An Intelligent Approach To Moving Goods

Systems Expertise in Trucks
The world is converging. Markets are becoming more and more international. Flexibility and efficiency are essential – for both people and goods. The result: a combination of ZF driveline and chassis technology and groundbreaking technology solutions. On all roads, under any conditions. ZF offers system-based solutions from a single source – ranging from mechanical basic transmissions, intelligent automatic-shifting transmission systems to electrical turnkey solutions with inverter and control software. In partnership with vehicle manufacturers, we secure the future prosperity of the truck as a viable means of transport and the success of hauling companies in today’s market. Under the aspect of our “See. Think. Act.” principle, we offer innovative solutions and ideas for the entire haulage sector.
ZF Innovation Vehicles –
Re-inventing Transportation

See. Think. Act. This is our road sign that guides us toward intelligent mobility solutions. Our ultimate aim is to achieve both zero emissions as well as zero accidents with our products: The latest ZF Innovation Vehicles have taken us one step further in this direction.

On the long journey to the truck depot, the ZF Innovation Truck driver can rely on autonomous driving functions. With Evasive Maneuver Assist (EMA) or Highway Driving Assist (HDA), ZF provides the driver with effective systems that proactively assist in avoiding accidents.

The TraXon hybrid system is fitted into the truck’s drive line. Alongside the standard diesel engine, the truck also has a highly integrated and powerful electric drive. When traveling, the electric motor is one step closer to zero emissions with functions such as boost or automatic engine stop. At the depot, the truck can perform near-silent, zero-emission movements with its electric drive.

A new feature of the TraXon system is the digital predictive maintenance function which can plan maintenance on the transmission proactively. This helps the vehicle operator to reduce operating costs.

Once the driver arrives at his destination it is not the end of the transport chain. Usually, challenging and hazardous tasks such as lifting, shifting and stacking containers have to be carried out. Our heavy, six-wheeler ZF Innovation Truck supports the driver enormously – namely by managing these tasks on its own.

As soon as the driver arrives at the depot, he activates autonomous driving mode and gets out of the truck – while the truck takes over the task at hand electrically, silently and precisely – as if led by an invisible hand. ZF sensor sets fitted with cameras, LIDAR and radar sensors keep an all-around eye on the surroundings to prevent any accidents. The integrated electric drive, the electrohydraulic ReAX steering and GPS navigation ensure the accurate positioning of the truck. The entire procedure is monitored and controlled by the ultra-high-tech on-board supercomputer ProAI, which guides the truck to its end position.

Autonomous driving is not just gaining traction in road vehicles, it is also increasingly used within enclosed company campuses. With its "autonomous depot" as an example, ZF is offering a glimpse into the future, showcasing special shuttle vehicles which autonomously maneuver the entire semitrailer to the loading ramp.

Equipped with functions such as Semitrailer Assist or SafeRamp, the vehicles move around the depot site following routes which are calculated in real time. An intelligent routing system sets the position where the vehicle should go and coordinates the routes of all the vehicles on the premises.

These functions can help entire shipping depots increase their efficiency and cost-effectiveness as well as offer maximum safety for personnel and vehicles.

Deliveries of ordered goods and parcels to private customers have witnessed exponential growth in times of online shopping. For this “last mile sector”, ZF has unveiled an Innovation Van. This vehicle is capable of autonomously finding its way to its destination while avoiding obstacles and recognizing both traffic lights and road signs. If the driver is faster on foot to a new address, he can use the tablet to send the van to the next stop. The van then finds its own way there. The Innovation Van is also fitted with sensors and cameras which feed the ZF ProAI computer with its information. The evaluated data is used as the basis for the output commands to the all-electric motor, electric power steering and the IBC brake system. The driver is guided by a support system which continually compares the parcel information and the traffic conditions to calculate the fastest route to the parcel's destination.

ZF uses a similar support system in its pilot ZF Model Factory where the production material to be supplied is networked to the plant’s own transport systems. This means the forklift trucks can be standing waiting for the delivery. Management systems then link the incoming goods to internal, autonomous transport systems. The vehicles are designed to manage autonomous driving, obstacle avoidance and vehicle overtaking. Sensors and camera systems keep an eye on the entire surroundings.

This intelligent control and linking of transport processes will not only optimize the delivery logistics, but also the entire material flow. The experiences gained from this Model Factory will be directly incorporated into the pre-development of autonomous driving functions, for commercial vehicles as well.
Systems Expertise in Trucks

As a result of globalization, traffic volumes on our roads are increasing. This is why our drive specialists at ZF are working at full speed to develop solutions for drivers, vehicle manufacturers and fleet operators. Our objective: cost-effectiveness, driving comfort and safety.

**ZF transmission systems** are the first choice on the road. Synchronesh transmissions have proven their worth a million times over. Automated transmission systems set benchmarks in cost-effectiveness, safety and comfort.

All ZF system components have been developed for full compatibility. Our systems expertise covers driveline technology as well as the associated chassis technology, steering systems, axles, dampers or cooling systems.

Clutch systems and torque converters enable a smooth vehicle launch while torsional dampers protect the driveline from unwanted vibrations caused by the entire driveline and also ensure maximum driving comfort. Complete axle systems guarantee precise axle guidance and beneficial handling characteristics. Dampers and cabin suspensions minimize the stress placed on the driver, vehicle and load, and are significantly aided by the electrically assisted hydraulic power steering, ReAX. And of course we support you with the integration of our systems into your vehicles.

**Electric systems** expand the horizon of drives. The TraXon hybrid transmission system with electric motor helps to reduce fuel consumption and provides zero-emission driving on the “last mile”. A key element in its design is the electronic transmission control module which provides innovative driving functions.

**We never stand still.** With our finger on the pulse of research and development. Our ZF Innovation Vehicles show today what the future of goods transport could look like tomorrow.

Find out more about ZF technology at www.zf.com/truck
Comfort and reduced fuel consumption, less weight and more performance, a longer service life and less maintenance – with the TraXon automated transmission system we are on our way towards achieving a new standard of efficiency.

Transmission efficiency
in direct drive
99.7 %

As a modular transmission platform featuring 12 or 16 forward gears, TraXon offers a variety of possible configurations. These include a single or twin plate clutch, a dual clutch, a hybrid module, the Intarder and various power take-offs.

Specially developed single and twin disk clutches are available for every application, allowing the TraXon transmission system to achieve its full performance.

ConAct® replaces the conventional clutch actuation system with a concentric, pneumatic release cylinder. The system automatically determines the optimal release position, the vehicle electronics system smoothly controls the actuation process. This eliminates the risk of a clutch overload caused by the driver.

PreVision GPS is the ideal combination of transmission and GPS. This system makes it possible to factor in uphill and downhill gradients in advance for the selection of shift points.

An optional predictive maintenance function will be available from 2019. This offers fleet operators the capability to monitor the condition of critical individual components such as transmission oil or clutch disks in the Cloud. Maintenance can thus be planned proactively, which in turn can shorten vehicle downtimes and avoid breakdowns. This reduces costs and extends the transmission’s service life at the same time.

The hybrid module is now in its third generation and supports electric driving over short distances as well as boosting the diesel engine and the recuperation of braking energy. It also uses up to 7 percent less fuel than conventional modules.

The extensive range of ZF power take-offs expands the range of application of the transmission system.

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Advantages at a glance
- High torque range: DD up to 2,850 Nm, OD up to 3,400 Nm
- Less fuel consumption thanks to maximum transmission spacing
- Less transmission noise
- Control electronics with many intelligent additional features
- Clutch perfectly adapted to the transmission system
Automatic Transmissions for Trucks
Full Power for Our Roads

Whether it is long-distance shipping, delivery traffic or city traffic – the business is already hard enough. The driving part at least should be as uncomplicated as possible: automatically economical, automatically safe, automatically relaxed.

This is why AS Tronic mid, AS Tronic lite and EcoTronic mid, each with an ideally adapted ZF clutch, complement the automated transmission family around TraXon.

**Automatic transmission: full focus on the road ahead**

With AS Tronic lite, light and medium-duty delivery traffic can also benefit from the advantages of automatic transmissions and electronic protection against incorrect gear changes, engine over-revving, torque peaks and clutch overload:

An intelligent electronics system selects the optimal gear based on the driving situation and the route.

AS Tronic mid is the flexible solution for medium-duty trucks in long-haul and delivery traffic as well as in shift-intensive city traffic. Smooth gear changes protect the clutch as well as the downstream driveline. The electronic control unit eliminates shifting errors, even in manual mode, which allows a simple gear selection at the push of a steering column switch.

**EcoTronic mid: automation is the future**

Demand for automatic transmissions will keep increasing all over the world. This is why ZF developed an automation module for the Ecomid transmission which is already being manufactured on different continents today. This allows customers all over the world to benefit from the advantages offered by this easy-to-service product. This module can be combined with the ZF shift strategy PreVision GPS used in TraXon.

**Complete with ZF components**

ZF offers all automatic transmissions with clutches that have been designed and fine-tuned specifically for this purpose.

Furthermore, ZF offers power take-offs for a wide range of applications, including fire-fighting vehicles, working platforms, hydraulic pumps, community service vehicles or loading/unloading support.
PowerLine

The New Driving Experience

Deceleration. Acceleration. Loading and unloading in city centers. Every assistance is of help in these situations. Speed, punctuality and accuracy are vital in the transport industry.

To handle these tasks, ZF has unveiled a revolutionary new transmission: PowerLine, the fully automatic power-shift transmission, reduces the driver’s workload when overtaking by safely engaging the most efficient gear, provides intelligent driving assistance and gear-ratio steps, offers powerful sprinting and scores highly with fuel savings in the double-digit range.

PowerLine has been specially designed for the medium-duty vehicle category and delivers excellent results, whether for trucks, heavy pick-ups or modern buses. PowerLine is based on our tried-and-trusted transmission concept with millions of units sold, a benchmark in the passenger car sector.

The torque converter is non-wearing, is bypassed early and reduces consumption when the vehicle is at a standstill (neutral idle control). The integrated dual torsional damper allows the transmission to run at reduced speeds and significantly increases driving comfort.

The revolutionary, ZF-patented planetary gearset featuring eight gears offers a higher spread than any other transmission on the market for this vehicle segment. Gear steps over several gears at once are also possible.

The intelligent transmission control provides a wide spectrum of driving functions, ranging from an extremely sensitive maneuvering function and hill start aid to automatic engine stop. A shift control unit customized for off-road vehicles is also available. PowerLine is also designed ready for use in hybrid vehicle concepts.

In addition, engine-dependent PTOs on both sides are also available. A parking lock completes the outstanding service portfolio of this transmission.

Servicing is also inexpensive thanks to extended oil change intervals and an oil filter designed to last the entire service life of the transmission.

Advantages at a glance
- 1,200 Nm input torque
- up to 30 % improvement of acceleration
- up to 30 % quieter
- 45 % lighter in weight (only 150 kg non-laden)
- Hybrid-ready

Fuel economy up to

10 %
Manual Transmissions for Trucks & LCV
Because They Prove Their Worth Every Day

ZF manual transmissions are perfectly adjusted to the service portfolio of modern commercial vehicles. They deliver the right torque for every situation, are easy to operate and are characterized by their quiet operation and optimal gear ratio spread.

The ZF manual transmissions can be used variably, promote low fuel consumption and guarantee efficient operation. Power take-offs further expand the range of applications.

**Ecoplit: driveline technology for heavy trucks**
Ecoplit enables long-distance truck drivers to always achieve the optimum output with all engines, even in case of difficult topography and with heavy loads. The transmission also demonstrates its strength in off-road applications, on construction sites, and in special vehicles. The optional Intarder also relieves the service brakes and increases safety.

**Ecomid: driveline technology for medium-duty trucks**
For long-distance traffic, maneuvering in the pedestrian zone, collecting garbage, working on construction sites or even clearing snow in winter – equipped with the Ecomid manual transmission system, trucks can be used efficiently around the world.

**Ecolite: driveline technology for light trucks**
The robust, easy-to-service 6-speed Ecolite transmissions ensure long-lasting driving pleasure in delivery traffic. Powerful but light, characterized by quiet operation and a long service life. In lower gears, the transfer of engine output is powerful, so it can also be used for off-road applications.

**Ecolite for light commercial vehicles**
The modular transmission kit designed for the three-and-a-half to eight-ton vehicle segment transmits torques of up to 480 Nm or even more if an intermediate plate is used. Functions such as automatic engine stop, all-wheel drive or power take-offs can be ordered based on application requirements.

The use of standard components also makes the transmissions attractive for emerging markets. With regard to costs, shift comfort, service life and emissions, the transmissions can be flexibly adapted to fit the respective market requirements.

Systematic further development: ZF clutches
ZF offers the appropriate clutch system for all transmissions including clutch releasers. The diaphragm springs used in the clutch cover offer good control characteristics for launching and low pedal forces. Clutch facings developed and produced in-house are extremely wear-resistant and make controlling the clutch very comfortable. The torsional damper integrated in the clutch disk eliminates driveline vibrations, thus protecting the transmission and providing driver comfort.

Due to its resistance to high thermal loads, the twin disk clutch is particularly well-suited for heavy-duty applications, for example, on construction sites.
Intarder

A Good Brake System Equals Better Driving

The truck’s brake system must be at least as powerful as its engine. The Intarder that is integrated in the transmission relieves the service brakes, reduces the impact on the environment and maintenance costs.

If the vehicle is equipped with an Intarder, the driver can select multiple brake stages in order to optimally adapt the truck’s braking performance to the route and the current traffic situation. The hydrodynamic hydraulic brake decelerates independent of the engine speed after a very short response time and enables wear-free continuous braking without fading. This reliably relieves the service brake. Even on downhill gradients, the service brake remains cool, the vehicle is always under control. Gentle braking protects the freight.

The brake force is not even interrupted during clutch actuation and shifting. Less wear on the brakes and optimal system integration not only reduce operating costs and guarantee significantly shorter maintenance downtimes with a reduced demand for spare parts. They also lead to a reduction in brake dust emissions. With more than one million Intarders delivered so far, this means a significant reduction in environmental impact. These special advantages make the Intarder the first choice – not only in long-distance traffic, but also wherever heavy loads have to be moved safely and economically.

The system concept pays off! In contrast to retarders made by other manufacturers, the Intarder is integrated into the transmission in a space-saving way. As a result, it can be easily attached to manual and automatic transmission systems and can be optimally integrated into the vehicle brake management including the cruise control function. The Intarder operates with a closed oil circuit. A more even, consistent traveling mode, reduced idling losses and ideal operating temperatures ensure perfect overall system operation.

Increased safety
• Fading and wear-free continuous braking
• Optimal scope of effect (between 30 and 80 km/h)
• Integrated oil circuit with cooling and heating function: the transmission oil can reach the required temperature faster
• Integration in brake management
• Swift amortization

Increases the service life of brakes by up to 90%
ZF Power Take-Offs – More Than Just Driving

ZF power take-offs turn commercial vehicles into true specialists for very specific applications. In fire trucks, concrete pumps and mixers, mobile cranes or drill and winch drives, for example.

The engine-dependent PTO is an independent module for special usage and a wide range of applications – from fire trucks to concrete pumps and mixers through to flushing and sewage vehicles. It is installed between the transmission and the vehicle engine (SAE interface) based on the sandwich principle, can shift under load at any time and withstands the most extreme loads even in continuous operation.

The powerful upstream torsional damper DynaDamp effectively reduces jolts caused by the irregular rotation of the crankshaft at the engine output.

The transfer case is the most important driveline component. It distributes the propulsive power coming from the engine and the manual transmission to the front and rear axles. ZF offers a wide and comprehensive range of transfer cases which are available for input torques from 10,000 Nm to 35,000 Nm and are designed for medium-duty and heavy all-wheel drive commercial vehicles.

Thanks to the modular system the transfer cases are based on, ZF can offer a large variety of customer-specific transfer case variants and solutions.

Power is key on all roads Engine power and torque ranges are rising continuously. With the VG 2700 transfer case, ZF offers driveline technology which has been specifically designed for the strongest engines in heavy all-wheel drive vehicles.

With a maximum input torque of 35,000 Nm, the VG 2700 is the most powerful volume-production transfer case worldwide. The compact design of the transfer case series makes vehicle installation easier and less costly. The two-stage design of the transfer cases allows for high off-road capability and mobility.

All ZF transfer cases can be equipped with the ZF ADM 2 function (Automatic Drivetrain Management) and thus constitute an essential factor when optimizing the performance of the whole driveline in all-wheel drive commercial vehicles.

Transfer Case Interface in Continuous Operation

Clutch-dependent PTOs are fitted on the output end or laterally on the transmission housing. They only operate when the engine is running and the vehicle clutch is closed. Applications are, for instance, water, sludge and hydraulic pumps, compressors, winches, turntable ladder fire trucks and working platforms.

Drive-dependent PTOs are connected to the transmission output shaft. They are active as soon as the drive wheels of the vehicle begin to move and supply the hydraulic system of dual-circuit steering systems with operating pressure. This means that the driver can still steer the vehicle in the case of engine failure.

With decades of experience in development and production, ZF is the world market leader for transfer cases for all-wheel drive vehicles starting at nine tons total weight and supplies almost all renowned commercial vehicle manufacturers worldwide.
Time and time again, the implementation of the engine/transmission interface proves to be highly complex. This is why manufacturers around the world who focus on performance, comfort and durability place their trust in tried and tested ZF components.

Decades of experience enable ZF to develop clutch systems which are perfectly fine-tuned to meet their demanding tasks in commercial vehicle drivelines, which is appreciated by vehicle manufacturers all over the world.

The engine input torque is transferred from the clutch cover to the clutch disk. Especially in automated drivelines, the perfect design of all parameters is necessary in order to optimize transmission performance when launching and shifting.

Their modular design enables ZF clutch disks to be adapted individually to any application. The special cushion spring technology provides for high comfort when launching the vehicle, and the optional predamper effectively eliminates idling noise.

ZF clutch facings with optimized friction coefficients, high wear and burst strengths as well as particular fading resistance reliably and precisely transfer engine torque. They are produced without using solvents and heavy metal, which is good for the environment.

Self-centering and maintenance-free push or pull-type clutch releasers interrupt the torque transmission when launching, during shifts and when stopping. The concentric ConAct pneumatic clutch actuation cylinder was developed for fully automatic operation. When combined with automated transmissions, the system automatically determines the ideal release position and allows for very gentle vehicle launch.

**Clutch for auxiliary drives** The multidisk clutch separates the mechanical connection of the compressor completely from the engine as soon as the cut-off pressure is reached. The fact that auxiliaries can be switched on and off based on demand reduces fuel consumption and thus also CO₂ emissions.

**Dual Mass Flywheel** Stricter emission standards in combination with greater engine output lead to increased vibrational tendency of the driveline due to rotational irregularities. At the same time, there is an increased demand for noise reduction, comfort and the protection of the transmission and vibration-sensitive vehicle components. The Dual Mass Flywheel is the answer – it provides for perfect vibration isolation.

It offers excellent protection from vibrations across the entire engine speed range.

**Torsional dampers** are used to protect the driveline from both engine torque peaks and uneven running. Through the selection of the corresponding torsional damper size and spring set, the characteristic curve can be adjusted quite well to the respective application profile.

In challenging applications with up to 4,000 Nm engine torque, the new torsional damper TD 285 guarantees the required smoothness and reduces stress on all components of the downstream driveline.
Axle Systems for Trucks

Comfort, efficiency and reliability under tough conditions – based on this premise, ZF developed new axle systems that even prove their worth in off-road applications.

Precise steering, uncompromising reliability – the APL 90 steering axle successfully masters the challenges of rough everyday work, for instance at construction sites. This axle with 100-percent differential lock has been designed for the modern off-road truck with a front axle load of ten tons. It allows for safe propulsion even in difficult operating conditions.

The ZF steering axle for all-wheel drive trucks stands out with its generous ground clearance, long service life and robustness. The hub reduction axle design reduces the weight and helps to maximize ground clearance.

Balanced steering kinematics make the vehicles very easy to maneuver, which results in reduced tire and road surface wear. An ABS-controlled drum brake, which is particularly well suited for demanding off-road applications, completes the axle concept.

With its maintenance-free steering-knuckle bearings and generous oil change intervals, the APL 90 also reduces operating costs. Additional optional features such as disk brakes, central tire inflation system and all-wheel drive continuous operation will in future round off the range of products.

The new independent suspension for heavy trucks ITS 80 F from ZF significantly increases comfort and improves handling. Large steering angles guarantee an optimal turning circle. The spring forces are supported by a separate, compact spring carrier. This reduces the unsprung masses, enhances the axle kinematics and allows for greater suspension travel. The chassis is therefore able to compensate road bumps more easily. This reduces stress on the vehicle and the driver.

The development objective, however, was not only to improve ride comfort, but also to protect the road surface. The air-spring damper module (LDM) supports all of this by providing ideal damping and chassis suspension while requiring minimal installation space.

Compared to the current air-spring solid axle which is guided by torque rods, the ITS 80 F is easily 40 kilograms lighter – a difference of more than ten percent compared to a conventionally produced independent suspension. The lower total weight saves fuel and keeps emission values low.
Front Axle Modules
Expertise Starts at the Top

We set the benchmark with the ZF joint design and our fine-tuning system for tie rods and drag links. Our dampers provide increased anti-roll stability and improve comfort and safety.

Torque rods are used for precise axle guidance in all driving conditions. Tie rods and drag links provide optimal wheel guidance and reduce noise. Apart from zero maintenance, low weight and a space-saving design, reliability and the long service life of parts are right at the top of the list of priorities. ZF also finds appropriate solutions for complicated installation space requirements. ZF dampers prevent the vehicle from pitching when driving on uneven roads. They are indispensable for good lateral guidance and braking effect. The ZF product portfolio ranges from standard dampers to stroke-dependent Vario dampers through to air-spring damper modules and complex damping control systems. They all have the following advantages in common: improved comfort, a long service life and quiet noise transmission. The vehicle is stabilized, minimizing the burden on the driver. The vehicle suffers less jolts, which protects the freight and the road.

Steering Systems
Everything Under Control

Apart from high-performance steering gears from the THP series, ZF also offers the electrically assisted ReAX hydraulic steering system, the especially energy-efficient eActivMode power steering pump and the Global Column series of adjustable steering columns.

The THP steering gear series offers exceptional steering comfort, a compact design, top performance, and reliability. ReAX is the combination of two tried-and-tested steering systems: The hydraulic power steering system generates the torque required for large commercial vehicles, while the electrically-powered steering guarantees precision and enhanced handling characteristics. The system reduces steering forces at low speeds and increases steering stability at high speeds. ReAX is available in two configurations: installed on the steering column or on the steering gear.

The unique flow logic of the ActivMode power steering pump saves energy and up to 50 percent of costs compared to other hydraulic power steering systems. eActivMode increases the savings even more by using vehicle data including steering and vehicle speed to precisely adjust the pump flow to the current steering system requirements.

The Global Column series of adjustable steering columns allows for smooth adaptation to all directions of movement. The multi-plate friction locking mechanism ensures solid lash-free operation. Global Column is available in a variety of designs.
Reduced unsprung masses in the vehicle also translate into greater comfort and reduced wear on bearings. The overall solution from ZF significantly reduces weight by integrating functions and using lighter materials, examples of this would be the 4-point link and the rear twin axle system.

The 4-point link is responsible for locating the non-driven leading axle with its weight-optimized hollow-cast design. The driven rear axle features a stabilizer link with new polygon joining technology. Together with a light aluminum v-link and a spring bellows carrier, it takes over axle guidance in longitudinal and transverse direction and vertical axle load support.

Thanks to the design enhancements on both axles, the new rear axle suspension weighs far less, leading to lower unsprung masses in the vehicle. This is crucial to safety and comfort. Fleet owners benefit from a lower vehicle weight which allows them to increase the payload and reduces relative fuel consumption, e.g. by saving fuel in the case of empty runs and partial load. Another positive side effect of the weight reduction is the reduced damage to the road surface and lower wear of the chassis mounts.

Cost and weight savings:
- Optimized rear axle suspension for twin-axle trucks integrates two lightweight construction solutions
- Increased payload thanks to lower vehicle weight
- Integration of functions

Weight reduction

Less can be more. This is also true for the truck chassis. ZF uses lightweight design for the innovative rear axle suspension system to increase efficiency. To save fuel and increase the loading capacity.
Rear Axle Modules
Part of the System

Rear axle modules are subject to increased and frequently changing loads/stresses. Our chassis components are designed for this.

The various chassis parameters mutually influence each other during vehicle operation. Kinematics, elasticities and their interaction have a decisive impact on vehicle handling alongside springs, spring-loaded stops, dampers, struts, v-links and stabilizers.

ZF modules are always developed based on growing safety and comfort requirements. Outstanding safety standards are the basis for problem-free transport of goods which often weigh several tons. Our premise: continuous improvement of dynamic driving properties.

And the fact that we also contribute to reducing costs is a further bonus.

As a systems supplier, ZF can develop and deliver complete solutions including suspension systems, spring suspensions, dampers and brakes.

ZF joints are maintenance-free and noise-optimized. They come with the options of molecular or plain bearings and are made with precisely defined rigidity. Therefore, they not only dampen vibrations, but at the same time offer specific elastokinematic properties.

Lightweight Chassis Design

The intelligent combination of alternative materials and the integration of functions reduces damper and spring damper module weight by up to 40 percent. We focus on efficiency and resource conservation.

The basic conditions are clear: Commercial vehicles must lose weight. Reduced curb weight makes it possible to increase payloads. Every weight reduction also helps to reduce fuel consumption. In addition, reducing the weight of unsprung masses, such as axle suspension, wheels, brakes or dampers, creates potential for improving comfort.

The ZF 4-point link combines three chassis tasks in a single component: not only longitudinal and transversal axle guidance, but also roll stabilization.

A concept study in which ZF uses glass-fiber reinforced plastic (GRP) instead of casting promotes both function integration and lightweight construction. The weight is reduced by approximately 25 percent or about 11 kilograms.

ZF lightweight dampers combine innovative materials and technologies. Hollow piston rods, aluminum containers with reduced wall thicknesses in some cases and a redesigned plastic tube are used in the lightweight dampers. Weight reduction compared to conventional dampers is up to 40 percent or 1.5 kg per damper.
Innovative Cabin Suspension
Comfort at the Workplace

Good working conditions in the truck must not be a luxury. They are a matter of course, required to ensure that driver, vehicle and freight are safe on the road. ZF cabin suspensions reduce stress on the driver and optimize both function and installation space.

The different applications for which trucks are used mean that driver’s cabs differ—quite significantly—in some cases—in size, equipment and weight. As a systems supplier, ZF develops and produces front and rear suspensions for the driver’s cab to cover all common cabin designs, including springs, dampers and rubber-metal components. This ensures that there is a perfect solution for each requirement. And the driver benefits from a more comfortable workplace with fewer jolts, pitching or rolling motions. The intelligent integration of cab level sensors and height leveling into the air spring damper unit makes it possible to significantly optimize the cabin suspension installation space.

Expertise in all components The front stabilizer that forms part of the overall cabin suspension is produced by means of welding or polygon joining technology. Intelligent assistance systems guarantee a discernible increase in safety. ZF offers individual spring damper solutions for each driver’s cab design. The product portfolio ranges from horizontal dampers (nearly horizontal installation), to steel and air spring modules and CALM, through to the electronically controlled damping system CDC. The focus is always on cost-effectiveness, comfort, saving installation space and ease of servicing.
CDC is the damping control system for all trucks that combines uncompromising comfort and driving safety. From a single source. From ZF.

The electronically controlled damping system permanently monitors all relevant influences on the driving situation, such as load condition, driver activities or vehicle movements. CDC optimally sets the damping force within a few milliseconds. It is no longer necessary to compromise between safety and comfort when it comes to damper settings.

With CDC, the vehicle remains stable and can be controlled safely in all situations. Damage to load, packaging and vehicle are kept to a minimum. Stress on the drivers is reduced significantly and they can concentrate better on their task: driving the vehicle.

ZF develops CDC as a complete system for commercial vehicles and delivers significant advantages in comparison to previous solutions. This is primarily thanks to the use of the skyhook control principle. Both ride comfort and driving stability are noticeably improved, especially if the vehicle is only partially loaded. The ZF system can be used both as a complete system and as the CDC 1XL single-axle solution.

CDC 1XL is a particularly efficient version of the CDC. It only controls the dampers on one vehicle axle. This is usually the rear axle, since the largest axle load differences occur there due to vehicle loading. The sensor and control strategy focuses on the key influencing factors. The performance capability of the new CDC control concept is already clearly apparent in this application. To achieve optimal vehicle handling for the overall vehicle, we continue to recommend the full CDC system, which appropriately controls all dampers.

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**Advantages at a glance**
- Stability even in critical driving situations
- Safe handling during dynamic driving maneuvers
- Protection of cargo, packaging, and vehicle body
- Reduced vehicle wear
- Increase in cost-effectiveness

**The CDC modular kit – solutions for a wide variety of requirements**

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<th>Full CDC</th>
<th>CDC 1XL</th>
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<td>Sensors</td>
<td>CAN data and separate sensors, if applicable</td>
<td>Sensor cluster integrated in ECU</td>
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<td>Regulation</td>
<td>Independently per wheel</td>
<td>Independently per axle</td>
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<td>Application</td>
<td>For all trucks and buses, 18 wheels can be damped independently</td>
<td>Frequently alternating, large axle load differences</td>
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On Site – Worldwide

There is a wide variety of truck driver, fleet operator and manufacturer requirements relating to their tasks and areas of application. We secure your competitive advantage by means of global synergies. On the road and in the market.

ZF systems designed for every market ZF’s success is based on innovation and accurate market observations. In cooperation with local vehicle manufacturers, we specifically design products to fulfill regional requirements. Different transmission model ranges are produced in several regions around the world based on this design-to-market approach. Supplementary modules can, for example, turn manual transmissions into automated transmissions for price-conscious markets.

It’s about the journey, not the destination Wherever our customers require our services, ZF is there for them. We can react optimally to different demand situations and exchange supply volumes between different locations worldwide, if required. Identical design, reliability and top quality at all times.

We offer our development potential, our production expertise and our logistics expertise to commercial vehicle manufacturers all over the world. A global network of more than 700 service centers is available for repair and maintenance. These service centers offer professional maintenance for ZF technology, genuine spare parts and exchange units as well as comprehensive consulting and support, technical add-ons and optimization solutions for your vehicles.

The ZF Group

Groundbreaking technologies for future mobility

As a leading technology company offering comprehensive system solutions, ZF’s clear objective is making intelligent mobility possible. Quality, technology leadership and innovative strength have shaped ZF’s identity for more than 100 years. As we look to the future in our Corporate Strategy 2025, we have defined our motivation and obligation to shape mobility safely, efficiently and sustainably with trendsetting technologies.

Our goal is to enable autonomous vehicles to see, think and act. ZF’s concept is Vision Zero – a world without accidents and emissions. With its development of efficient and electric drives as well as its broad portfolio, ZF is advancing mobility and services in the automobile, truck and industrial technology sectors.

Here, we cooperate with often highly specialized partners, participate in promising startups or set up our own innovation and technology centers around the world.

In product development, ZF relies on meticulously selecting materials and uses life cycle analyses to improve the design of products with every generation. Climate protection, respect for natural resources and eco-friendly product design are the foundations of our globally applicable environmental policy.

Since ZF manufactures products worldwide at 230 locations in 40 countries, the procurement and transport of components plays a major role in a sustainable value-added chain. In order to achieve positive effects, we rely on the strategy “local for local”. We procure in the regions where materials or components are required. The resulting shortened transport routes help to preserve the environment and this “local” purchasing approach boosts the well-being of the local economy and community.