 units, falling below the previous year's level for a third consecutive year. By truck type, ordinary trucks registrations dropped 22.3% to 123,000 units over the previous year while light-duty truck registrations fell 8.4% to 212,000 units over the same period. In contrast, mini-vehicle truck registrations rose 9.7% to 413,000, recovering to the 400,000 unit level for the first time in three years. The drop in ordinary and light-duty truck registrations is the result of the halt in shipments due to the Hino emissions and fuel consumption certification scandal, as well as to deteriorating business conditions caused by high fuel prices driving the transport industry to refrain from buying new vehicles and transition from light-duty to mini-vehicle trucks (Fig. 4).

2.4. Truck Exports

Benefiting from a further recovery of economic activity following the slowdown triggered by the COVID-19 pandemic, the number of exported trucks in 2022 in-

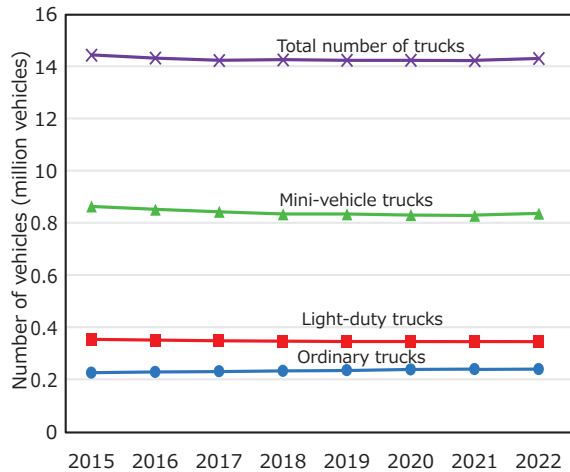


Fig. 3 Number of vehicles (calendar year)

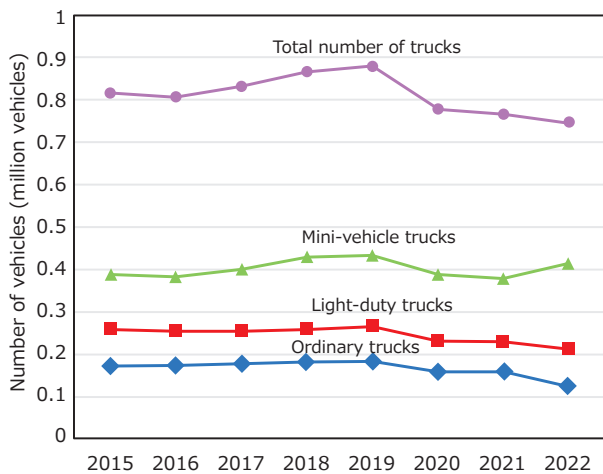


Fig. 4 Number of New Registrations (Calendar Year)

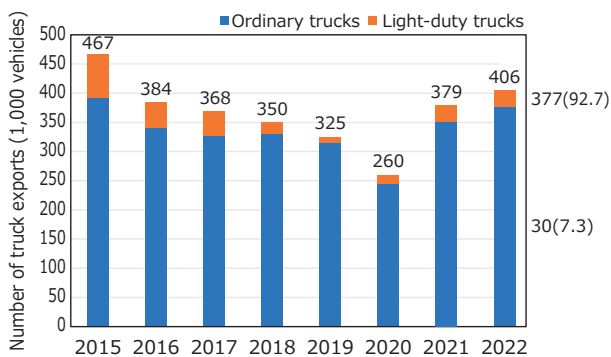


Fig. 5 Number of Buses Exported (Calendar Year)

creased 7.2% over the previous year to 406,000, exceeding the 400,000 mark for the first time in seven years (Fig. 5). By destination, exports to Asia and Central and South America rose by more than 15% over the previous years, while exports to Europe, North America, and the

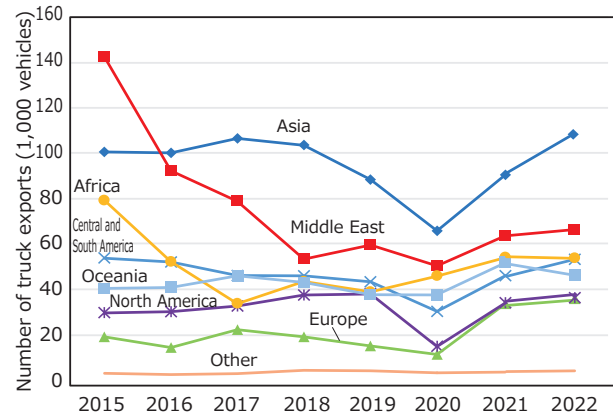


Fig. 6 Number of Truck Exports According to Destination (Calendar Year)

Middle-East increased by 5.5 to 9.5% (Fig. 6).

3 2022 Model Year Trucks and Special Characteristics

3.1. Trucks Manufactured in Japan (1) Heavy-Duty Trucks

Isuzu released an upgraded version of its Giga heavy-duty truck in October 2022 (Fig. 7). The flagship model achieves the 2025 fuel economy standards + 5% level through improvements to the 6UZ1 engine, the use of new tires with low rolling resistance, and other upgrades. At the same time, the Lane Keep Assist activation conditions on vehicles equipped with the Smoother-Gx (AMT) have been expanded to start at a vehicle speed of 0 km/h, while the Driver Emergency Assist system received a new optional function that brings the truck to a stop while keeping it in its lane when driving in a straight line or a curve. In addition, the traffic sign recognition function has been made standard on all models, with a speed limiter linked to traffic signs offered as an option. The mandatory installation of rear visibility or detection systems on existing vehicles coming into effect in May 2024 has also led to making rear view cameras standard equipment on all models, including dump trucks and mixers.

UD Trucks launched the 2022 model of its Quon heavy-duty truck in July 2022 (Fig. 8). The addition of the ECO+ mode, improved engine oil performance, the use of low rolling resistance tires and other upgrades have enhanced the fuel efficiency and environmental performance of this model equipped with an 11-liter engine and the ESCOT-VI transmission. Driving performance has also been improved by updating Traffic Eye Cruise



Fig. 7 Isuzu Giga



Fig. 9 Isuzu Forward



Fig. 8 UD Trucks Quon



Fig. 10 Hino Dutro Z EV

Control (a distance control system), which originally deactivated automatically when vehicle speed dropped below 15 km/h, to remain active after slowing down, even if the vehicle stops completely. Furthermore, the Quon sold in September has been equipped with the Smart Blind Spot Information System (BSIS) and Smart Lane Change Assist (LCA). The Smart BSIS is a rear collision warning device that detects moving bicycles at the left rear, an area prone to becoming a blind spot, and alerts the driver, while the Smart LCA is a system that detects vehicles at the left rear during a lane change and emits a warning. Detecting a bicycle or vehicle at the left rear turns on an indicator installed in the passenger seat pillar. If there is a risk of collision, the indicator starts blinking, and warnings are emitted via a pop-up indication and a buzzer.

(2) Medium-Duty Trucks

In February 2022, Isuzu started selling Smoother-Fx (AMT)-equipped Forward medium-duty models newly featuring millimeter wave adaptive cruise control with all-speed tracking (Fig. 9). That cruise control system reduces the burden on the driver by automatically accelerating, decelerating, stopping or starting to maintain a preset distance with the preceding vehicle in the entire 0 to 90 km/h speed range.

(3) Light-Duty Trucks

In June 2022, Hino launched the Hino Dutro Z EV (only available via a five-year lease), an ultra-low floor front-wheel-drive light-duty BEV truck built on a newly



Fig. 11 Mitsubishi Fuso Truck and Bus eCanter (from the left, small, medium, and large battery trucks)

developed dedicated BEV chassis (Fig. 10). It primarily targets deliveries in urban areas, and is characterized by an ultra-low floor that reduces driver burden when working with cargo or getting in the vehicle. A walk-through design makes the cargo area directly accessible, and two types of cab chassis are available, making it possible to customize the cargo bed based on usage. Safety systems include the Pre-Collision Safety system (PCS3), the Erroneous Start Prevention Function, a clearance sonar, a lane departure warning system, an electric parking brake, as well as a rear view camera and electronic rear view mirror.

Mitsubishi Fuso Truck and Bus launched its completely redesigned eCanter BEV light duty truck in September 2022 (Fig. 11). While the previous model had a battery capacity of 82 kWh, a cruising range of 100 km (in

JE05 mode) and a gross vehicle weight (GVW) in the 7.5-ton class, this next-generation model uses modular batteries, offers a cruising range of 324 km, and variants ranging from the 5-ton class for the smallest model to the 8-ton class for the largest. The new modular batteries have a capacity of 41 kWh per pack, and come in small, medium and large sizes respectively containing one, two, or three packs. Different options based on usage are available for the cruising range, which is 116 km with a small pack, 236 km with a medium pack, and 324 km with a large pack when driving at 60 km/h for a half-loaded flat-bed model. The truck also features a new external electricity supply system and can serve as source of power for the social infrastructure in the event of an emergency. The safety systems feature the first use of the Active Sideguard Assist 1.0 left turn accident prevention system with a collision damage mitigating function in a Fuso brand light-duty truck, as well as the Back Eye Camera System that relies on a rear view camera to reduce the risk of accidents when reversing. The company started taking orders for the new model in March 2023.

The Elf EV added by Isuzu to its fully redesigned Elf series lineup in March 2023 also uses modular batteries, and is offered in two versions, a standard cab with a 40 kWh two-battery pack, and a high cab with a 60 kWh three-battery pack.

(4) Mini-Vehicle Trucks

Suzuki launched version of its Carry and Carry Special Purpose truck with partially modified specifications in April 2022 (Fig. 12). The modifications involve a switch from the 3-speed to a 4-speed automatic transmission, and the adoption of a start-stop system in the Carry. The Carry Special Purpose truck was outfitted with the Suzuki Safety Support active safety technologies (dual camera brake support, erroneous start prevention, rear erroneous start prevention, lane departure warning, vehicle swerving warning, preceding vehicle departure reporting, and more).

3. 2. Trucks outside Japan

In July 2022, Daimler Truck started production of the eEonic waste disposal truck based on the eActros and aimed at organizations such as local authorities in Germany (Fig. 13). Mass production of the eActros 300 tractor is scheduled to start in the latter half of 2023.

Volvo started mass production of the heavy-duty Volvo FH (Fig. 14), FM (Fig. 15), and FMX BEV models at



Fig. 12 Suzuki Carry KX



Fig. 13 Daimler Truck eEonic



Fig. 14 Volvo FH Electric



Fig. 15 Volvo FM Electric

the Tuve plant in Göteborg, Sweden, in September 2022. According to the Volvo Group, the mass production of heavy-duty BEV trucks is a world first.

In Europe, Daimler Truck, Traton, and Volvo created the Commercial Vehicle Charging Europe joint venture



Fig. 3 Interior of the Mitsubishi Fuso Truck and Bus eCanter



Fig. 4 Gauge Display in the Mitsubishi Fuso Truck and Bus eCanter

a design that also enhances functionality. At the same time, unifying the display graphics of the gauges with the dashboard motif (Fig. 4) and the touch panel extending out at center create an interior with a modern feel. The interior color arrangement consists of dark tones offering a sober overall impression with, as on the exterior, the electric truck defining orange used as an accent to bring out the sense of EV specialty.

1. 3. Color Design

With its fire quartz red metallic (Fig. 5), ice green (Fig. 6), and offbeat khaki metallic (Fig. 7) exterior colors, along with the black interior color, the Daihatsu Hijet Truck became the first mini-vehicle truck to win the Grand Prix at the Auto Color Awards 2022 hosted by the Japan Fashion Color Association (JAFCA). The award-winning colors, which coordinate interior and exterior color based on the concept of making tasks more enjoyable and comfortable, also drew significant interest in mini-vehicle truck color variations that had received little attention in the past, even among people who do not use trucks. The high acclaim for the color coordination in the Hijet Truck has led to heightened focus on the colors of upcoming mini-vehicle and other trucks.



Fig. 5 Fire Quartz Red Metallic Daihatsu Hijet Truck



Fig. 6 Ice Green Daihatsu Hijet Truck



Fig. 7 Offbeat Khaki Metallic Daihatsu Hijet Truck

2 Truck Design outside Japan

2. 1. Exterior Design (Appearance)

Tesla began deliveries of its Semi heavy-duty tractor head (Fig. 8) in 2022. There were no major changes to the design announced in 2017, which is characterized by a flat front mask with no radiator cooling opening (Fig. 9), a structure unique to electric trucks that is not seen in conventional trucks. The majority of zero-emission trucks currently on the market are based on conventional models and use the grille or front mask design to differentiate themselves. As a dedicated electric truck, the Tesla Semi also features overall proportions that move away from conventional designs such as long hoods containing a large engine or cabovers to adopt a radical new style worthy of an electric truck. With the number of dedicated zero-emission vehicles anticipated to increase,



Fig. 8 Exterior of the Tesla Semi



Fig. 9 Exterior of the Tesla Semi



Fig. 10 Exterior of the Ford Motor Company F-150 Lighting

the delivery of the Tesla Semi, which retains the concept car-like design from its original announcement, is expected to influence upcoming overall trends in truck design.

Ford Motor Company started production of the F-150 Lighting electric pickup truck in April 2022. An EV version of the F-150, the F-150 Lighting features a front mask design completely different from that of the original model. The dedicated front mask features a distinctive thick horizontal belt-shaped line, with some grades offering the option have a version of the belt that lights up. On a structural level, the front mask also takes aerodynamics into account with a smooth design presenting relatively little unevenness (Fig. 11), drawing a line from



Fig. 11 Exterior of the Ford Motor Company F-150 Lighting



Fig. 12 Exterior of the Toyota Motor North America Tundra

the traditional North American market pickup trucks that relied on a large, tough looking front grille to project a strong presence.

Toyota Motor North America modified the design of its Tundra full-size pickup truck (Fig. 12). As in other typical North American market pickup truck designs, the front grille taking up a large part of the front mask contributes to projecting a strong presence. The design of the front grille exudes robustness with a horizontally stretched hexagonal pattern with a motif that connects to the profile line of the grille. The entirety of the front mask, including the grille, gives an overall impression of sharp lines and a rugged build that blend with the fierce headlamps to emphasize a forceful image.

3 Concept Truck Design

3.1. Concept Vehicles in Japan

In December 2022, MFTBC unveiled the NomadPro Canter, a concept truck designed to serve as a remote office (Fig. 13). Based on the MFTBC Canter, the NomadPro Canter concept vehicle presents the idea of turning the rear body of the truck into a space for remote work or relaxation. The design concept proposes a new style involving working remotely in a place in touch with nature, which constitutes the focus of the choice of colors



Fig. 1 Mitsubishi Fuso Super Great

Table 2 Main Product Technology Trends for Medium-Duty Trucks in 2022

Month of launch	Name of vehicle model	Main characteristics
February	Forward (Isuzu Motors)	Expanded safety systems.

Table 3 Main Product Technology Trends for Light-Duty Trucks In 2022

Month of launch	Name of vehicle model	Main characteristics
June	Dutro (Hino Motors)	Low-floor EV.
September	eCanter (Mitsubishi Fuso)	Complete redesign Expanded chassis lineup.



Fig. 2 Mitsubishi Fuso eCanter.

(3) Light-Duty Trucks

Table 3 shows the light-duty trucks announced in Japan in 2022, and the main product technology trends. Hino has released a new Dutro EV built on a chassis developed exclusively for EVs. It features an ultra-low floor structure that makes working with cargo, as well getting on or off, easier.

Mitsubishi Fuso announced a complete redesign for the third generation eCanter (Fig. 2). The new model in-

Table 4 Main Product Technology Trends for Mini-Vehicle Trucks In 2022

Month of launch	Name of vehicle model	Main characteristics
January	Hijet Truck series Sambar Trucks (Subaru)	Safety systems added
April	Carry series Carry (Suzuki) NT100 Clipper (Nissan) Minicab Truck (Mitsubishi) Scrum Truck (Mazda)	Use of a 4 -speed automatic transmission.

tegrates the rear axle and motor, creating a compact structure that extends the chassis lineup.

(4) Mini-Vehicle Trucks

Table 4 shows the mini-vehicle trucks announced in Japan in 2022, and the main product technology trends. The Subaru Sambar Truck has boosted its safety functions with the addition of Smart Assist as standard equipment on all models.

The Mazda Scrum Truck, Nissan NT100 Clipper, Suzuki Carry, and Mitsubishi Minicab Truck have adopted a 4-speed automatic transmission to offer improved fuel efficiency.

(5) Trucks Manufactured outside Japan

Efforts to decarbonize commercial vehicles are moving forward. Freightliner, the North American brand of Daimler Truck, announced that it had begun mass producing the eCascadia heavy-duty battery electric vehicle (BEV) truck. Similarly, Volvo Trucks announced it had started mass production of a BEV with a gross vehicle weight of 44 tons. In addition, the Scania announcement that it would introduce a fuel cell vehicle (FCEV) truck to the market shows that manufacturers are making progress in both BEV and FCEV development.

1. 2. Interior Comfort

Advances have been made in development related to improving coziness and comfort, particularly in heavy-duty trucks.

The Isuzu Giga released in October 2022 features new seats with a high performance design. The seats reduce fatigue over long drives and enhances safety and driving operability by providing a mechanism to lock the seat at the desired height and expanding the range of adjustable driving positions.

The Mitsubishi Fuso eCanter offers heating for the seats, steering wheel, and other appropriate locations to offer comfort while reducing electricity consumption through the use of energy efficient heating functionality.



Fig. 3 Mitsubishi Fuso eCanter.

1. 3. Operability

The number of drivers has been decreasing year after year, and more and more operators are sustaining their pool of drivers and attracting new ones by hiring women drivers. This has led to development efforts aimed at also accommodating short drivers.

The Isuzu Giga makes getting on and off easier by complementing the grab handles found in heavy-duty trucks with the installation of the smart entry system also used in light-duty trucks.

Since its 2017 complete redesign, the UD Trucks Quon has used a rounded instrument panel centered on the driver. This makes the gauges in the instrument panel easier to reach from the driver's seat, which reduces the burden on women drivers.

The Hino Dutro features an ultra-low floor dedicated EV chassis, reducing driver burden by offering superior accessibility for working with cargo, as well as for entering or exiting the vehicle. The walk-through structure providing direct access to the cargo area from the driver's seat, as well as the use of a sliding door, deliver excellent ease-of-use in narrow urban or residential roads.

1. 4. Noise and Vibration

Continued improvements in comfort and the transition to EVs are leading manufacturers to take measures against road noise. The Mitsubishi Fuso eCanter ensures interior comfort by optimizing the placement of sound absorbing and insulating materials inside the cabin to dampen interior noise and improve insulation.

The UD Trucks Quon features an improved powertrain system that provides comfort through smooth gear shifting. At the same time, the Active Steering system used since 2021 reduces driver fatigue by offering enhanced straight line stability when driving at high

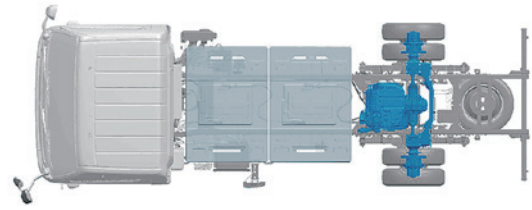


Fig. 4 Mitsubishi Fuso eCanter.

speeds, as well as by absorbing the impact from road joints.

1. 5. Safety

The intensifying development of EVs makes it necessary to protect the lithium-ion battery packs from the impact of a collision. In passenger cars, safety is secured by placing the battery case containing several battery packs in the underbody and surrounding it with the vehicle frame, but doing the same thing with the rudder frame structure of trucks had proven complicated. In the Mitsubishi Fuso eCanter released in September 2022, the use of the eAxle made it possible to install the batteries under the empty frame (Fig. 4) to protect them from impacts.

1. 6. Aerodynamic Characteristics

Manufacturers are striving to make improvements in aerodynamics in response to the 2025 fuel economy regulations.

The freight line of Isuzu Giga trucks uses a spoiler and side skirts to enhance aerodynamics and help improve fuel efficiency.

2 Rear Body

More and routes have relaxed the restriction on the length of full trailers from 21 to 25 m to enhance transportation efficiency, in anticipation of the so-called "2024 problem" that will set upper limits on work outside regular hours for drivers. The relaxed restriction has been applied to routes in the Hokuriku and Shikoku areas in addition to those in the Tokyo metropolitan area.

In that context, NEXT Logistics Japan is seeking to improve transportation efficiency through the use of transportation between depots.

At the same time, swap body containers, which reduce cargo loading and unloading time to raise driver operating efficiency, have been the object of further development and are seeing greater adoption.