

TRUCKS

Overall Trends

1 Introduction

The political and geopolitical situation outside Japan in 2017 was made unstable by the uncertainty surrounding the policies of U.S. President Trump and tensions surrounding North Korea. On the economic front, strong employment in the U.S., in conjunction with recoveries in China and resource-rich countries in the latter half of the year led to economic growth in both developed and emerging countries.

Led by exports, the Japanese economy also continued to grow, with the gross domestic product (GDP) for the 2017 calendar year (January to December) exhibiting a positive growth rate of 1.7% over the previous year, and exceeding the rate for 2016. Although strong business results translated into wage increases in some cases, the intensifying concern over labor shortages stemming from the declining birth rate and aging of the population led the government to finalize a work reform implementation plan.

In the automotive field, manufacturers launched new models compliant with the 2016 emissions regulations one after another. To address the increasingly serious shortage of truck drivers, a new semi-medium vehicle license (holding an ordinary license is not a prerequisite) permitting the driving of trucks with a gross vehicle weight of 3.5 tons or more and less than 7.5 tons from the age of 18 was established. At the same time, in reaction to the rise in accidents involving elderly drivers, license renewal restrictions for drivers 75 or older have become stricter, and the vision of public transportation, including the introduction of automated driving, drew attention as a measure for vulnerable road users whose available means of transportation are limited.

2 Recent Truck Market Trends

2.1. Freight Shipments in Japan

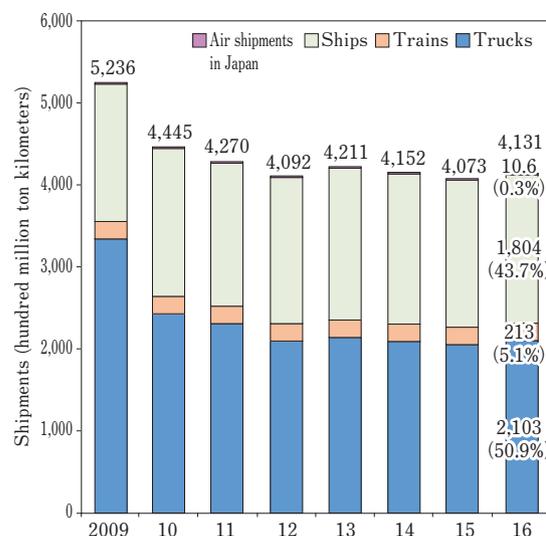
Freight shipments in Japan in 2016 amounted to 413.1

billion ton kilometers, a 1.4% increase compared to 2015. This total breaks down into 210.3 billion ton kilometers shipped by trucks, 21.3 billion ton kilometers shipped by trains, 180.4 billion ton kilometers shipped by ships, and 1.1 billion ton kilometers shipped by air. In terms of share, motor vehicles accounted for 50.9%, ships for 43.7%, trains for 5.1%, and air shipping for 0.3% (Fig. 1).

If the amount of freight shipped by motor vehicles is further broken down by truck type, ordinary trucks account for 79.9%, light-duty trucks account for 1.8%, special-purpose trucks account for 18.1%, and mini-vehicle trucks account for 0.2%. Compared to the previous year, the number of ordinary trucks in Japan increased by 1.5%, while the number of special purpose trucks decreased by 1.4% (Fig. 2).

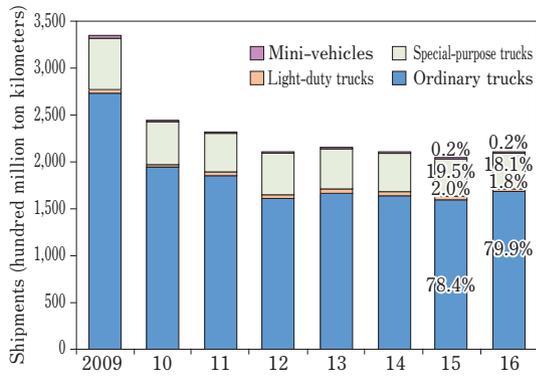
2.2. Number of Trucks in Japan

The number of trucks owned in Japan continues to decrease. At the end of 2017 the number of trucks was approximately 14.32 million vehicles, a decrease of approximately 90,000 vehicles or 0.6% compared to the previous



* Figures in parentheses represent share
Private mini-vehicle trucks have been excluded from the survey since 2010.

Fig. 1 Freight shipments in Japan (fiscal year).



* Figures in the graph represent share
Private mini-vehicle trucks have been excluded from the survey since 2010.

Fig. 2 Freight shipments in Japan by vehicle type (fiscal year).

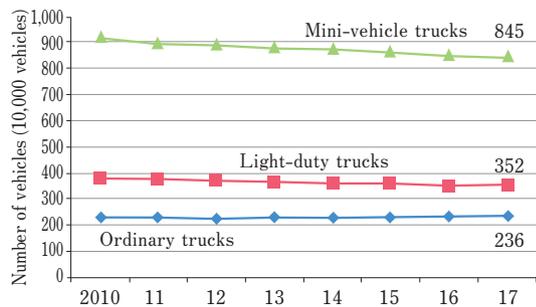


Fig. 3 Number of trucks in Japan according to vehicle type (as of the end of December).

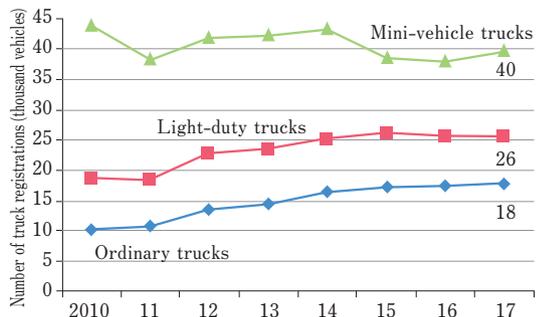


Fig. 4 Number of truck registrations in Japan according to truck type.

year for light-duty and mini-vehicle trucks (Fig. 3).

2.3. Number of Truck Registrations in Japan

The number of truck registrations in Japan in 2017 was approximately 830,000, an increase of 3.0%, or 24,000 vehicles, compared to the previous year. Broken down by type of truck, the number of ordinary trucks grew by 1.8%, that of light-duty trucks increased by 0.5%, and the number of mini-vehicle trucks rose by 5.1% compared to the previous year (Fig. 4).

2.4. Truck Exports

Approximately 370,000 trucks were exported in 2017, a decrease of 16,000 units, or 4.0%, compared to the pre-

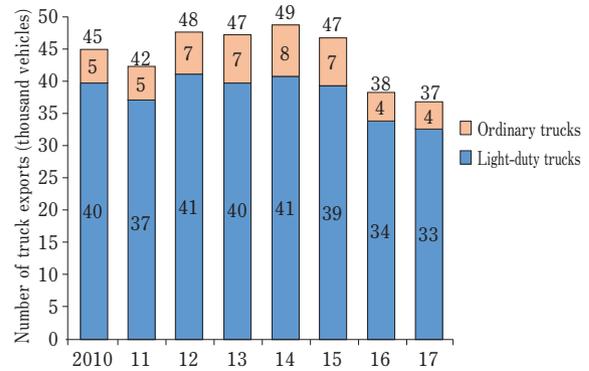


Fig. 5 Number of truck exports according to truck type.

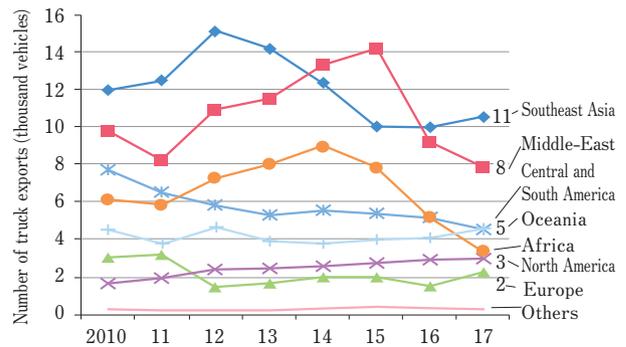


Fig. 6 Number of truck exports according to destination

vious year. By type of truck, both ordinary and light-duty trucks decreased by 4.0% compared to the previous year (Fig. 5).

By destination, exports rose in Southeast Asia, Europe, North America, and Oceania, but declined in the Middle-East, Central and South America, and Africa. Southeast Asian exports, which had been declining since 2013, increased by 6.3% over the previous year, while exports to Europe exhibited an impressive 54% increase compared to the previous year.

3 2017 Model Year Trucks and Special Characteristics

3.1. Trucks Manufactured in Japan

With 2017 marking the year the 2016 emissions regulations came into effect for both new and existing vehicles with a gross vehicle weight exceeding 7.5 tons, all manufacturers completed redesigns to achieve compliance. Revenue-related functions such as fuel efficiency and loading efficiency were improved, and safety enhancements to help reduce accidents were made. In addition, functional improvements that will appeal to drivers, such as a reducing the driving burden or enhancing comfort,



Fig. 7 UD Trucks Quon⁽¹⁾



Fig. 9 Mitsubishi Fuso Truck and Bus Super Great⁽³⁾



Fig. 8 Hino Profia⁽²⁾



Fig. 10 Isuzu Giga⁽⁴⁾

were applied to address the issue of driver shortage faced by the transportation sector. The field of connectivity was also subject to active development, and all four truck manufacturers in Japan have made a unique connectivity function standard equipment on new heavy-duty trucks. This function involves using data transmission and GPS to enable operation centers to check various operational data for the vehicle. Services are expanding beyond the management of operating conditions with offerings such as the analysis of fuel economy data or the provision of advice on fuel-efficient driving.

3. 1. 1. Heavy-Duty Trucks

In conjunction with the emissions regulations, complete redesigns were carried out on the UD Trucks Quon (April), the Hino Profia (May), and the Mitsubishi Fuso Truck and Bus Super Great (May). A partial redesign was applied to the Isuzu Giga, which had been completely redesigned in 2015.

The new UD Trucks Quon (Fig. 7) is based on the concept of being considerate and staying ahead, enhances operability to help alleviate the driver shortage in the transportation sector. All models are equipped with the ESCOT-VI 12-speed AMT. The shifting pattern uses a simple straight line that provides driving operations close to those of a passenger vehicle. This manufacturer is the only one in Japan to make disc brakes with superior heat dissipation and anti-fade performance standard equipment. They combine with the brake blending function that optimizes control of the main and auxiliary brakes to increase the sense of security and reliability of

braking. A new 8-liter engine was presented as a reference exhibit at the Tokyo Motor Show in October, with UD Trucks announcing it would mount it on the Quon in late 2018.

The new Hino Profia model (Fig. 8) was developed as a truck drivers can drive with pride and assurance, and a money-earning truck. The functionality of the PCS collision mitigation braking system installed as standard equipment on all models has been enhanced, and now detects pedestrians and stopped vehicles, and provides support to avoid a collision. This is the first heavy-duty truck in Japan to offer variable light distribution LED headlamps, which improve nighttime visibility by allowing the constant use of high beams, as an option, thus improving safety. The newly developed downsized A09C 9-liter engine is not only lighter, but also combines with the 12-speed ProShift 12 AMT to make this the first heavy-duty truck in Japan to exceed the 2015 fuel economy standards by 10%. ProShift-equipped vehicles replace the shift lever with a dial gear selector set in the instrument panel and provide a sequential lever in the steering column to perform shifting, reducing driver burden and enhancing freedom of movement in the cabin.

All Mitsubishi Fuso Truck and Bus Super Great (Fig. 9) models are equipped with the 12-speed ShiftPilot AMT. Shifting is performed using a multifunction level set on the left side of the steering column, reducing hand movement away from the steering wheel during the operation. The inclusion of a single dry plate clutch enables creeping, which maintains very low speed driving conditions, and combines with the EZGO hill start assist system to reduce the operation burden when starting on a



Fig. 11 Hino Ranger⁽²⁾



Fig. 13 Mitsubishi Fuso Truck and Bus Fighter⁽⁵⁾



Fig. 12 Isuzu Forward⁽⁴⁾



Fig. 14 Hino Dutro⁽⁶⁾

hill. The engine has been made lighter and more compact with new downsized 11- and 8-liter engines. Safety enhancements have been applied in the form of an upgrade to the ABA4 collision mitigation braking system, which can now detect pedestrians and stopped vehicles. The newly developed Active Side-guard Assist uses a millimeter wave radar to monitor blind spots when making a left turn and warn the driver by turning on a lamp in the passenger-side pillar and emitting an audible alert if danger is detected. All models also adopt Belt-in-Seat embedded seat belts. The seat also provides high occupant restraint force during front-to-back movement or when reclined.

Isuzu has upgraded the Giga (Fig. 10). Compliance with the 2016 emissions regulations has been complemented with enhanced deceleration effectiveness achieved by improving the recognition capabilities of the millimeter wave radar and camera in the pre-collision braking system.

3.1.2. Medium-Duty Trucks

Safety improvements achieved by making safety systems comparable to those of heavy-duty trucks standard equipment were notable.

In May, Hino completely redesigned the Ranger (Fig. 11). Almost all safety systems found in the heavy-duty Profia were made standard equipment all at once, significantly raising safety the performance of the model. Setting the PCS collision mitigation braking system also capable of detecting pedestrians as standard equipment is a first for medium-duty trucks in Japan. It is equipped

with a new 5-liter A05C engine that achieves high torque despite a small displacement. A lineup with four horsepower ratings ranging from 190 PS to 260 PS is available. Convenience has been enhanced by adopting a urea-free system for the low horsepower specifications that are in high demand for rental or private use.

In April, Isuzu upgrade the Forward (Fig. 12). Fuel efficiency was considerably enhanced, with some models becoming the first medium-duty trucks to exceed the 2015 fuel economy standards by 10%. The range of equipment in cargo-centered models has been expanded by making all safety systems standard equipment. The UD Trucks Condor, an Isuzu OEM supply model, was launched as a 2016 emissions regulations-compliant model in July.

The Mitsubishi Fuso Truck and Bus Fighter (Fig. 13) was made compliant with the 2016 emissions regulations while retaining the 6M60 7.5-liter direct injection 6-cylinder turbocharged engine.

3.1.3. Light-Duty Trucks

In May, Hino upgrade the Dutro (Fig. 14). The PCS collision and lane departure warning became standard equipment on all models, improving their safety performance. The same upgrades were applied to the Toyota Dyna and Toyoace. In addition, the Dutro Hybrid was upgraded to a wide cab model in November. The previous 5-speed AMT has been replaced by a 6-speed AMT. The hybrid system control was refined, and now exceeds the 2015 fuel economy standards by 15%. Expanding motor drive at starts and other aspects of the motor operational range has improved drivability and the sense of



Fig. 15 Mitsubishi Fuso Truck and eCanter⁽⁷⁾



Fig. 17 Daihatsu Hijet⁽⁹⁾



Fig. 16 Suzuki Carry⁽⁸⁾



Fig. 18 Iveco Stralis NP⁽¹⁰⁾

hybrid-like driving.

In October, Mitsubishi Fuso Truck and Bus launched the 2017 Canter model. The Canter EX, which offers a carrying capacity and carrying space comparable to those of medium-duty trucks, now comes in two variants with different wheelbases, providing a greater selection for different uses. Furthermore, the eCanter (Fig. 15), the world's first mass-produced light-duty electric truck, was unveiled in September. Mass production for Japan started in July at the Kawasaki plant. The model unveiled in North America has a gross vehicle weight in the 7.5 ton class, and six motors (maximum output of 129 kW and maximum torque of 420 Nm) and battery packs (360 V, 13.8 kWh). The cruising range for one hour of rapid charging is 100 km or more, and the model is intended to play a role in addressing the issues of noise and emissions.

3. 1. 4. Mini-Vehicle Trucks

Manufacturers have also worked to improve the safety of mini-vehicle trucks, with ABS and other safety systems becoming standard equipment.

In November, Suzuki modified the specifications of the Carry (Fig. 16). Driver and passenger seat SRS airbags, seat belt pretensioners, and four-wheel ABS have been made standard equipment. The Mitsubishi Minicab Truck, Honda NT100 Clipper, and Mazda Scrum Truck OEM supply models from Suzuki also received the same modifications.

In November, Daihatsu upgrade the Hijet Truck (Fig.

17). It became the first commercial mini-vehicle truck to use LED headlamps. ABS has been made standard equipment on all models.

3. 2. Trucks outside Japan

In September, the Italian major commercial vehicle manufacturer Iveco announced it would enter the Japanese market. It will sell its Stralis NP natural gas heavy-duty truck, designed to reduce greenhouse gas emissions, in Japan. Developed with long-distance driving in mind, models equipped with two LNG tanks have a cruising range of 1,500 km. This means they can drive from Morioka to Shimonoseki without having to refuel. The new 9-liter Cursor 9 engine is the first natural gas engine to offer the same power and torque as diesel engines of the same size, and boasts a maximum output of 400 PS and a maximum torque of 1,700 Nm. Moreover, using the new silent mode 72 dB(A) function enables quiet driving in city centers or at night. The manufacturer has announced its intent to collaborate with the parties involved, including transportation sector operators, gas companies, local authorities, and government agencies, to support the popularization of natural gas in Japan.

References

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- (2) Website of Hino Motors, Ltd., <http://www.hino>



Fig. 2 UD Trucks Quon



Fig. 4 Interior of Profia



Fig. 3 Mitsubishi Fuso Truck and Bus Super Great

UD Trucks hexagonal grille core motif was expressed more clearly. The cab tilting parting line was retouched at the corner to appear to be linked to the body color when seen from the front, LED headlamps were adopted with a vertical shaped influence by the grille produce a streamlined exterior with a leading edge feel.

The face of the front panel of the Mitsubishi Fuso Truck and Bus Super Great (Fig. 3) was broadened and made to stand out, and the distinctive V-shaped grille with a gentle centerfold above the main mark evokes the family resemblance with the light-duty Canter truck. The headlamps have the same peripheral shape as those of the Mercedes-Benz Antos while presenting their own unique expression through LEDs with signature lamps.

In the redesign of these heavy-duty trucks, each of the three manufacturers introduced advances while keeping part of the basic cab frame the same as in the preceding model.

The Profia, Quon, and Super Great, as well as the Ranger and Croner described later, were all awarded the 2017 Good Design Award. Of those, the Hino Profia received the 2017 Good Design Gold Award (Minister of Economy, Trade and Industry Award).

1. 2. Interior Design (Cabin)

The interior design of heavy-duty trucks incorporates advances in safety systems as well as improvements in operability and comfort as a workspace while also exhibiting an evolution that offers a leading-edge feel and high level of quality comparable to that of passenger vehicles. The camera for functions such as lane departure detec-

tion and the camera that monitors the driver's face to warn of drops in alertness have been relocated inside the cab, and advances in transmissions have given shift levers easier to operate shapes. The steering wheels now have four spokes in which steering switches are set, and the enhanced surface texture is complemented with a metallic decorative ornament.

The interior of the Profia (Fig. 4) presents a brown semi-cockpit style intended to create a tasteful and relaxed high-quality space, and in models equipped with the ProShift automated manual transmission, the shift lever has been replaced with a dial gear selector set in the instrument panel, to which the parking brake lever has also been moved. In conjunction with these changes, the floor tunnel next to the driver's seat has been made flat, and in high roof models, cabin height has been increased by 19.5 cm compared to the preceding model, providing consideration for the smooth movement of occupants in the cabin. The upper part of the instrument panel offers a large tray and tablet holder where objects can be put down during breaks as well as a meter with a large 7-inch color LED screen, and has been given a carbon-like finish. This combines with the narrowed parts parting line and other features to heighten the sense of quality. The driver's seat has a seat belt in the back rest and has been designed as a highly functional seat that gives a strong sense of quality through its combination of synthetic leather and stitching. These enhancements are designed to create a pleasant workplace that puts the driver first.

The interior of the Quon (Fig. 5) was modified based on ergonomics using a concept that is fundamentally centered on the driver's comfort. The black and silver-themed geometric design evokes the cutting-edge, while the straight line shifting pattern adopted with the ESCOT-VI electronically-controlled automatic transmission and the switches set in the steering wheel combine to



Fig. 5 Interior of Quon



Fig. 6 Interior of Super Great



Fig. 7 Hino Ranger

create a pleasant environment that makes concentrating on driving easy.

The interior of the Super Great (Fig. 6) revamps the instrument panel face while retaining the existing cockpit style, producing a workplace that is both functional and pleasant and becomes a place that boosts motivation. The newly developed ShiftPilot 12-speed automated manual transmission has been installed on all models, and the use of the multifunction lever set in the steering column for shifting leaves the instrument panel uncluttered. The triangular lamp and audible alert set in the passenger side pillar as part of the Active Side-guard Assist safety system that warns the driver are firsts in Japan. The interior is offered in Eco Line, Pro Line and Premium Line grades, with a choice of a dark or light series for the interior colors.

1.3. Medium-Duty Truck Design

Like the Profia, the Hino Ranger (Fig. 7) front lighting uses combination lamps giving a simple, leading-edge im-



Fig. 8 Scania P and L



Fig. 9 Seat of Scania XT

pression and presents an exterior design that projects the nimbleness of medium-duty trucks. The instrument panel has been made straight to facilitate the entry of three people and their movement in the cabin. Elements such as the area around the meter and in front of the passenger seat, and the driver's seat, have been commonized with the Profia, establishing the family resemblance while also giving the vehicle safety systems and a high sense of quality on par with those of heavy-duty trucks.

The UD Trucks Condor has become an Isuzu OEM supply model, but the front grille is the same brand appeal hexagonal grille as on the Quon.

2 Truck Design outside Japan

Among European models, Scania has added the light-weight P-series and low-entry L-series cabs to the previously mentioned G-series cab and announced the XT range of construction trucks, expanding the next-generation Scania. The P- and L-series (Fig. 8) offer the City Safe Window as an option in the passenger side door panel. Creative styling centering on the number of grille bar steps and the front bumper is used to compensate for the differences in cabin height ranging from the flagship S-series to the low-entry L-series and the Scania mark set higher and made broader give every model an imposing design that clearly expresses the family image. In the XT range, functional aspects for construction use such as the steel front bumper are complemented by the XT badge on the grille and the seat cover with a tag featuring the logo (Fig. 9), bringing out the model's individuality.

UD Trucks announced the Croner medium-duty truck (Fig. 10) for markets in emerging countries. The 2,100 mm day and sleeper cabs follow the same design motif as the Quester and Quon heavy-duty trucks, while the grille periphery is solidly carved to achieve an imposing exterior that clearly represents the brand. The interior



Fig. 10 UD Trucks Croner



Fig. 11 Volvo VNL



Fig. 14 Tata Prima



Fig. 12 Mack Anthem



Fig. 13 Heavy-duty truck from JMC Heavy Duty Vehicle



Fig. 15 Isuzu FD-SI

design is carried over from the previous generation Condor, highlighting its sibling relationship with the Quester.

In North America, there were changes to the Class 8 heavy-duty trucks, with designs by manufacturers further accentuating the distinctiveness of their conventional hood trucks.

The Volvo VNL (Fig. 11) showcases its aerodynamic performance with an aerodynamic form featuring a grille through the bottom of the front bumper from which the headlamps are shaped to flow continuously, as well as a characteristic fine grille mesh.

Positioned as the new flagship model, the Mack Anthem (Fig. 12) presents a bold and powerful design that leaves a strong impression. The tasteful component design with left and right fenders that look as if they were carved out of the hood, giving a modern look that incorporates a sense of solid power and aerodynamic performance. The interior of both vehicles are also clean, comfortable modern designs with a high sense of quality.

There are numerous truck manufacturers in China, with JMC Heavy Duty Vehicle, a member of the Jiangling Motors Corporation, exhibited a heavy-duty truck (Fig. 13) at the 2017 Shanghai Auto Show. This new entry by the company established in 2013, features a consolidated design with a clear-cut and tasteful, sculpted exterior and interior that will not go unnoticed in the market.

In South Korea, Tata Motors gave a facelift to its Prima heavy-duty truck (Fig. 14). The mark with the logo has been made larger to emphasize the brand, and the

exterior has been made more dynamic by elongating the grille bar and corner vanes. In the interior, usability has been improved with the use of a 7-inch color LCD meter along with the large tray set in the floor and other features.

3 Concept Truck Design

The Isuzu FD-SI and E-Fuso Vision One were exhibited at the 2017 Tokyo Motor Show.

The Isuzu FD-SI (Fig. 15) integrates a center driver seat with the cargo handling space in anticipation of future home delivery networks and is equipped with a retractable steering wheel that consolidates all operations into a center instrument panel. The simple configuration aims to make collection and delivery tasks more convenient. The beehive-inspired design distinguishes itself with its functionality that also accommodates hexagonal delivery boxes.

Mitsubishi Fuso Truck and Bus announced the E-Fuso brand specializing in electric trucks and buses. The exterior of the Vision One (Fig. 16), the first fully electric heavy-duty truck in Japan, presents a simple design with no grille, outer mirrors converted to small cameras and no cab tilting parting line. The E-Fuso logo in the center of the front face, V-shaped motif, and 3D-pattern immediately below make the new brand distinctive. The interior presents a high-quality driver's seat and spaces for work and relaxation arranged in organic layers, while rearview monitors in the front pillars, the heads-up display, and the elimination of as many legacy switches as possible of-

Table 2 Main product technology trends for medium-duty trucks in 2017.

Month of launch	Name of vehicle model	Main characteristics
April	Forward (Isuzu Motors)	Partial redesign Compliant with 2016 emissions regulations
May	Ranger (Hino Motors)	Complete redesign Compliant with 2016 emissions regulations
July	Condor (UD Trucks)	OEM procurement from Isuzu Compliant with 2016 emissions regulations
September	Fighter (Mitsubishi Fuso Truck and Bus)	Partial redesign Compliant with 2016 emissions regulations
October	Croner (UD Trucks)	Model targeting emerging markets Introduced in Central and South America

plete redesign, making significant modifications to the interior and exterior to introduce a model with improved functionality and safety. In contrast, the new Condor introduced by UD Trucks has become an Isuzu OEM supply model. In markets outside Japan, Mitsubishi Fuso Truck and Bus announced a new Fighter model in Indonesia, where demand for medium-duty trucks is expanding. UD Trucks unveiled the Croner developed for emerging countries in the Middle-East and also deployed to Central and South America.

1. 1. 3. Light-Duty Trucks

Table 3 shows the light-duty trucks announced in Japan in 2017, and the main product technology trends. In Japan, this class saw the introduction of models equipped with expanded safety systems and made compliant with the 2016 emissions regulations, as well as of the first EV in the class. The Hino Dutro offers a fuller complement of safety systems with the addition of the forward object collision mitigation braking system and lane departure warning system as standard equipment. A limited number of 80th anniversary special specifications model of the Isuzu Elf, with exclusive cab colors, genuine leather seats, and other special features were made available. The Mitsubishi Fuso Truck and Bus Canter series was expanded to 26 models, including the addition of models with different wheelbases and a 7.5 ton model to address customer needs. In addition, production of the eCanter Japanese-made electric truck began in Japan and Portugal.

1. 1. 4. Mini-Vehicle Trucks

Table 4 shows the large trucks announced in Japan in 2017, and the main product technology trends. Both the Hijet and Carry series were partially upgraded in November, offering enhanced product appeal with a fuller complement of safety systems.

Table 3 Main product technology trends for light-duty trucks in 2017.

Month of launch	Name of vehicle model	Main characteristics
May	Dutro (Hino Motors)	Partially refined. Safety systems installed. Com
July	Canter Mitsubishi Fuso Truck and Bus	Partially refined. Compliant with 2016 emissions regulations (vehicles over 7.5 tons)
October	Elf (Isuzu Motors)	Sold as 80 th anniversary special specifications vehicle
	Dutro (Hino Motors)	Partially refined. Introduces 6-speed specifications for the hybrid model (wide)
	Canter Mitsubishi Fuso Truck and Bus	Introduces an EV truck

The Daihatsu Hijet Truck became the first mini-vehicle truck equipped with LED headlamps, and four-wheel ABS was made standard equipment. The Suzuki Carry made the SRS front passenger airbag, passenger seat belt pretensioner, and four-wheel ABS, as well as a power outlet, standard equipment, and increased the capacity of the glove compartment.

The Toyota Pixis and the Subaru Sambar are OEM supply models from Daihatsu, while the Nissan NT100 Clipper, Mitsubishi Minicab Truck, and Mazda Scrum Truck are OEM supply models from Suzuki.

1. 1. 5. Trucks Manufactured outside Japan

In May 2018, the Italian major commercial vehicle manufacturer Iveco announced the launch of its Stralis NP400 heavy-duty truck for the Japanese market. The Stralis is a natural gas vehicle that can run on liquefied natural gas (LNG), compressed natural gas (CNG), or a combination thereof, equipped with a 400 horsepower engine that can run a long distance of 1,500 km on a single tank in the LNG-only configuration. In February 2018, Daimler Trucks announced the mass production of its eActros EV truck.

1. 2. Interior Comfort

Since truck drivers spend a long time in the cabin, it must be safe and comfortable to ride. For the cabins of Japanese-made vehicles, regulatory specifications on packaging have led to development that prioritizing cargo bed space, and various ingenious approaches have been used to make the limited available more pleasant and comfortable space. One of these is the use of a high roof, which makes it easier to get changed or move in the cabin and provides more storage room, leading more and more users to choose high roof models.

Table 4 Main product technology trends for mini-vehicle trucks in 2017.

Month of launch	Name of vehicle model	Main characteristics
November	Hijet Truck series Hijet Trucking (Daihatsu) Sambar Truck (Subaru) Pixis Truck (Toyota)	Partially refined. Equipped with LED headlamps Equipped with ABS and other systems
	Carry series Carry (Suzuki) NT100 Clipper (Nissan) Minicab Truck (Mitsubishi) Scrum Truck (Mazda)	Partially refined. Equipped with ABS Seat belt with pretensioner installed on passenger seat Equipped with SRS front passenger airbag and more

1. 3. Operability

Japanese society is aging rapidly, with 27% of the population aged 65 or more. In addition, only 28% of drivers are younger than 40, and women only account for 20% of the total, making this occupation dependent on a workforce consisting of middle-aged men. To alleviate this situation, manufacturers are applying measures such as adopting universal design, moving to automatic transmissions, using multifunction levers, or enhancing driver visibility, which aim to significantly streamline driving operation and reduce fatigue for elderly or female drivers.

1. 4. Noise and Vibration

To reduce the fatigue caused by long-distance driving and enhance comfort for truck drivers, sound absorbing material such as glass wool or felt is applied to plastic parts or thin cover plates of the engine compartment enclosure to isolate sound. Also, flush surface designs are becoming more common to reduce wind noise. Highly functional seats and cabins with air suspensions are used to obtain structures that mitigate cabin vibrations to decrease the number of causes of driver fatigue. Inside the cabin, various techniques, such as the optimal placement sound absorbing and damping material, are used to reduce noise and vibration.

1. 5. Safety

Safety is broadly divided into passive and active safety. In the area of passive safety, manufacturers employ high rigidity cabins to minimize their deformation in an impact and secure occupant rescue space. In addition, the installation of front and rear underrun protection devices (FUPDs and RUPDs) to prevent the submarining of passenger cars under the truck in the event of a frontal or rear-end collision is mandatory. With respect to active

safety, with AEBS forward object detection collision mitigation braking systems becoming mandatory to prevent rear-end collisions and mitigate damage, the Mitsubishi Fuso Truck and Bus Super Great and the Hino Profia have adopted systems that include pedestrian detection. Electronic stability control systems (ESC) and lane departure warning systems (LDWS) have also becoming mandatory, and manufacturers have installed them on all their 2017 models. In addition, the Mitsubishi Fuso Truck and Bus Super Great and Hino Profia also offer greater safety with the introduction of systems that warn against driver drowsiness or distraction.

1. 6. Aerodynamic Characteristics

Improved aerodynamic performance not only contributes to significantly better fuel efficiency during high speed cruising, but also has a strong impact on wind noise, dirt accumulation on the body, and maneuverability. It has therefore been an area on which manufacturers have been concentrating their efforts.

The width of the cab front face, which is hit by the wind first, has been reduced (narrowed face), and the corners of the vehicle regulate airflow. Grille shutters that close front grille openings based on driving conditions to achieve a flush surface, and front spoilers to reduce drag, have been installed. In addition, manufacturers have optimized and set window deflectors to decrease the drag caused by the difference in level between the cab and the rear body.

Other measures applied to the rear body, which has a major effect on aerodynamic performance, include the narrowing of the rear end to reduce negative pressure behind the rear body, and side skirts designed to regulate the airflow near the rear wheels.

At the same time, these improvements involve trade-offs such as reducing cabin space, negatively affecting styling and practicability, and increasing cost and weight, and it is essential to consider the balance of these trade-offs when making aerodynamic enhancements.

1. 7. Corrosion Prevention

Vehicle service life has been getting longer, creating increased demand for high levels of corrosion prevention for chassis parts. The redesigned Hino Profia is the first truck in Japan to use powdered paint on the chassis frame. The main raw material in that paint is polyester, which has excellent weather resistance, supplemented with adaptations such as raising viscosity to enhance its capacity to cover the edge of parts.

2 Rear Body

As logistics become more and more diversified and improved handling of cargo and transport efficiency are increasingly being called for, the effective use of aluminum and improvements in the performance of insulating materials are leading to lighter wingvan bodies and expanded carrying capacity.

Weight has been reduced by 200 to 300 kg, and specifications targeting even greater weight reduction have been defined.

The inside dimensions of the truck bed have been extended to over 2,510 mm × 9,600 mm, enabling standard cabs allowing the mounting of eighteen 1.2 m × 1.0 m pallets rather than the previous sixteen 1.1 m × 1.1 m pallets.

Manufacturers are also using vehicle redesigns as an opportunity to conduct joint development of rear bodies.

References

- (1) Materials for public relations of manufacturers, Catalogs