Trucks

Overall Trends

1 Introduction

Thanks in part to the government's growth strategy based on monetary and fiscal policies, as well as encouraging investment by the private sector starting to bear fruit, the Japanese economy exhibited a clear upward trend in 2014. By contrast, the effects of the last-minute demand up to March 2014 and the negative rebound starting in April due to the on-schedule raising of the consumption tax from 5 to 8% that month have become apparent. The consumption tax hike and rising import prices marked 2014 as a year of weak consumer spending, but despite those effects, the economy showed sustained signs of slow recovery. On a quarterly basis, the real GDP growth rate fluctuated between positive growth in the January to March quarter, negative growth in the April to June and July to September quarters, and positive growth again in the final October to December quarter.

The Japanese truck market followed the same trend, with last-minute demand before the consumption tax increase, followed first by a large slump in sales caused by the negative rebound in April, and then by a slow recovery.

The current post-new long-term emissions regulations are scheduled to be followed by the next emissions regulations from October 2016. In addition, since November 2014, mandatory installation of safety systems such as electronic vehicle stability control (EVSC), advanced emergency brake system (AEBS) and lane departure warning system on new vehicles has gradually come into effect in accordance with gross vehicle weight class.

A number of extensions and revisions to vehicle-related tax systems are expected to encourage the further adoption of fuel efficient, safe vehicles from 2015 onward.

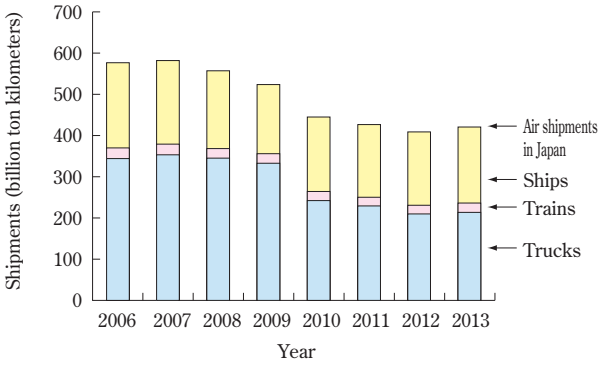
The fuel-efficient vehicle tax reduction based on emissions or fuel economy was subjected to revisions of the fuel economy for eligible vehicles and will be extended for another two years, and the range of vehicles that qualify will be expanded. Moreover, eligibility criteria (e.g., adding vehicle stability control systems to the eligible systems and new categories of eligible vehicles covering trucks with a gross vehicle weight (GVW) or more than 3.5 t and 8 t or less, and buses with a GVW or 5 t or less) for the special measures applied to vehicles equipped with advanced safety vehicle (ASV) technologies – the so-called ASV tax reduction – will be expanded, and the special measures for the motor vehicle weight and the vehicle acquisition taxes will be extended by three and two years, respectively.

In the export trucks markets, the European Euro 6 emissions standards fully came into effect in December 2013. Application to the introduction of safety systems is currently progressing gradually. In North America, the EPA GHG14 regulations on reducing CO_2 came into effect from January 2014.

2 Recent Truck Market Trends

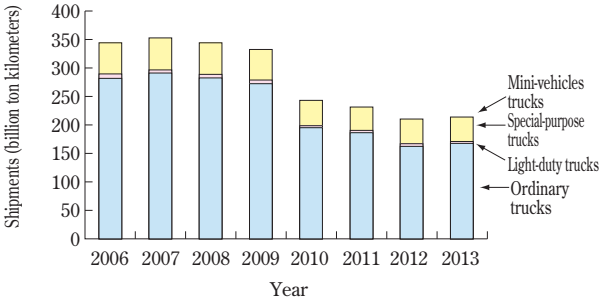
2. 1. Freight shipments in Japan

Freight shipments in Japan in 2013 amounted to 421.1 billion ton kilometers, a 2.9% increase over 2012, bringing the ongoing decrease in freight shipments to a halt. With all transport organizations increasing their volume of shipment, truck shipments amounted to 214.1 billion ton kilometers, 2.0% more than in 2012. Freight shipments break down to 50.8% for motor vehicles, followed by 43.9% for ships, 5.0% for railways and 0.3% for air transport (Fig. 1). Further broken down by type of vehicle, ordinary trucks account for 78.1% of freight shipments, special-purpose trucks for 19.7%, light-duty trucks



∗Since 2010, private mini-vehicle trucks were excluded from the survey.

Fig. 1 Freight shipments in Japan [1]



2010 revised

Fig. 2 Freight shipments by vehicle type [1]

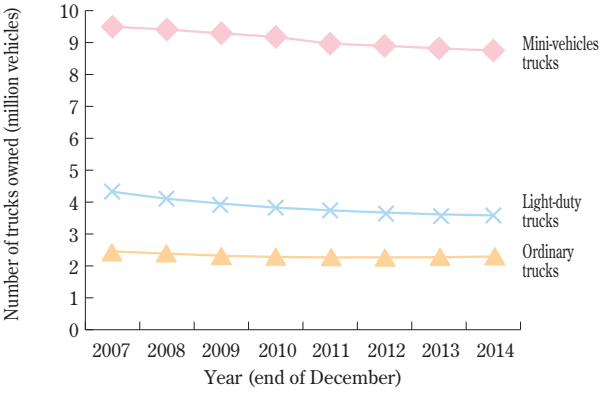
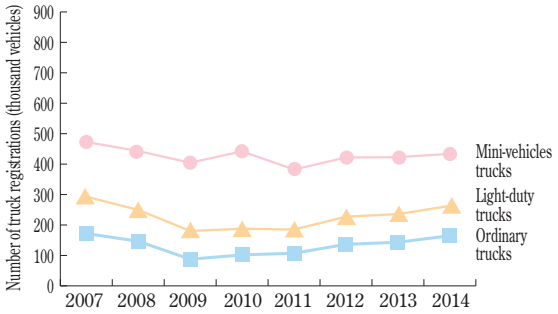


Fig. 3 Number of trucks in Japan according to vehicle type [2]

for 1.9%, and mini-vehicle trucks for 0.3%. For ordinary trucks, this represents a 1.1% increase compared to the previous year (Fig. 2).

2. 2. Number of trucks in Japan

The number of trucks owned is Japan has continued to decline, reaching 14.63 million at the end of December 2014, a decrease of approximately 80,000 vehicles, or 0.5%, relative to the previous year. Although the number of ordinary trucks owned rose by a little over 2,000, the number of light-duty and mini-vehicle trucks has dropped (Fig. 3).



Note: Starting in 2003 the classification criteria were changed from the vehicle chassis to license plate number (mini-vehicle trucks are excluded).

Fig. 4 Number of truck registrations in Japan according to truck type [2]

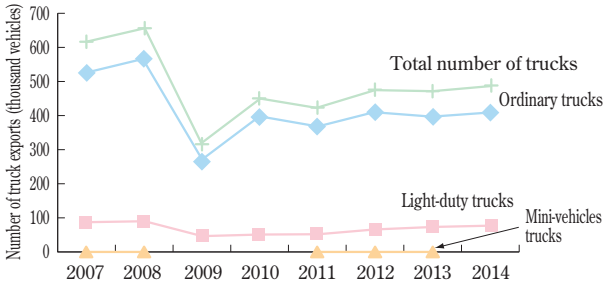


Fig. 5 Number of truck exports according to truck type [2]

2. 3. Number of truck registrations in Japan

The number of truck registrations in Japan in 2014 was approximately 860,000, an increase of 7.4% compared to the previous year. By vehicle type, registrations rose by 15% for ordinary trucks, and 11% for light-duty trucks, a significant rate of expansion compared to 2013. By contrast, registrations for mini-vehicle trucks were limited to a 2% increase over the previous year (Fig. 4).

2. 4. Truck exports

In 2014, approximately 410,000 ordinary trucks and 80,000 light-duty trucks were exported, a total of 490,000 units and a 3.5%, or approximately 16,000 unit increase from 2013 (Fig. 5). By region, the Middle East surpassed Southeast Asia and exhibited the highest number of exported trucks, with approximately 130,000 units, representing a 15.2% rise over 2013. Southeast Asia had the second highest number of exports, which nevertheless declined for a second consecutive years, falling to approximately 120,000 units, 13% less than in 2013. Exports to Africa have been strong in the last few years, with 90,000 vehicles exported in 2014, a 12%, or approximately a 9,000 unit increase relative to 2013 (Fig. 6).

3 2014 Model Year Trucks and Special Characteristics

3. 1. Trucks manufactured in Japan

In 2014, manufacturers released upgraded heavy-medium- and light-duty models primarily featuring improvements in fuel economy, safety and maneuverability, marking an intensification of steps to further spread systems promoting greater fuel-efficiency and lower emissions, as well as active safety. Such efforts will also tie in to enhanced performance for, and more widespread use of, vehicle eligible for the fuel-efficient vehicle and ASV tax reductions.

Some manufacturers also introduced full-model changes for mini-vehicle trucks.

3. 1. 1. Heavy-duty trucks

In January, Hino Motors, Ltd. upgraded its Profia heavy-duty truck, enhancing its fuel efficiency and safety systems (Fig. 7). Better fuel efficiency was achieved through refined engine control, adoption of a new automatic coasting system (E-Coast), and a dedicated high roof spoiler. Except in a few models, the 2015 heavy-duty vehicle fuel economy standards have been exceeded by 5%.

Safety support systems have also received expanded functionality and been made standard equipment. A function to avoid collisions with a vehicle moving slowly at the tail end of a traffic jam was added to the pre-collision safety (PCS) system. This system has been made compliant with the new standards for collision mitigation braking systems that came in effect for new vehicles as of November 2014. At the same time, improvements were also made to the lane departure warning system and the camera in the driver monitor that detects whether drivers have shut their eyes or which way they are facing and provides a warning. Other refinements to safety support systems include enhancing the functionality of the Left & Right Balance Monitor which measures the tilt of the trailer resulting from unbalanced loads and of automatic downshifting in the Pro Shift 12 AMT.

In May, UD Trucks upgraded its Quon heavy-duty truck, enhancing its fuel efficiency and safety systems (Fig. 8). It is equipped with a GH11 or GH13 engine and meets the 2015 heavy-duty vehicle fuel economy standards. The GH11 (11 L) engine features powerful torque even at low engine speed ranges, achieving excellent start and acceleration performance. The ESCOT-V 12-speed electronic AMT combined with the above engines includes the Economy ED mode, which makes use of the Soft Cruise Control and Acceleration Limiter features, as well as ESCOT Roll, which disengages engine braking while coasting downhill, to provide even greater driving fuel economy. Fuel-efficient driving is also supported by the UD Information Service (UDIS).

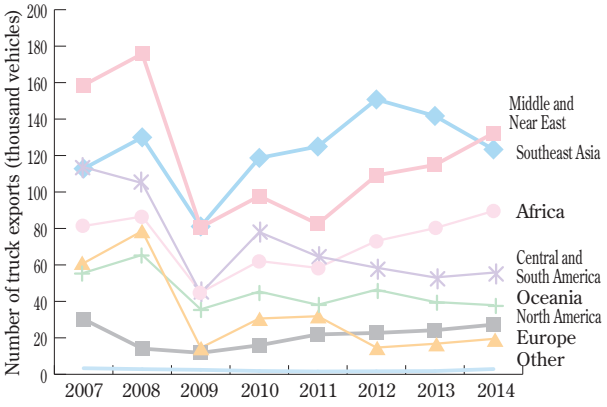


Fig. 6 Number of truck exports according to destination[2]

Fig. 8 UD Trucks Quon[3]

Fig. 7 Hino Profia[3]

Fig. 9 Mitsubishi Fuso Super Great V [3]

Fig. 10 Isuzu Giga [3]

In terms of enhanced safety functions, the collision mitigation function included in the Traffic Eye Brake system has been boosted and made compliant with the new standards for collision mitigation braking systems, and a lane departure warning system (LDWS) was added as optional equipment. In addition, weight reduction in some models has increased their load capacity by up to 200 kg.

Also in May, Mitsubishi Fuso Truck and Bus Corporation launched the Super Great V featuring enhanced fuel efficiency and safety systems (Fig. 9). The improvements in fuel efficiency come from the 6R10 engine with an asymmetric turbocharger and electronic variable-flow water pump, as well as the computer-controlled auto-cool fan coupling and the stop-start system, which have been made standard equipment. Except in a few models, the 2015 heavy-duty vehicle fuel economy standards have been exceeded by 5%.

Active safety support enhancements include supplementing standard safety equipment with the MDAS-II driver alertness monitor and AMB collision mitigation braking systems. A new design featuring silver and blue lines in various locations on the exterior and in the interior has been adopted.

In October, Isuzu Motors upgraded its Giga heavy-duty truck, enhancing its standard safety equipment (Fig. 10). Support for active safety was enhanced by expanding the range of standard safety equipment to include a

Fig. 11 Volvo FH [3]

Fig. 12 Isuzu Forward [3]

pre-collision (collision mitigation) braking system, an electronic stability control system (IESC), and a system that uses millimeter waves to monitor distance. In addition, weight reduction in some models has increased their load capacity by up to 200 kg.

In August, Volvo Trucks launched its latest FH heavy-duty truck (Fig. 11). This first full-model change in approximately 20 years revamps the cab design and increase comfort and visibility as well as operability. Safety functions were also enhanced. The lineup for Japan includes a 6×2 rigid and 4×2 and 6×4 tractor models. The neck-tilt function for the steering wheel and expanded cabin space allows a greater range of driving positions and increases in-cabin storage capacity. In addition, the increased windscreen glass area and upright A-pillars increase visibility, and the inclusion of switches in the steering wheel for the functions drivers use most often improve operability. The Secondary Information Display has been made standard equipment and enhances exterior visibility on the passenger-side and at the rear of the vehicle.

3. 1. 2. Medium-duty trucks

In October, Isuzu Motors upgraded its Forward medium-duty truck, enhancing its fuel efficiency and safety systems (Fig. 12). The Eco-stop system that automati-

Fig. 13 UD Trucks Kazet [3]

Fig. 14 Isuzu Elf [3]

cally turns off and restarts the engine has been made standard equipment (except in a few models), and the functionality of the Econo mode, which recognizes the current load and road gradient, and controls horsepower and speed according to driving conditions, has been improved. These systems achieve better fuel efficiency by suppressing unnecessary fuel consumption. Vehicles with a GVW of 11, 14.5, and 16 t have exceeded the 2015 heavy-duty vehicle fuel economy standards by 5%.

Active safety has also been increased with the addition of lane departure warning (LDWS) and electronic stability control (IESC) systems as new options (except in a few models). The radiator grille and steering wheel designs have been changed. In some models (vehicles with an 8 or 20 t GVW), a greater load capacity was obtained through weight reduction.

3. 1. 3. Light-duty trucks

In September, UD Trucks launched the new Kazet light-duty truck (Fig. 13), which is an OEM supply model from Mitsubishi Fuso Truck and Bus Corporation. Users benefit from a broad lineup including hybrid and 4WD vehicles. Meeting both the low-emission vehicle certification and the 2015 heavy-duty vehicle fuel economy standards, this model not only achieves excellent environmental and fuel economy performance, but also better drivability through a dual-clutch AMT that provides fuel-efficient and powerful driving.

Fig. 15 Mazda Titan [3]

In November, Isuzu Motors upgraded its Elf light-duty truck, enhancing its fuel efficiency and customizability (Fig. 14).

The 4JJ1 engine was refined to use a low compression ratio and new injectors. The Eco-stop system that automatically turns off and restarts the engine has been made standard equipment (except in a few models), and the Econo mode function, which recognizes the current load and road gradient, and controls horsepower and speed according to driving conditions, has been added. A variable displacement power steering pump was adopted, the 6-speed transmission gear ratio was revised, and the use of fuel-efficient tires was expanded. With these improvements in fuel economy, 2 and 3 t vehicles with the Eco-stop system have exceeded the 2015 heavy-duty vehicle fuel economy standards by 10%, while 3 t 2WD vehicles and 4WD vehicles with a GVW of 5 t or higher have exceeded that standard by 5%.

Customizability has also been enhanced by integrating the DPD and muffler, and switching to a front intake design (except in a few models). The radiator grille, as well as the seat and steering wheel designs, have been modified.

The Mazda Titan OEM supply model was also remodeled in November, enhancing its fuel efficiency (Fig. 15). The 3-liter engine was modified to use a low compression ratio and new injectors. The Eco-stop stop-and-start system was also made standard equipment (except in a few models). Improvements in fuel efficiency were achieved by adding the Econo mode function, which recognizes the current load and road gradient, and controls horsepower and speed according to driving conditions, adopting a variable displacement power steering pump, and revising the 6-speed transmission gear ratio. At the same time, the radiator grille was revamped and the design of the seats was modified.

3. 1. 4. Mini-vehicle trucks

In August, Suzuki upgraded its Carry (Fig. 16). Addressing the needs of a broad range of customers, this

Fig. 16 Suzuki Carry[3]

Fig. 17 Daihatsu Hijet[3]

Fig. 18 Fuji Heavy Industries Sambar[3]

Fig. 19 Renault T-series Optifuel Lab 2[3]

Fig. 20 Scania R-series Euro 6 certified with a 100% biodiesel range[3]

model is equipped with new Auto Gear Shift AMT which offers both the superior fuel efficiency and powerful driving performance advantages of manual transmissions and automatic transmission advantages such as not needing to operate the clutch.

In September, Daihatsu carried out the first full model change in 15 years for its Hijet model (Fig. 17). The basic performance and comfort improvements made to the model include a wider door opening that facilitates entry and exit, a roomier cabin and increased storage space, a revised body frame and more rigid panels that make the vehicle quieter, and a refined front suspension that provides enhanced stability and allows tighter turns. Better fuel efficiency was achieved through powertrain enhancements such as the use of a high compression ratio, improved combustion, and the reduction of mechanical loss. In addition, the frame was revised and high tensile strength steel sheets adopted to achieve a body with high rigidity, and safety was increased by making an SRS driver airbag standard equipment in all vehicles. At the same time, anti-corrosion performance was raised, with body exterior panels benefiting from a 5-year guarantee against corrosion perforations a 3-year guarantee against surface corrosion.

A simultaneous full model change for the Fuji Heavy Industries Sambar OEM supply model was also announced in September (Fig. 18).

3. 2. Trucks manufactured outside Japan

In Europe, manufacturers had already announced and launched their main Euro 6-compliant models, and 2014 only saw occasional announcements of derivatives of those models since no major model changes were made.

The biennial Hanover International Motor Show Germany (IAA) for commercial vehicles held in September, featured many exhibits encompassing models that achieve improved fuel economy and reduced CO_2 emissions by combining various fuel-efficient technologies such as GPS-based cruise control, aerodynamics parts, and modules that reduce rolling resistance (Fig. 19), HEV and EV trucks, vehicles making use of alternative fuels such as biodiesel or CNG/LNG (Fig. 20), and vehicles featuring active safety systems. While active safety systems are also becoming more widespread in Japan, especially in heavy-duty vehicles, the IAA featured vehicles equipped with advanced emergency braking systems using higher-performance cameras and radars, lane change

Fig. 21 Volvo FH450[3]

assist systems, and dynamic steering systems that help the driver recover from a lane departure (Fig. 21).

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Design Trends

1 Globalization of Design Trends

As stated in his book Never Leave Well Enough Alone, the famous early industrial designer Raymond Loewy, who moved from France to the U.S. in 1919 and whose design efforts crossed a variety of fields including product packages, appliances, automobiles and railways, advocated a shaping approach known as streamlining. Streamlining approaches design through fluid dynamics concepts and emerged from New York as a widespread style called Streamline Moderne (sometimes Miami Art Deco) in the 1930s, influencing product design not only in America, but all over the world. Notable examples of the design include the Chrysler Airflow (automobile), the Greyhound Corporation Silversides and PD-4501 Scenicruiser (buses) and the Pennsylvania Railroad's K4s locomotive (Fig. 1).

This style strongly has strongly made its presence felt in the field of vehicle design both in Europe and elsewhere in the world. In the latter half of the 1960s, Italy was at the center of an emerging angular, straight line style known as wedge design. The design, which featured a low front end with a wedged shaped body that sought to take advantage of the downforce produced by the aerodynamic effects of the airflow on the surface of the body while driving, spread around the world like wildfire. In the 1980s, automobile started taking on rounder shapes, a design referred to as aeroform or rounded form which, like wedge design, spread to vehicles throughout the world. After the year 2000, automakers started to emphasize stronger brand recognition, differentiation from competitors, and distinctiveness in design, leading to greater assertiveness than ever. In the graphics industry, an approach called corporate identity design is gradually spreading to both passenger and commercial vehicles. Nowadays, design bears the burden of conveying the appeal of the manufacturer's products to customers and striking a balance between styling and functionality.

2 Truck Design

2. 1. Trucks manufactured outside Japan

While major truck production countries and regions include Europe, the U.S., China, Brazil, India, and the ASEAN nations, when it comes to leading the pack in design trends, all eyes turn to Europe, which boasts high technical ability and considerable capital strength. Recently, Asian truck manufacturers have been raising the quality of their design at a pace that puts them on the verge of catching up to European manufacturers. This section looks at cab form and front face design trends separately.

Form design, in essence, tends to incorporate aerodynamic principles, and designs that become gradually narrower closer to the front of the vehicle are becom-

Fig. 1 Streamlined designs by Raymond Loewy

Fig. 2 The new Renault T-series model named 2015 International Truck of the Year

Fig. 3 Example of bumper corner vent adjustments: new Daimler Actros (left) and new Renault T-series (right)

Fig. 4 New Volvo FH announced in 2012 (left)

ing more common. The new Renault T range heavy-duty truck, which was announced in 2013 and awarded the 2015 International Truck of the Year title (Fig. 2), achieves a shape that reduces drag by inclining the front pillar more steeply than in its predecessor. Vehicles typically include vents at the corners of the cab to regulate airflow and reduce mud splashes attributed to eddies from the wind on the side of the cab. Many new models announced since 2002 apply the same principle to the corners of the bumper, and more and more designs integrate the bumper and cab corner vents (Fig. 3).

For the front face, there is a notable trend toward larger brand marks or emblems and bigger grilles with a design that evokes quality. The new Volvo FH heavy-duty truck announced in 2012 sets the Volvo mark higher than on previous models (Fig. 4), and a similar approach can be seen in the new Actros model announced

Fig. 5 Example of bumpers with a slanted outward base: Subaru WRX STI (top left), BMW i8 (bottom left), Lexus NX (top right) and Mazda Demio (bottom right)

by Daimler 2011. These trends are certainly aimed at raising manufacturer brand recognition, differentiating them from competitors and expressing their distinctiveness. In addition, some examples of brand image use as a sales strategy in individual markets seek to leverage resemblance by emphasizing an iconic characteristic of the manufacturer (the BMW front grille, for example). Such a strategy is effective for manufacturers with a small market share, and they are often seen adopting it.

The use of slightly slanted character lines that encompass the external appearance of the grille and appeal to the emotions is becoming more common. As an element of front face design, there are also cases of bumper designs that come closer to reflecting trends originating in passenger vehicles. More trucks are adopting a powerful design that suggests the stability of being firmly planted on the ground when the bumper is viewed from the front through a shape slanted outward at the base (Fig. 5). At some manufacturers, the passenger and commercial vehicle design departments collaborate closely to give both types of vehicle a common design (Fig. 6), while at other manufacturers, actively differentiated designs are part of the product strategy.

These examples indicate that design trends in passenger vehicles, for which the interval between model changes is short, are extremely important not only as criteria for expressing novelty and designs in tune with the times, but also in understanding trends in commercial vehicle design. Given the long interval between model changes, incorporating currently fashionable trends in commercial vehicle design involves some risk. Nevertheless, since the year 2000, the round lights in the

Fig. 6 Comparison of Daimler M-Class passenger vehicle and new Actros heavy-duty truck

Fig. 7 Illumination on new Volvo FH

Fig. 8 New Isuzu Elf (left)

headlights of the BMW 5 series kicked off the use of illumination (signature lights) as a visual style in vehicles, and the adoption of this approach in commercial vehicles as well is growing. Manufacturers are striving for a common design in their product lineup while enhancing the novelty appeal of the vehicles (Fig. 7).

2. 2. Trucks manufactured in Japan

Although differences in land area, regulations, or customer use and expectations between Japan and other countries prevent comparisons at the same level for some points, basic design trends share a common progression. All Japanese manufactures limited themselves to small-scale modifications in 2014. The Isuzu Motors Elf light-duty truck announced in November has a modified grille featuring slanted lines rather than the straight lines of the previous model which give a sense of surging forward (Fig. 8). For the interior, only the styling was changed. In the ASEAN nations such as Thailand, Indonesia, and Malaysia, where Japanese automakers have an overwhelming advantage, all manufacturers introduced new models. The Quester heavy-duty truck announced in Thailand by UD Trucks in 2013 (Fig. 9) features a graceful, typical Volvo Group front face and a design that dynamically expresses the hexagonal grille characteristic of UD Trucks. The Hino 500 medium-duty truck announced by Hino Motors in January 2015 (Fig. 10) now projects a formidable impression through modifications including a grille design featuring a larger main mark than on the same manufacturer's Profia heavy-duty truck. The design with a slanted outward base was also incorporated in the bumpers of construction vehicles such as concrete mixing transport trucks and dump

Fig. 9 New UD Trucks Quester (left) and Quon (right)

Fig. 10 New (left and middle) and previous (right) Hino 500 Series

Fig. 11 Isuzu T-Next

Fig. 12 Mitsubishi Fuso FUSO-Concept II

trucks, encompassing a sense of the hard usage made in ASEAN countries and representing a design that subtly follows current trends.

2. 3. Concept trucks

The grille design of the Isuzu Motors T-Next unveiled at the 2011 Tokyo Motor Show (Fig. 11) and the Elf light-duty truck announced in November 2014 leave a common impression. The Mitsubishi Fuso Truck and Bus Corporation FUSO-Concept II unveiled in 2012 (Fig. 12) features a front face design that includes a grille illumination expressing a V, and is poised to iconize a V motion for the front face of upcoming Mitsubishi Fuso Truck and Bus Corporation models. The WAVE concept truck showcased by Walmart at the 2014 Mid-America Trucking Show features a radical streamlined design that puts the driver's seat in the middle of the cabin and also strives to reduce drag and vehicle weight (Fig. 13). The Future Truck 2025 announced by Daimler in October 2014 focuses on autonomous driving. It proposes a visual expression of autonomous driving where the grille emits no light during normal driving with a driver at the wheel, but emits a blue light when the vehicle is driving itself (Fig. 14).

In the years ahead, manufacturers are expected to propose designs that involve the approaches of drag and

Fig. 13 Walmart WAVE concept truck

Fig. 14 Daimler FT 2025, with autonomous driving illumination shown at bottom right

weight reduction as well as automated driving, and to introduce radical shapes that incorporate lighting and other high-tech functions. Current concept trucks proposals are presented in various ways by manufacturers, and many the plans for the future they embody reflected in production vehicles. In addition, those proposals give a sense that, further in the future, they will become reality.

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Body Structures

1 Cab and Chassis

1. 1. Product trends

1. 1. 1. Large trucks

Table 1 shows the large trucks announced in Japan in 2014, and the main product technology trends. In the Japanese market for this class, all manufacturers have introduced vehicles fully loaded with functions related to better fuel economy and enhanced safety performance.

The Profia has exceeded the 2015 fuel economy standards by 5% through refinements to the engine and the adoption of an automatic coasting system. Safety functions have been augmented with the addition of a collision mitigation braking system that helps prevent colliding with the vehicle ahead, thereby achieving compliance with the new standards for collision mitigation braking systems in effect since November 2014. At the same time, the performance of the lane departure warning and driver monitoring systems has been enhanced, and those systems were made standard equipment on all tractors.

The Quon has exceeded the 2015 fuel economy standards by 5% through refinements to the engine and the adoption of an electronic 12-stage transmission with a wide gear ratio. On the safety front, its collision mitigation braking system has been made compliant with the new standards for collision mitigation braking systems in effect since November 2014.

The Super Great V has exceeded the 2015 fuel economy standards by 5% through refinements to the engine as well as auto-cool fan coupling and a stop-start system that have been made standard equipment. In terms of safety, collision mitigation braking and driver alertness systems have been made standard in the long-haul series, and the same has been done in the tractor series for the vehicle stability system.

The Volvo FH that was given its first full-model change in 20 years has been introduced in the Japanese market.

Millimeter wave distance monitoring, collision mitigation braking, and vehicle stability control safety systems have been made standard equipment on the Giga.

1. 1. 2. Medium-duty trucks

Table 2 shows the medium-duty trucks announced in Japan in 2014, and the main product technology trends. In the Japanese market for this class, all manufacturers finished announcing both vehicles adapted to the new low-emissions vehicle certification system and vehicles equipped with safety systems in 2012.

The Forward is the first medium-duty truck to offer a lane departure warning system as an option. It is also equipped with the same vehicle stability control system that mitigates skidding and rollovers as the heavy-duty Giga.

The Canter EX represents a new category of trucks that uses a light-duty truck base and expands the width of the cabin and cargo bed to achieve the load capacity of a medium-duty truck while retaining the high mobility and cost-efficiency of light-duty trucks and securing greater cargo space.

Table 1 Main product technology trends for heavy-duty trucks in 2014

Month of launch	Truck model name	Main characteristics
April	Profia	Partially refined • Vehicle configured to achieve the 2015 fuel efficiency standard +5 % threshold. • Safety systems refined and made standard equipment
May	Quon	Partially refined • Vehicle configured to achieve the 2015 fuel efficiency standard +5 % threshold. • Safety systems refined
	Super Great V	Partially refined • Vehicle configured to achieve the 2015 fuel efficiency standard +5 % threshold. • Safety systems made standard equipment
September	Volvo FH	Launched in the Japanese market
October	Giga	Partially refined • Safety systems made standard equipment

Table 2 Main product technology trends for medium-duty trucks in 2014

Month of launch	Truck model name	Main characteristics
October	Forward	Partially refined • Safety systems installed
December	Canter EX	Partially refined • Medium-duty truck loading capacity with a light-duty truck base

Table 3 Main product technology trends for light-duty trucks in 2014

Month of launch	Truck model name	Main characteristics
June	Light Ace Truck	Partially refined • All vehicles achieved the 2015 fuel efficiency standard
September	Kazet	OEM procurement from Mitsubishi Fuso Truck and Bus Corporation
November	Elf	Partially refined • All vehicles achieved the 2015 fuel efficiency standard

1. 1. 3. Light-duty trucks

Table 3 shows the light-duty trucks announced in Japan in 2014, and the main product technology trends. Vehicles with fuel economy related improvements have been introduced in the Japanese market for this class.

All models of the Light Ace Truck produce cleaner emissions thanks to refinements in the engine catalyst and were certified as achieving the 2005 emissions standard 75% reduction level and met the 2015 fuel economy standards.

The Kazet is a new light-duty truck released through OEM procurement from Mitsubishi Fuso Truck and Bus Corporation.

The Elf further improved its fuel economy, combining refinements to the engine and a revision of the transmission gear ratio with the inclusion of a stop-start system as standard equipment in its main variants and the installation of Eco-stop system. All models now meet the 2015 fuel economy standards.

1. 1. 4. Mini-vehicle trucks

Table 4 shows the mini-vehicle trucks announced in Japan in 2014, and the main product technology trends. In the Japanese market for this class, even as full model changes are carried out to increase product appeal, development costs and reduced investments are leading manufacturers to move from in-house products to OEM models (production by a competing brand).

The Minicab Truck is a new mini-vehicle truck released through OEM procurement from Suzuki Motor Corporation.

Table 4 Main product technology trends for mini-vehicle trucks in 2014

Month of launch	Truck model name	Main characteristics
February	Minicab Truck	OEM procurement from Suzuki Motor Corporation
September	Hijet	Full model change • Revamped platform, enhanced fuel efficiency, improved anti-corrosion, higher loading capacity
	Pixis Truck	OEM procurement from Daihatsu Motor Co., Ltd.

Refinements to the engine of the Hijet aimed at greater utility and cost-efficiency led to a better compression ratio and reduced drive loss. In automatic vehicles, the adoption of a new electronically controlled 4-speed automatic transmission achieves fuel-efficient, quiet cruising. In addition, to provide super ease-of-use and enhance running performance, the 1,945 mm guard frame length and thin rectangular guard frame that does not intrude into the cargo bed were kept, extending the length of the cargo bed to 2,030 mm. Load capacity, the essence of commercial vehicles, was increased, and usability considerations led to expanding cabin space by pushing the windshield further forward. The steering wheel angle was revised to make the vehicle more comfortable for users to drive. At the same time, anti-corrosion performance has been improved by adopting anti-corrosion plates for the entire body surface area.

The Pixis Truck is a new mini-vehicle truck released through OEM procurement from Daihatsu Motor Co., Ltd.

1. 1. 5. Trucks manufactured outside Japan

With the dust settling on the introduction of Euro 6, no notable new models were introduced in 2014. However, Daimler's announcement of a concept truck targeting commercialized autonomous driving in 2025 at the Hanover International Motor Show Germany (for commercial vehicles) underscored the high degree of interest in the latest IT technologies. The FH from Volvo Trucks was voted International Truck of the Year.

1. 2. Interior comfort

Truck drivers spend the majority of their time in the truck cabin. This makes the comfort of the cabin extremely important, and manufacturers are striving to use its limited space as efficiently as possible and enhance its convenience. Recent cabins have a square frame, with a wide door opening and a tall roof, making minimizing

the amount of crouching necessary to get in or out of the truck. The Hijet mini-vehicle truck that was completely revamped in 2014 pushes the windshield further forward to expand cabin space. Driver operation was made easier by revising the steering wheel angle and increasing the sliding range of the driver's seat. Improvements in cabin comfort are also reflected in a range of convenient features such as extensive and easy-to-use storage space provided mainly around the instrument panel.

1. 3. Operability

The rapid aging of society is making the shortage of drivers is a serious issue. As drivers become older, more women become drivers, and fatigue due to long driving hours increases, vehicle operation must be further simplified and ways to reduce driver fatigue must be considered. More and more trucks are now being equipped with features such as automatic transmissions, manual transmissions with no clutch pedal, and devices that aid the driver when starting on a hill. This trend of making trucks easier to drive has recently been expanding to heavy-duty trucks, where it was uncommon until now. The area around the driver's seat has been made roundish and compact, with the panels, switches and levers laid out in a functional, ergonomically-based manner that provides an ideal operational environment for the driver and reduces fatigue.

1. 4. Noise and vibration

Noise and vibration related improvements are also being made to reduce fatigue and enhance comfort for during prolonged driving. To absorb vibration from the road surface during driving and improve ride quality, manufacturers are refining the engine mount and cab suspension, enhancing frame rigidity and, in the cabin, introducing suspension seats that offer fine-grained control. Similarly, noise is addressed through the addition of covers near the engine compartment and sound absorbing material. Quietness is improved through various means, such as the optimal placement of interior material with high sound insulation or sound-absorbing properties, to reduce sound penetration in the cabin.

1. 5. Safety

Collision damage mitigation initiatives intended to minimize damage in the event of an accident were introduced early and include the adoption of structural reinforcements that keep cab deformation to a minimum and ensure survival space in a collision, as well as of pretensioner seatbelts, SRS airbags, and shock absorbing steering wheels. In recent years, manufacturers are also increasingly equipping their vehicles with active safety systems designed to help prevent accidents from occurring. Pre-collision safety technologies such as advanced emergency braking systems (AEBS), lane departure warning systems (LDWS), and electronic stability control systems that control skids and rollovers are becoming more widespread. The heavy- and medium-duty trucks introduced in the market this year have improved such active safety systems and made them standard equipment.

1. 6. Aerodynamic characteristics

Aerodynamic characteristics make a significant contribution to reduced fuel consumption, and all manufacturers are putting more effort into improving those characteristics. The cab of the truck is the first part of the truck that contacts the wind, which it then funnels up and down, left and right, and toward the rear of the vehicle. Consequently, cabs are being designed with narrower fronts, and innovations to the corners to rectify the flow of air and reduce drag. However, modifying the design to change the flow of air around the cab can also lead to negative impacts such as more wind noise in the cabin, poorer aerodynamics around the tires, instability in crosswinds, decreased engine cooling performance, and lessened interior comfort due to the narrowing of the front. This means that any design changes must improve aerodynamics while simultaneously minimizing these kinds of problems. Recent advances in analytical technologies such as optimization calculation methods has led to major improvements in the flow of air under the floor, which has a large impact on the cooling performance, as well as in the flow of air in the engine compartment, and to the negative pressure region behind the rear body. Considerable time and effort is now being poured into initiatives that make use of computational fluid dynamics (CFD) analysis in addition to conventional wind tunnel testing with scale models to carry out these aerodynamic design activities more efficiently.

1. 7. Corrosion prevention

In recent years, improved corrosion prevention has been promoted, even on mini-vehicle trucks. In the completely redesigned Hijet truck, a thorough 3-layer coating and the use of anti-corrosion plates for the surface of the upper body achieves vastly increased anti-corrosion performance. On a similar note, in addition to extending the surface corrosion and corrosion perforation guaran-

tees to 3 and 5 years, respectively, the Carry launched in the previous year (2013) also enhanced underbody anti-corrosion through measures such as the adoption of anti-corrosion plates. In addition, the need for styling excellence and weight reduction is leading to improvements in anti-corrosion performance through the active use of plastics, particularly in external plates.

2 Rear Body

As logistics become more and more diversified, the need to further improve freight handling and transport efficiency is being addressed by reducing weight and increasing load capacity. Vans and complete wing body trucks configurations, which are reasonably priced and can be delivered quickly, are becoming more common. Increased adoption of aluminum and plastics, as well as structural refinements, have helped reduce weight. At the same time, nature conservation concerns are leading to the use of fast-growing materials such as acacia or bamboo to replace the traditional apitong wood. For refrigerator trucks, antibacterial and odor eliminating specifications have been established to address hygiene issues during the transportation of foods.

References

(1) Publicity materials and catalogs of the individual manufacturers