

# TRUCKS

## Overall Trends

### 1 Introduction

The increase of the consumption tax to 10% in October is one of the events that affected the truck industry in 2019. However, this was accompanied by a change in the automobile tax system from the vehicle acquisition tax to a tax proportional to environmental performance. Advance demand before the rise came into effect was minor and had limited impact. Natural disasters also had an impact, with Typhoon No. 15 (known in Japan as Reiwa 1 Bōsō Peninsula Typhoon) and Typhoon No. 19 (known in Japan as Reiwa 1 East Japan Typhoon) striking the Tokyo metropolitan area directly in September and October, respectively. Some automaker and parts manufacturer facilities were damaged, disrupting operations. Driver aging, driver shortages, greater efficiency, reduced fuel consumption, and safety remained the most prominent issues in the transportation sector, intensifying purchases of vehicles that address these issues, as well as the sharing of deliveries between competitors. Outside Japan, the slowdown of the Chinese economy and the emergence of U.S. protectionism, along with the U.K. decision to leave the EU, stirred greater uncertainty in the global economy.

Collaborations involving Japanese truck manufacturers saw a growing number of global partnerships. Isuzu Motors joined forces with Cummins (June), allied with Volvo, and announced the acquisition of UD Trucks (December). Hino Motors established a procurement joint venture with Volkswagen (October), while Mitsubishi Fuso continues to form a part of the Daimler Group.

At the Tokyo Motor Show held in October against this backdrop, manufacturers presented their concept vehicles and safety initiatives. With the 2016 emissions regulations applying to registered vehicles with a GVW below 7.5 t, and the J-OBV II regulations applying to those with a GVW of 7.5 t or higher as of October, exhibits of partial redesigns by all manufacturers to make their ve-

hicles compliant drew a lot of attention. At the same time, there were also exhibits featuring concept vehicles, hybrid trucks, and other new technologies.

### 2 Recent Truck Market Trends

#### 2.1. Freight Shipments in Japan

Freight shipments in Japan in 2018 amounted to 409.9 billion ton kilometers, a 1.1% decrease compared to 2017. Truck, railway, maritime and air shipments all decreased. Nevertheless, the fluctuation over the last five years remains within  $\pm 2\%$ , indicating a relatively stable situation. By share, trucks continue to constitute the majority of freight shipments, accounting for 51.3% (Fig. 1). Broken down by vehicle type, ordinary trucks account for 80.6% of shipments, a trend that has remain un-

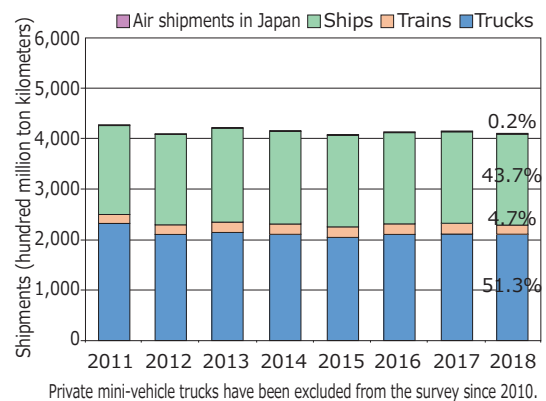


Fig. 1 Freight Shipments in Japan

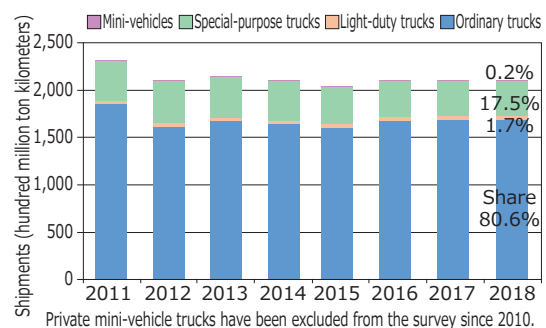
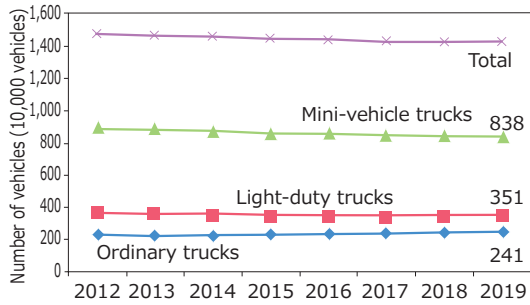
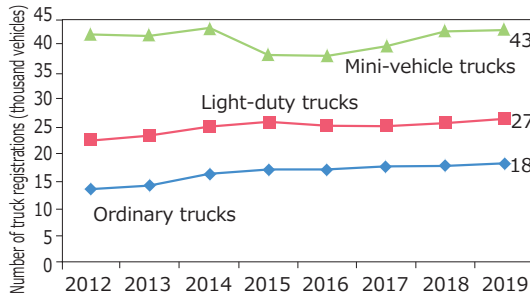


Fig. 2 Freight Shipments by Vehicle Type



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



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

changed for several years (Fig. 2).

## 2. 2. Number of Trucks in Japan

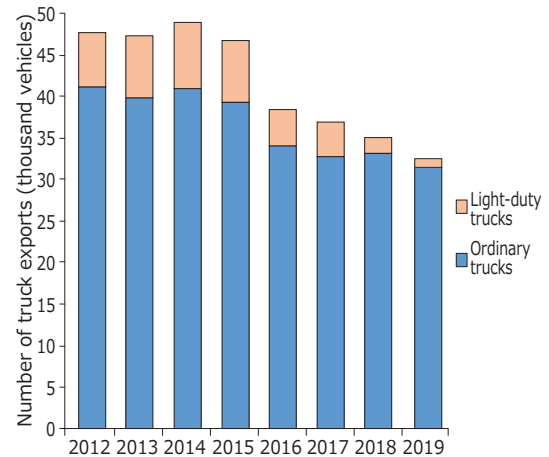
The number of trucks owned in Japan in 2019 as 14.3 million vehicles, a slight increase of 1,000 vehicles compared to the previous year that brought the continued decrease of the last few years to halt. The increase in the number of ordinary and light-duty trucks exceeded the decrease in the number of mini-vehicle trucks (Fig. 3).

## 2. 3. Number of Truck Registrations in Japan

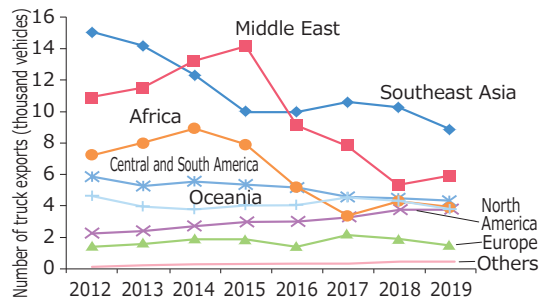
The number of truck registrations in Japan in 2019 was approximately 880,000, an increase of 1.5% over the previous year. By category, light-duty trucks saw a large increase of 3.3%, which contrasts with the 0.6% for mini-vehicle trucks. This represents three consecutive years of increase since 2017 (Fig. 4).

## 2. 4. Truck Exports

Approximately 325,000 trucks, 315,000 ordinary trucks and 10,000 light-duty trucks, were exported in 2019, a decrease of 7.2% compared to the previous year. This represents a fifth consecutive year of decrease (Fig. 5). By destination, the number of vehicles exported to the Middle East and North America both rose, by 11.4% for the former and 1.2% for the latter. Exports decreased in all other destinations, most notably in Southeast Asia, where they dropped by approximately 15% (Fig. 6).



**Fig. 5** Number of Truck Exports According to Truck Type



**Fig. 6** Number of Truck Exports According to Destination



**Fig. 7** UD Trucks Quon

## 3 2019 Model Year Trucks and Special Characteristics

### 3. 1. Trucks Manufactured in Japan

In January 2019, the criteria for passage permits for special vehicles were relaxed, enabling the operation of 25-meter articulated vehicles. Double articulated trucks that meet this criterion have started operation. In September, the Japan On-Board Diagnostic (J-OBD II) became mandatory for new registered vehicles with a GVW exceeding 7.5 t, while the 2016 emissions regulations became mandatory for new registered vehicles with a GVW of 7.5 t or less. Manufacturers introduced new models compliant with these regulations.

This compliance with emissions regulations was ac-



Fig. 8 25 t Double Articulated Truck



Fig. 9 Hino Profia

accompanied by a broadening of the scope of safety systems, a trend encouraged by additional government subsidies (for side collision warning systems).

### (1) Heavy-Duty Trucks

**January:** UD Trucks targeted users traveling short-to medium distances or prioritizing load capacity with the addition of a model equipped with an 8-liter GH8 engine to its Quon heavy-duty truck lineup (Fig. 7) It also made all variants compliant with J-OBID II.

**March:** With the Giga and Profia heavy-duty trucks, Isuzu Motors and Hino, respectively, offered a possible solution to the eventual driver shortage by initiating the operation of a double articulated 25-meter full trailer designed to increase transport efficiency. Yamato Transport, Nippon Express, Seino Transportation, and Japan Post established joint major transport routes for parcel and other deliveries between the Kanto and Kansai areas (Fig. 8)

**April:** Hino Motors partially redesigned the Profia heavy-duty truck, making it J-OBID II compliant while also introducing the Sight Around Monitor side collision warning system, making variable light distribution LED headlamps standard equipment on all variants, and enhancing the performance of the Driver Monitor II system to offer a fuller suite of safety systems (Fig. 9).

Mitsubishi Fuso Truck and Bus partially redesigned the Super Great to make it compliant with J-OBID II regulations.

**June:** Hino Motors mounted a lithium-ion battery on



Fig. 10 Hino Profia Hybrid



Fig. 11 Mitsubishi Fuso Super Great



Fig. 12 Isuzu Giga

the Profia heavy-duty truck and launched a hybrid model that features gradient anticipation control based on AI technology (Fig. 10). This model exceeds the 2015 heavy-duty vehicle fuel economy standards by 17.5%. The lineup also offers the Hino Profia Cool Hybrid electric refrigerator truck, which uses the hybrid system as a source of power for the refrigerator.

**October:** Mitsubishi Fuso Truck and Bus partially redesigned its Super Great heavy-duty truck, expanding its safety systems, introducing the level 2-equivalent Active Drive Assist advanced driving support system, enhancing the performance of the Active Brake Assist (ABA®5) collision mitigation braking system, and adding new systems such as a road sign recognition function and the Intelligent Headlight Control system (Fig. 11).

**December:** Isuzu Motors partially redesigned the Giga, enhancing its safety performance by extending the pre-collision braking system detection range to include crossing pedestrians, and installing systems such as millimeter wave adaptive cruise control with all-speed tracking, side collision warning, and a driver monitor. A new high-roof model with a total height of 3.8 m has also been added to the lineup (Fig. 12).



Fig. 13 Isuzu Forward



Fig. 14 Hino Ranger



Fig. 15 Mitsubishi Fuso Fighter



Fig. 16 Hino Dutro

## (2) Medium-Duty Trucks

**March:** Isuzu Motors partially redesigned the Forward medium-duty truck, making it compliant with J-OB D II, and using that opportunity to expand its safety features by setting connected services, brake override, side under view mirrors and other items as standard equipment.

**May:** Hino Motors partially redesigned the Ranger medium-duty truck, making it compliant with J-OB D II, and expanding its safety systems through changes such as setting automatic high beams as standard equipment and enhancing the performance of the Driver Monitor II system.

**September:** Mitsubishi Fuso Truck and Bus partially redesigned the Fighter medium-duty truck to both make it compliant with J-OB D II and expand its safety systems



Fig. 17 Isuzu Elf



Fig. 18 Mitsubishi Fuso Canter

(Fig. 15). Systems such as the Active Sideguard Assis side collision warning, collision mitigation brakes, and a driver monitor have been added.

## (3) Light-Duty Trucks

**May:** Hino Motors partially redesigned the Dutro light-duty trucks to comply with the 2016 emissions regulations for models with a GVW of 7.5 t or less, and with J-OB D II for those with a GVW exceeding 7.5 t. At the same time, it expanded the scope of its safety systems (Fig. 16). New additions include making the forward false start prevention and low-speed collision mitigation functions, as well as LED headlamps, standard on all models, the adoption of a digital rearview mirror, and connected services.

Isuzu Motors partially redesigned the diesel models with a GVW exceeding 7.5 t and hybrid variants of the Elf light-duty truck to comply with the 2016 emissions regulations (Fig. 17). At the same time, it expanded its safety systems by enhancing the capability of the object detection system via the installation of a stereo camera, improving the performance of the collision mitigation braking system, and adding connected services as standard equipment. Models with a GVW exceeding 7.5 t were also made compliant with J-OB D II. In addition, variations were added to the 4WD series of models.

Similarly, Mitsubishi Fuso Truck and Bus also made the Canter light-duty truck variants with a GVW of 7.5 t or less compliant with the 2016 emissions regulations, and variants with a GVW exceeding 7.5 t compliant with J-OB D II. It also expanded its safety systems by extend-



Fig. 19 Nissan NT450 Atlas



Fig. 20 Nissan Atlas Diesel



Fig. 21 Suzuki Carry

ing the installation of advanced safety technologies, including collision mitigation braking, vehicle stability control, and lane departure warning systems to the class of vehicles with a GVW exceeding 7.5 t.

**July:** Nissan made its Mitsubishi Fuso Truck and Bus OEM-models of the NT450 Atlas light-duty truck with a GVW of 7.5 t or less compliant with the 2016 emissions regulations, and expanded its safety systems by making the Vehicle Dynamic Control (VDC), Intelligent Emergency Brake (collision mitigation braking), and Lane Departure Warning (LDW) systems standard equipment on all variants.

**August:** Nissan launched a 1.5 t variant of the Atlas Diesel Isuzu OEM-model (Fig. 20). Compliance with the 2016 emissions regulations was complemented with extended safety features provided by the addition of advanced safety technologies such as the Intelligent Emergency Brake, Vehicle Dynamic Control (VDC) and Lane Departure Warning (LDW) systems.

#### (4) Mini-Vehicle Trucks

**September:** Suzuki expanded the safety features of the Carry mini-vehicle truck by adding the Dual Camera Brake Support collision mitigation braking system, adopt-



Fig. 22 Mitsubishi Minicab



Fig. 23 Daihatsu Hijet



Fig. 24 Renault C Range



Fig. 25 Volvo FH XXL

ing a system capable of detecting pedestrians at night, and installing lane departure warning, erratic driving warning, preceding vehicle start notification, and high-beam assist functions (Fig. 21).

Mitsubishi Motors added the active safety e-Assist system to the Minicab mini-vehicle truck OEM model from Suzuki (Fig. 22).

**October:** Daihatsu partially refined the Hijet mini-vehicle truck, making LED headlamps standard on some grades (Fig. 23).



**Fig. 26** Mercedes-Benz Actros



**Fig. 28** Iveco S-Way



**Fig. 27** Volvo FE



**Fig. 29** DAF City Turn Assist

### 3. 2. Trucks Manufactured outside Japan

Sales of new technologies announced at the 2018 IAA have begun. As in Japan, safety features are being expanded. In addition, European truck manufacturers are working on the development of electric heavy-duty trucks and customer testing by transport operators is underway.

**April:** Renault Trucks expanded the safety features of the C and K range medium-duty trucks with the addition, notably, of a side collision warning system and passenger-side lower window (Fig. 24).

**June:** Volvo Trucks added an XXL version to the FH cab heavy-duty truck (Fig. 25). The rear panel of the cab was moved 25 cm rearward, expanding the interior cabin space.

At 13 cm long and 25 cm, the large bed expands its luggage capacity to 50 liters.

**July:** Mercedes-Benz has begun to sell the new technology it unveiled at the 2018 Internationale Automobil Ausstellung (IAA) international commercial vehicle show (Fig. 26). The partially redesigned Actros heavy-duty truck, equipped with level 2 driving support, MirrorCam, road sign recognition and other systems, has been introduced in the European market. This model received the

European 2020 Truck of the Year award. Some of those technologies are also used in the Mitsubishi Fuso Truck and Bus Super Great.

**November:** Volvo Trucks announced the launch of the FL (GVW of 16 t) and FE (GVW of 27 t) electric heavy-duty trucks in some European countries (Sweden, Norway, Germany, Switzerland, France, and the Netherlands) starting in March 2020. They are designed for local transport uses such as deliveries and garbage collection (Fig. 27).

**December:** Iveco launched the S-Way heavy-duty truck (Fig. 28). This successor to the Starlis offers features such as a newly designed cab with enhanced aerodynamic performance, better fuel efficiency thanks to the Iveco Hi-Cruise GPS predictive system, and full connectivity. There is currently no right-hand drive model available for Japan and other left-hand drive traffic.

DAF has offered enhanced safety performance with the introduction of the DAF City Turn Assist side collision warning system as an ex-factory option on its 4 × 2 FT and 6 × 2 FTP heavy-duty tractor units (Fig. 29)

## 1 Introduction

How many readers of this article have had the experience of driving a truck? Trucks use centers on commercial use, and their design focuses on how effectively they can transport cargo, which makes them differ from general passenger vehicles in many respects. This section uses Mitsubishi Fuso trucks to illustrate the design of the elements that give trucks their distinctive impression, which day-to-day life offers very few opportunities to appreciate.

## 2 Fuso as Part of the Daimler Group

A member of the world-leading Daimler German commercial vehicle group, Mitsubishi Fuso Truck and Bus Corporation (simply Fuso in the rest of this article), develops and manufactures trucks, buses and production engines. It offers its customers environmentally friendly, safe, reliable, economically efficient products of superb quality in over 170 countries worldwide. Fuso is also part of the Daimler's Asian strategic organization, Daimler Trucks Asia (DTA), in which it collaborates with Daimler India Commercial Vehicles (DICV), on everything from research and development to procurement, production, export and sales to offer a broad lineup of products (Fig. 1). Expectations and uses concerning trucks vary from one country to another. Some, like Japan, have a good road infrastructure and driving environment, while others have rough, not even paved roads that impose unexpectedly high driving loads. Even in such environments, manufacturers must offer a broad selection of reliable, high-quality products.

The new Product and Design Center in Kawasaki carries out development and branding for a variety of products meeting those criteria targeting the core Asian market. The greatest benefit of collaborating with Mercedes-Benz Trucks and BharatBenz Trucks as a member of the Daimler Group is the ability to prepare a production structure adapted to local needs and keep development costs down thanks to the sharing of parts.

Developing and selling vehicles throughout the world means working with people from various regions and nationalities of different genders and ways of thinking. Diversity is a key element in responding flexibly to chang-

ing market needs, and joining the Daimler Group has imbued Fuso with an abundance of internationally-oriented and multifaceted viewpoints. The Head Office in Kawasaki also employs many non-Japanese workers, and uses its diversity as a weapon in product development.

## 3 The Fuso Identity

When talking about truck distinctiveness, their large size is the first thing that comes to mind. It is a little known fact that cabs (the cabin and driver's seat) come in a variety of types, such as narrow or wide, or with high or low bumpers, allowing a choice of the optimal specifications for the intended destination, application, and use of the cargo bed. There are also several variations on the length of cab frames and engine power. Since Fuso also offers a lineup of buses in addition to those variations, it also focuses on expressing its brand distinctiveness by presenting a uniform face across its range of products that differ in size and specifications.

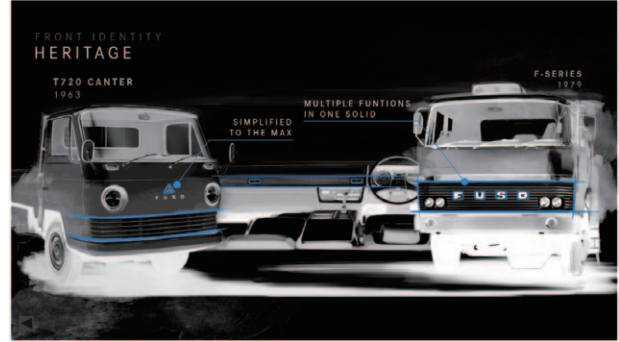
Brand distinctiveness is something that matures over many years. It is created by the impression of the manufacturer's products themselves, it is grounded in elements such as the usage made by various users and the vision that prompts their release into the market, and clearly cannot be established overnight. These factors are reflected in the mindset and attitude towards manufacturing of each and every employee, and the approach taken by the design and engineering divisions, which are involved in the development of the product, have a notable influence on the subsequent course of action. Fuso must therefore establish a clearly recognized image and



Fig. 1 Daimler Group Lineup From the left: BharatBenz, Western Star Trucks, Mercedes-Benz Trucks, Freightliner Trucks, Fuso, Thomas Built Buses



**Fig. 2** The Fuso Identity and Face Design The truck in the middle is the eCanter F-Cell



**Fig. 3** 1963 First-Generation T720 Canter and 1979 Fourth-Generation F Canter

build appealing products that make people want to use its vehicles in their work.

Vehicles driven on ordinary roads must comply with regulations that differ from one country to the next. This makes it necessary to incorporate, for example, aerodynamic requirements aimed at increasing fuel efficiency, or collision requirements designed to protect pedestrians and occupants, and the position of headlamps to ensure safe driving, and the size of radars, all impose restrictions on designs. On top of that, manufacturers have their own manufacturing requirements, which combine with the adoption of carryover parts as a cost reduction measure to largely determine the design of the frames. The trucks and buses produced at Fuso are also all, without exception, subject to design restrictions. This makes it an iconic design recognizable as Fuso at a glance all the more important.

The recently released eCanter F-Cell promotes its fuel cell technology of the future by further accentuating the black belt design identity concept first used in the light-duty Rosa and heavy-duty Aero Queen buses to express the simplicity and precision that constitute the essence of Fuso design (Fig. 2). The next section will describe the intent behind that concept.

#### 4 The Black Belt

Fuso has plans to give all of its products a uniform face to strengthen its brand identity. The previous generation Canter offers an easy-to-understand example of the design intent that consolidated functionality around the radiator grille. This served as the basis for the black belt concept. The concept uses the power of the black belt to directly express the values of authenticity, courage and persistence that form the pillars of Fuso.

The radiator grille of the fourth-generation Canter F

launched in 1979 was more than just an inlet for cooling air. It also served to emphasize the headlamp bezels and the emblem, and was a successful example of keeping model costs down by reducing the number of parts (Fig. 3). One major difference between commercial vehicles and ordinary passenger vehicles is the low production volume, and keeping costs down is a strict maxim because recovering them takes years. Taking steps to reduce the number of parts and model costs to make products as affordable as possible is not enough. It is also essential to simultaneously offer added value through the expression of Fuso distinctiveness. Perceived quality refers to the sense of quality users attribute to a product based on its appearance, tactile feel, and ease-of-use, and balancing the cost of the product with that perceived quality is the most difficult responsibility imposed on designs.

Commercial vehicles are used every day, and that is precisely why perceived quality must be offered in the form of comfort and utility that makes users want to use the vehicle in their work. The ultimate goal of manufacturers such as Fuso is to make the user happy. Improving grip texture by simply switching between grains without using separate parts, for example, is a perceived quality improvement easily overlooked in commercial vehicles that ingeniously enhances user satisfaction while reducing costs. The Fuso black belt, like its martial arts namesake, represents the culmination of many years spent building the Fuso history and the passion of the designers who have worked to enhance the brand image.

#### 5 Common Headlamps

This section presents another example of design centered on consolidating functionality. In an effort to further strengthen the aforementioned brand identity, Fuso





**Fig. 4** Aero Queen with the Common Headlamp Unit

uses the same headlamp unit in both the light-duty Rosa and heavy-duty Aero Queen buses (Fig. 4). Using common headlamps has the obvious benefit of cutting down on the overall company investment, but beyond that, the use of identically shaped lamps connecting to the black belt makes it possible to present a face that is even more recognizably Fuso. A product's face strongly impacts the impression it makes. Revamping the common headlamps that consolidate functionality into a shape that symbolizes the brand eliminates the sense of having seen this before, and turned out to be a highly cost effective idea that can be used across products.

Switching not just the high and low beams, but also the daytime running lights (DRL) to LEDs ensures both good forward visibility at night and longevity. The DRL act as position lamps and their shape emphasize the black belt while making the truck, which is wider than passenger vehicles, noticeable to other vehicles to help reduce accidents both during the day and at night. In terms of the integration of several functions into a single element, combining the headlamp, DRL and turn signal functions into a single unit led to enhanced component efficiency as well as a higher quality appearance.

Looking at just the headlamp unit illustrates how a component that previously only served to provide forward illumination at night has been endowed with functionality that improves safety as well as with styling elements, and clearly demonstrates the dramatic increase in the functionality provided by that part. Determining how to incorporate ever advancing technologies into product appeal is important, and designers are being called upon to present ideas that offer true added value to users.

## 6 Vision One

Carrying over cabs, which take a long time to develop, makes it difficult to revamp their image without making



**Fig. 5** Exterior and Interior of the Vision One

major structural changes around their face. As noted in the preceding section, common headlamps have been used to present a shared brand image. For the Vision One announced at the 2017 motor show, the design theme centered on what face to give it to further strengthen the Fuso identity. This concept vehicle represented a major milestone in clearly demonstrating Fuso distinctiveness and implementing it simply and recognizably in the subsequent lineup.

The several designers involved in the project dug into the question of "What is Fuso?" and decided to incorporate the newly finished black belt in the main exterior motif. The large side mirrors were removed to preserve the sense of a simple, elegant exterior. For the interior, the seamless design theme was expressed through a single brush stroke motif applied from the dashboard to the roof storage compartment.

Elements around the driver were kept to the absolute minimum to create an environment that facilitates concentrating on driving (without attention-grabbing distractions). Comfort is provided by replacing the passenger seat with a rest area that extends from the bed and is reminiscent of a lounge chair. The design was developed along the concept of integration, which combines several functions in a single component, as illustrated, for example, by the air vents set in the spaces between the storage area, MirrorCam system, instrument panel, and body

frame. The normally uneven floor has been made as flat as possible and the passenger seat eliminated in a design that proposes a new usage and seeks to visibly bring out the electric nature of this truck, which has no engine despite its cabover appearance.

The driving environment was optimized to reflect the limited use in safe long-haul transportation, and careful attention was given to enabling users to recognize the low-stress quality of the product from its styling. Making product quality visible does not stop at the refinement of colors, material and finish (CMF) on the styling surface. It is also intended to enhance product appeal through a design that allows users to understand why that styling was chosen. The seamless shape and integration of functionality concepts of the Vision One were applied to the dashboard of the Rosa light-duty bus and entered mass production.

## **7 Trucks and Society in Days to Come**

All over the world, the infrastructure of society has long been supported by the commercial vehicles known as buses and trucks, both large and small. The rapid pace of change in society will place increasing demand on society, and vehicles previously called upon simply to move people or goods from one location to another are likely to be pressed into more complex, niche roles. Without forgetting the concepts that have led to today, providers of vehicles and their attendant services must revisit the question of why they move people or goods, and give serious consideration to the type of future they wish to create.

The work of designers goes beyond creating highly functional and stylish items and involves imagining what products they want to create in the future, and what the society that will use those products will be like. The future is found not in accomplishments or past examples, but in our imaginations. In an era of rapid changes, the freedom of thinking to select the best solution from a variety of choices, and the flexibility to step out of the box and pursue that solution, are absolutely essential. Vehicles must not be viewed as an isolated product. It is necessary to adopt a broad, long-term view that considers

what kinds of roads link one town to the next, what type of community is found in those towns, and how the people and goods there are connected to one another. As a member of such a social system, the Fuso design team will continue to capitalize on its diversity and tackle such issues.

## **8 Conclusion**

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Although they seemed distant, the days when autonomous driving becomes commonplace and using a vehicle to move around will not require a license are just on the horizon. Digital technologies have advanced to the point of blurring the line with reality, and the Internet becomes faster with each passing year. The turmoil caused by the Covid pandemic has resulted in establishing home offices, and people have realized that work previously done at the office can be done at home. This, too, represents one possible flexible approach to work, but it raises the question of just what the movement of people or goods means. Are the typical commutes to school or work really necessary? What was the point of buildings near train stations? As the global economy seeks ways to recover, it seems that the distinction between what is really necessary, and what is not, is becoming clearer. What will happen to the trucks and buses that had formed a part of the infrastructure until now? Given the premise that the distribution of goods will not disappear, what form will Fuso products and vehicles take? How will they change?

This conclusion is deliberately phrased in the form of questions to invite readers to envision their own anticipated future. The boundaries that distinguish designers from other professionals or delimit where work is performed have already blurred, and the science and technology allowing people to achieve the future they want is gradually taking shape. Designers have the mission of making the impossible possible through design, and those who work on vehicles in this age of rapid developments and changes are pouring their efforts into next-generation products that will lead to a prosperous future. It is hoped that this article will provide a little inspiration in that respect.



**Table 4** Main Product Technology Trends for Mini-Vehicle Trucks In 2019

Month of launch	Name of vehicle model	Main characteristics
September	Carry series Carry (Suzuki) NT100 Clipper (Nissan) Minicab Truck (Mitsubishi) Scrum Truck (Mazda)	Added advanced safety systems.
October	Hijet Truck series Hijet Truck (Daihatsu) Sambar Trucks (Subaru) Pixis Truck (Toyota)	Added advanced safety systems.



**Fig. 1** Mercedes-Benz Actros

of the first vehicle in the world equipped with the MirrorCam system.

### 1. 2. Interior Comfort

Manufacturers have been offering extra roominess and comfort, especially in their heavy-duty models, with high-roof variants that provide extensive storage capacity and make it possible to get changed in the cabin. They have also worked to enhance user convenience by installing USB ports and other amenities. A newly designed high-roof variant of the Isuzu Giga greatly enhances comfort and roominess (Fig. 2). Manufacturers have also been



**Fig. 2** Isuzu Giga

working on highly functional seats designed to reduce fatigue during prolonged driving.

As EVs become more prevalent, cabins are likely to become larger as flat floors become the norm. At the 2019 Tokyo Motor Show, Isuzu unveiled the Elf EV Walk-Through Van, exhibiting a vehicle that takes advantage of EV characteristics to make a walk-through structure possible.

### 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. Manufacturers are therefore offering a lineup of vehicles that takes safety, and drivability (operability) into account by, for example, ensuring a field of view and mirror positioning suitable to both shorter and taller drivers, and reducing prolonged driving fatigue through the adoption of highly functional seats that can be adjusted to an appropriate position (Fig. 3). In addition, steering wheel switches and multi-information displays are increasingly used to reduce eye movement during steering operations, improving both operability and comfort (Fig. 4).

### 1. 4. Noise and Vibration

Continued improvements in comfort and the transition to EVs are leading manufacturers to take measures against road noise and sound from the air conditioner. To ensure interior comfort, manufacturers are relying on the optimal placement of sound absorbing and acoustic



**Fig. 3** Mitsubishi Fuso Super Great Driver's Seat with Integrated Seat Belt



**Fig. 4** Area around the Mitsubishi Fuso Super

material in the cabin to reduce noise, and are also applying sound absorbing material such as glass wool or felt to cover plates such as plastic parts around the engine. Measures using designs that take exterior aerodynamic characteristics into account to minimize wind noise are also being applied.

### 1. 5. Safety

Manufacturers are installing more and more advanced safety systems, with collision-avoidance support systems and collision mitigating systems becoming standard equipment, and blind spot systems seeing greater adoption. The use of LEDs in exterior lamps is also becoming increasingly widespread to increase nighttime visibility, and some models feature variable light distribution LED headlamps. Driver support functions and systems are also used in a larger number of vehicles, and the Mitsubishi Fuso Super Great is equipped with advanced driving support technology equivalent to level 2 autonomous driving. The Hino Profia Hybrid features a system that uses AI to predict the driving load based on route gradient information obtained from vehicle position and other data to provide optimal driving control.

Manufacturers showcased their latest advanced safety

systems at the 2019 Tokyo Motor Show. Various concepts focusing on the upcoming transition to autonomous driving and electric trucks including AI-based driver support, fuel cell vehicles and EVs were unveiled.

Manufacturers are also increasingly equipping their mini-vehicle trucks with false start prevention functions as well as collision avoidance support and collision mitigation braking systems.

### 1. 6. Aerodynamic Characteristics

Aerodynamic characteristics have the potential to improve fuel efficiency more economically and efficiently than powertrain or other improvements, while accessories such as mudguards effectively mitigate dirt accumulation on the vehicle body and improve visibility, making this an area manufacturers actively strive to improve. As more and more trucks become hybrid or electric vehicles, higher priority is being placed aerodynamic characteristics with respect to not only fuel efficiency, but also quietness. The front grille also contributes significantly to engine cooling performance and fuel efficiency in addition to aerodynamics, and manufacturers are introducing designs that optimize the surface area and position of the openings.

### 1. 7. Corrosion Prevention

The increasing use of plastic rather than sheet metal for parts in the front of the vehicle, has been leading to changes in plastic parts, which are used in more areas in the latest designs. The adoption of many plastic parts also constitutes a measure against corrosion caused by flying rocks.

## 2 Rear Body

The need to compensate for the labor shortage and increase efficiency in truck transportation has led to greater demand for swap body containers, which allow the cargo bed to be detached from the vehicle body. Manufacturers have followed standard specifications to allow the mounting of compatible containers, enabling efficient operations.

Double articulated trucks, which allow a single heavy-duty truck to transport the same load as two trucks, are seeing greater adoption, and the length limit on full trailer articulated trucks has been raised from 21 to 25 meters.

The change initially only applied to the section of the Shin-Tomei Expressway between the Ebina and Toyota Higashi junctions. In August 2019, the Ministry of Land,

Infrastructure, Transport and Tourism announced that it was being extended to the Tohoku Expressway (up to the Kitakami-Ezuriko interchange), the Ken-O Expressway, Tomei Expressway, Meishin Expressway, Shin-Meishin Expressway, Sanyo Expressway, and Kyushu Expressway (up to the Dazaifu interchange).