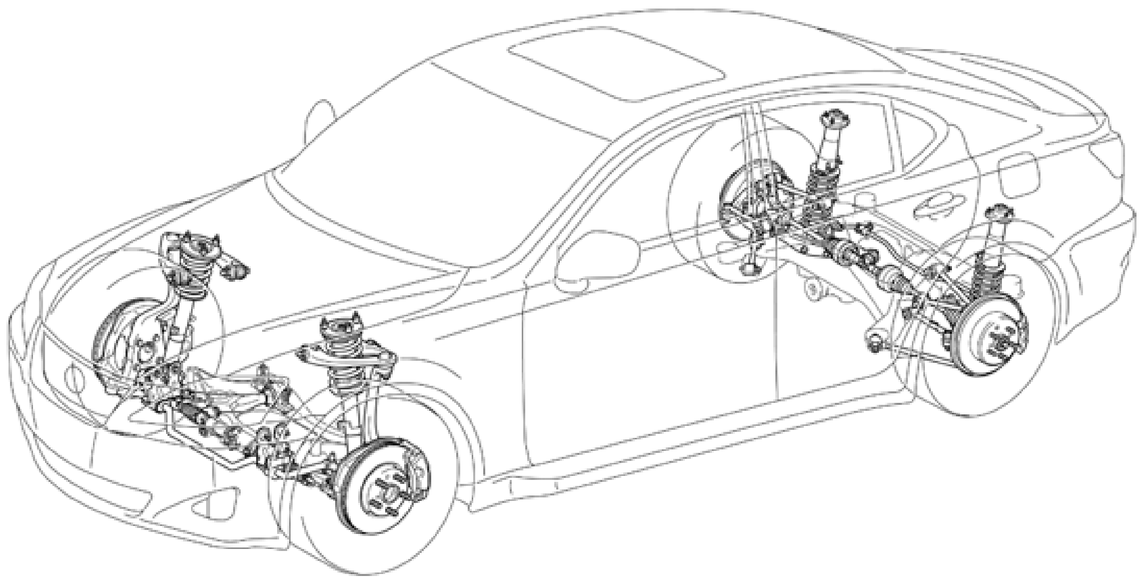
SUSPENSION AND AXLE

■SUSPENSION

1. General

- A double-wishbone type suspension is used in the front.
- A multi-link type suspension is used in the rear.



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▶ Specification ◀

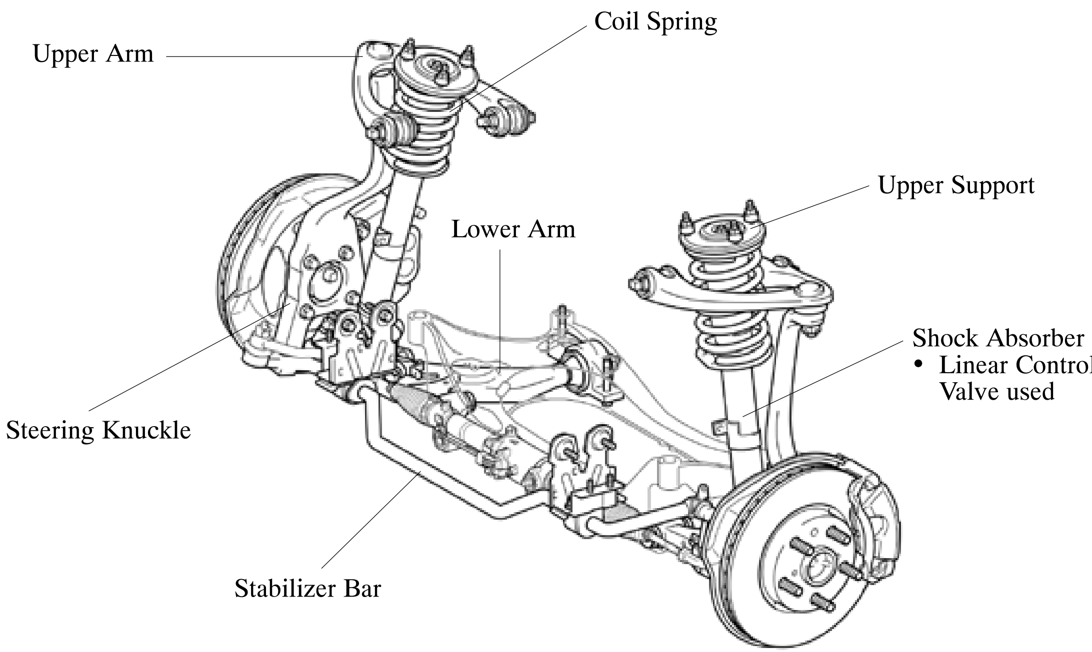
Model			IS250	
Package			Normal	Sport Package
Front Wheel Alignment	Type		Double-Wishbone	
	Tread*	mm (in.)	1535 (60.4)	
	Caster*	degrees	8° 07’ [205/55R16] 8° 11’ [225/45R17] 8° 04’ [225/40R18]	8° 04’
	Camber*	degrees	-0° 23’	-0° 36’
	Toe-in*	mm (in.)	1.0 (0.04)	
	King Pin Inclination*	degrees	10° 41’	10° 55’
Rear Wheel Alignment	Type		Multi-Link	
	Tread*	mm (in.)	1535 (60.4) [205/55R16] 1535 (60.4) [245/45R17] 1525 (60.0) [255/40R18]	1525 (60.0)
	Camber*	degrees	-1°01’ [205/55R16] -1°14’ [245/45R17] -1°14’ [255/40R18]	-1° 14’
	Toe-in*	mm (in.)	3.0 (0.12)	

*: Unloaded Vehicle Condition

2. Front Suspension

General

- A high-mounted upper arm, double-wishbone type suspension is used.
- Arms made of high-strength sheet steel are used for weight reduction.
- The steering gear is placed forward of the axle. During cornering, this changes the steering angle to toe-out in accordance with the lateral force. As a result, a smoother response has been realized during high-speed driving.
- The suspension components are optimally allocated to increase the steering angle of the wheels. As a result, the minimum turning radius is reduced and excellent maneuverability is realized.
- The wheel stroke is increased, urethane bound stoppers are used, and various components are optimized to ensure excellent ride comfort.
- A large, liquid-filled bushing is used at the rear of the lower arm for optimal vibration and harshness control.



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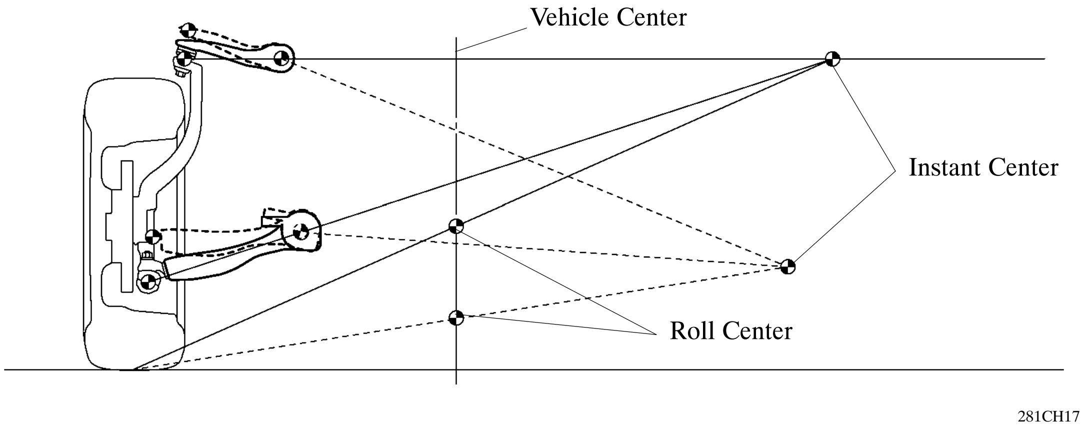
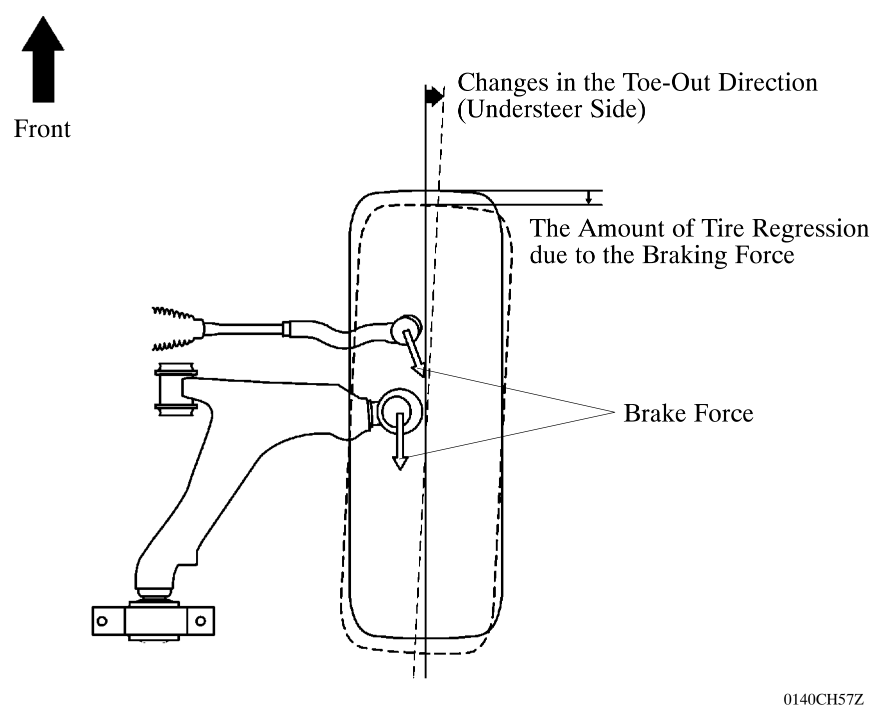
Optimized Roll Center

During a roll, a difference in the change in the height of the center of gravity is created geometrically depending on the setting of the roll center height and its rate of change. For this reason, the arms have been placed appropriately to achieve an optimal setting. As a result, the center of gravity height is kept low and an excellent roll posture is ensured.



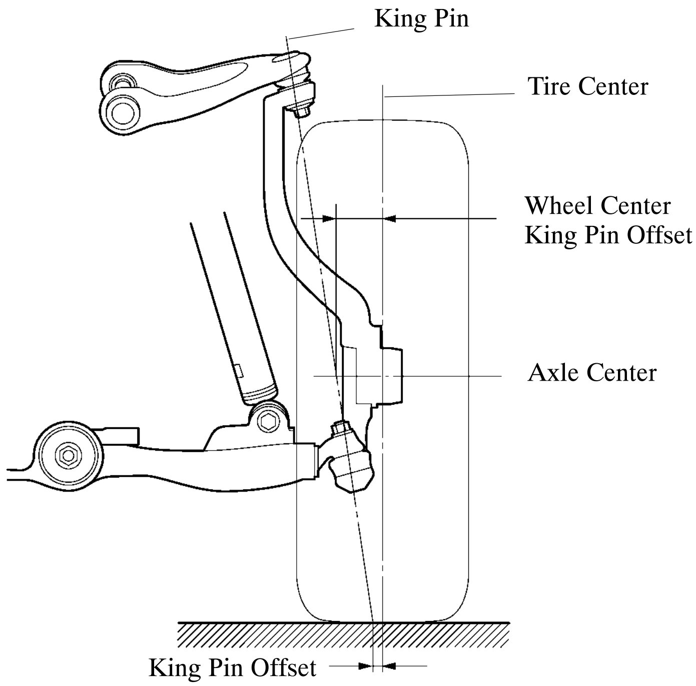
Braking Understeer Characteristics

- During braking, the load of the vehicle moves to the front wheels. If the direction of the wheels during a turn is constant, the tire will exhibit the behavior of rolling inward of the turn, due to the nature of the forces on the wheels. To gain the appropriate understeer (thus reducing the steering angle of the wheels) during braking, the suspension components have been appropriately allocated so that the wheels will change to toe out during braking.
- This ensures the proper stability and longitudinal compliance, as well as superior ride comfort.



Optimized King Pin Offset

By adopting high-mount type upper arms, the offset between the tire center and the king pin is reduced at the axle center height. This reduces the moment (forces) around the king pin axis and suppresses the generation of flutter.



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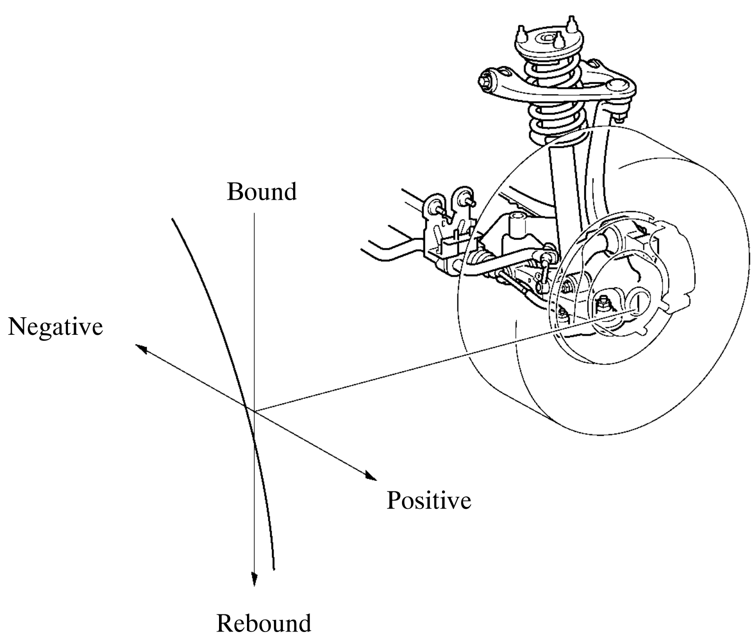
Optimized Camber

Both the initial camber and the camber change rate have been optimized to ensure excellent driving stability.



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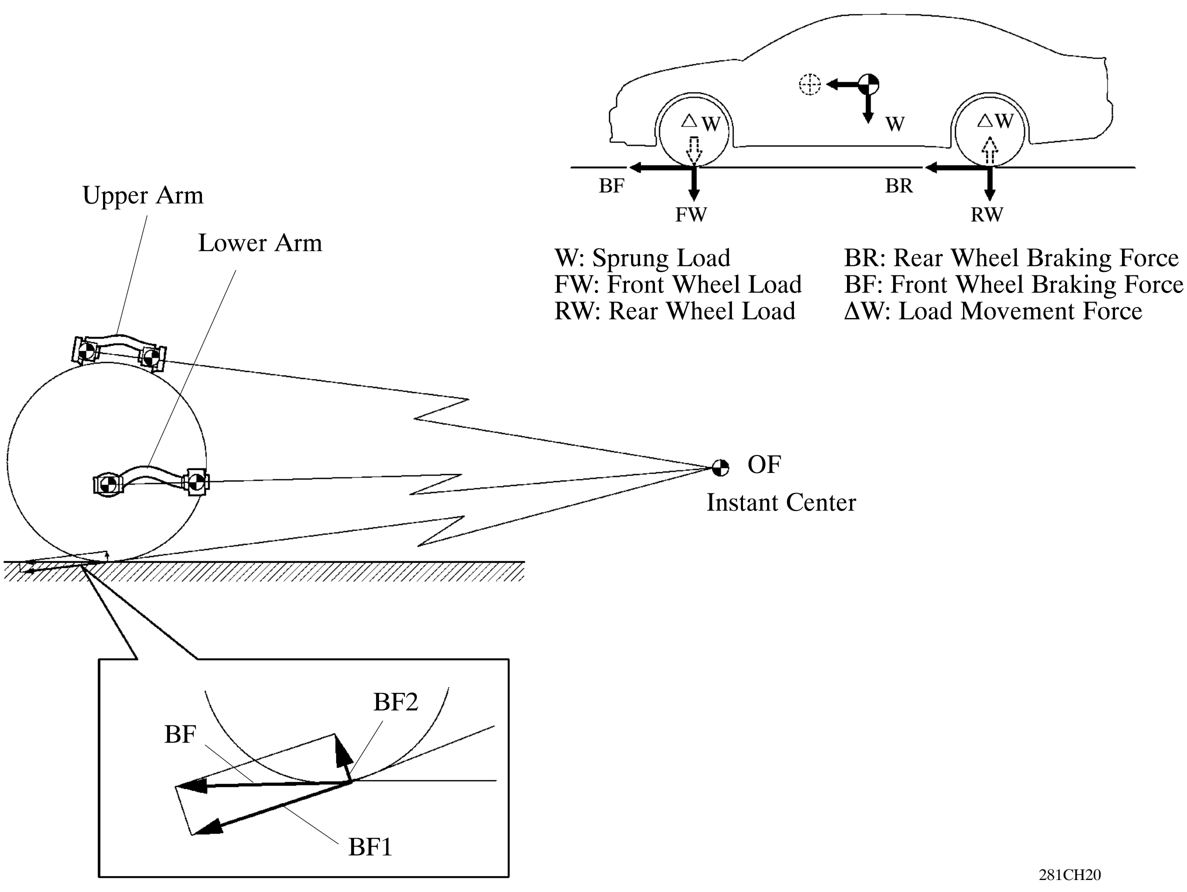
Anti-Dive Geometry

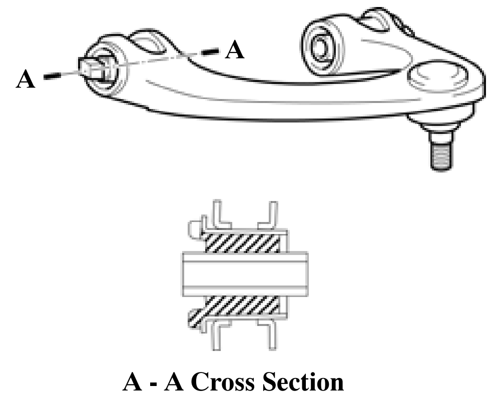
- The lower arm is mounted to the body higher at the back than at the front, and the rear of the upper arm is set lower. As a result, the intersecting point "OF", to which the lines extend geometrically from the lower and upper arms, has been set higher than the road surface.
- The intersecting point OF is in a position in which the vehicle body sustains the braking force BF that acts on the front wheels during braking. For this reason, the braking force BF generates the following components: the force BF1 that acts on the intersecting point OF, and the force BF2 that acts in the direction of the ground surface. The direction and the intensity of the force BF2 that acts in the direction of the ground surface vary by the position of the intersecting point OF. Thus, by setting the intersecting point OF at a position higher than the road surface, the increase in the front wheel load that is increased by the inertia during braking can be suppressed geometrically.



W: Sprung Load
FW: Front Wheel Load
RW: Rear Wheel Load
BR: Rear Wheel Braking Force
BF: Front Wheel Braking Force
ΔW: Load Movement Force

Upper Arm

The upper arm is made of high-strength sheet steel for weight reduction. The area that fits into the bushing has been burred, without a weld, to simplify the construction and reduce the weight.



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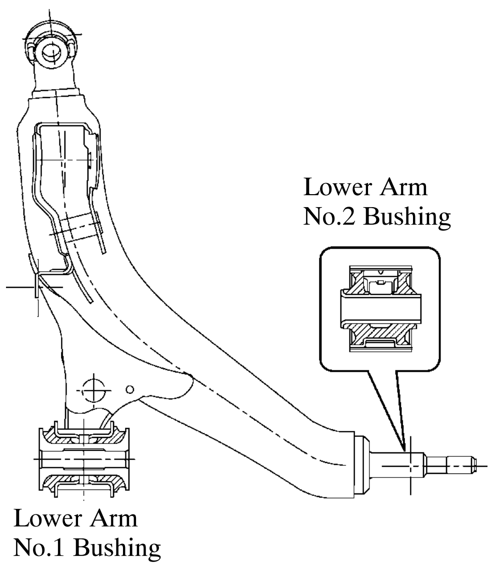
Lower Arm

- The lower arm is made of high-tension sheet steel for weight reduction.
- A two-way split construction is used in the bushing in lower arm No. 1. A preload pressure is applied axially to the rubber flange to increase its rigidity in the longitudinal direction.



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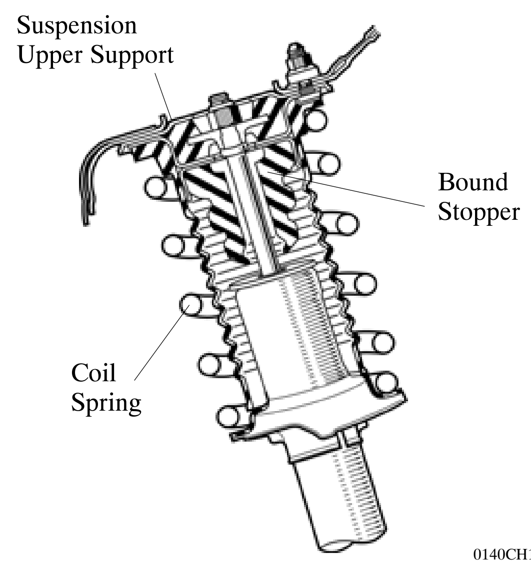
Suspension Upper Support

The suspension upper support has adopted a load input dispersion construction. This provides support while dispersing the three input loads from the shock absorber, coil spring and bound stopper thus improving ride comfort and reducing noise and vibration.



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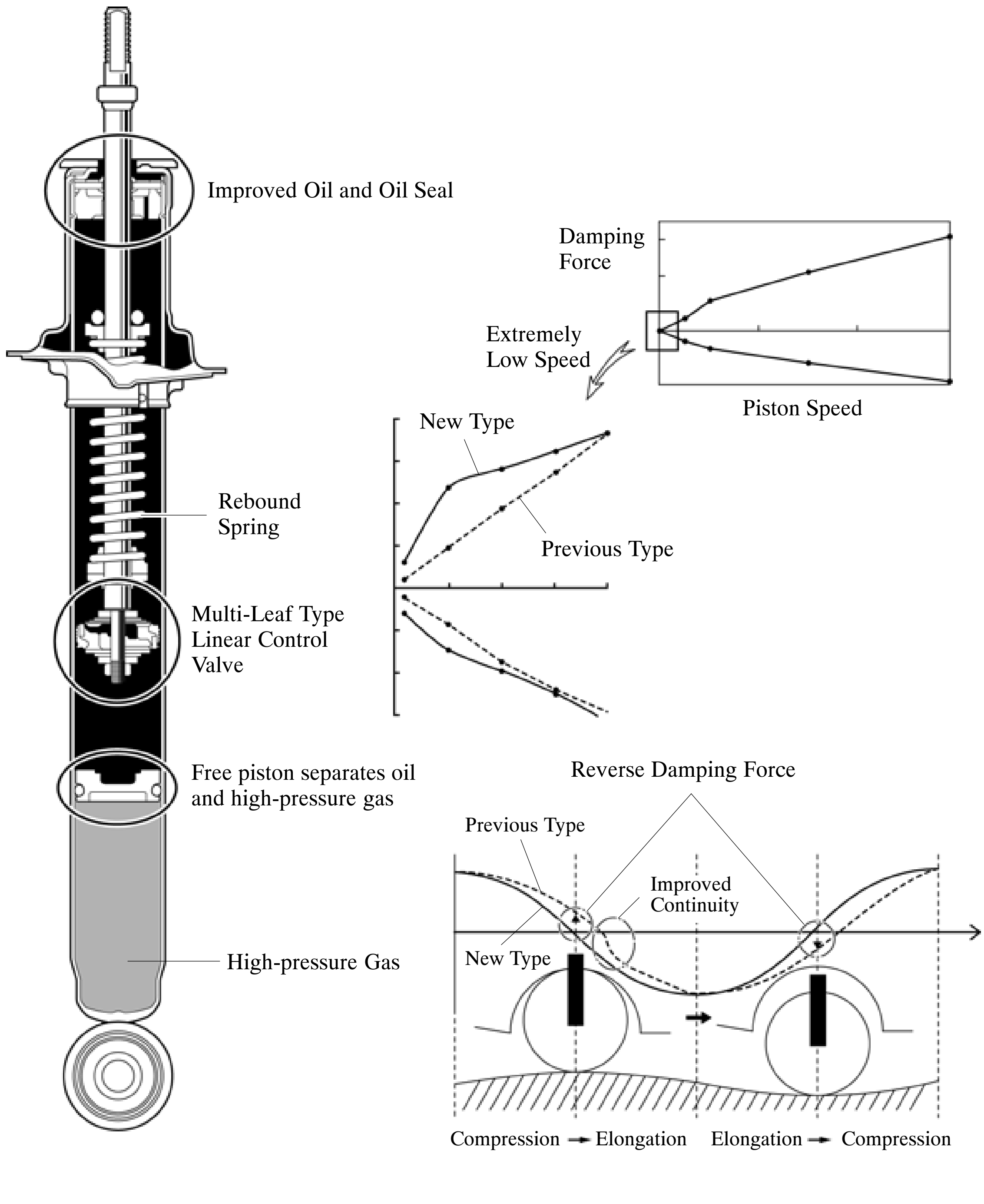
Shock Absorber

- A mono-tube type shock absorber with a rebound spring and a multi-leaf type linear control valve is used.
- This shock absorber generates a damping force starting with an extremely low piston speed range. Thus, it realizes a natural and linear vehicle behavior in response to driving maneuvers and a flat ride comfort. Furthermore, the proper response and continuity of the shock absorber damping force have been ensured. This minimizes useless unsprung movement to ensure the proper road tracking capability and ride comfort.



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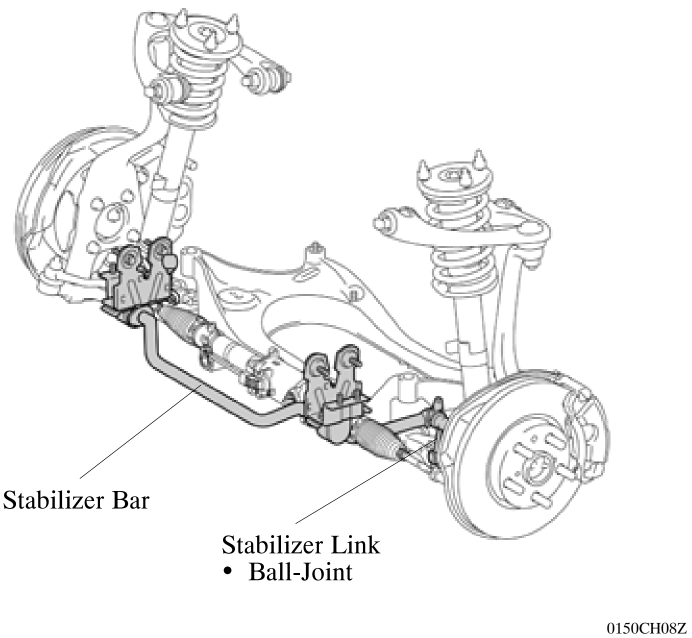
Stabilizer Bar

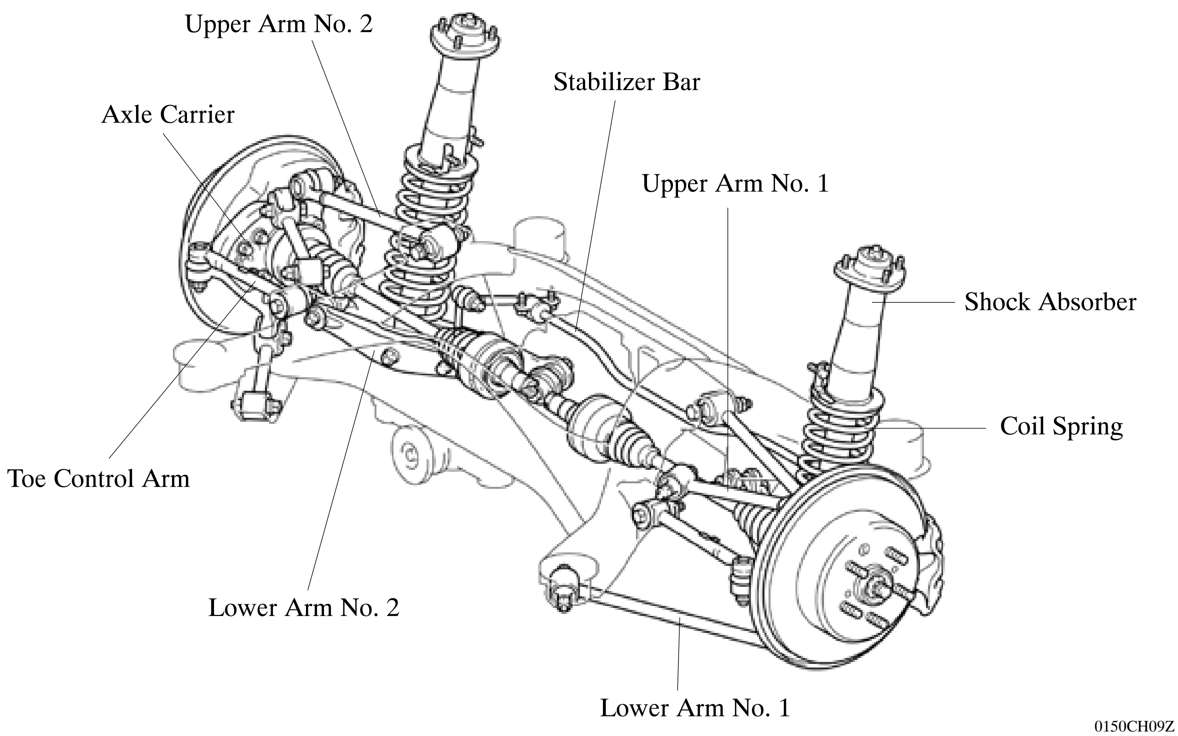
The stabilizer bar is made of a hollow bar, reducing the weight. A ball joint is used between the stabilizer link and the stabilizer bar, and between the stabilizer link and the lower arm. This helps reduce suspension friction and increase link rigidity.
As a result, the ball joints perform effectively even for slight rolling and maintain stable roll feeling.



3. Rear Suspension

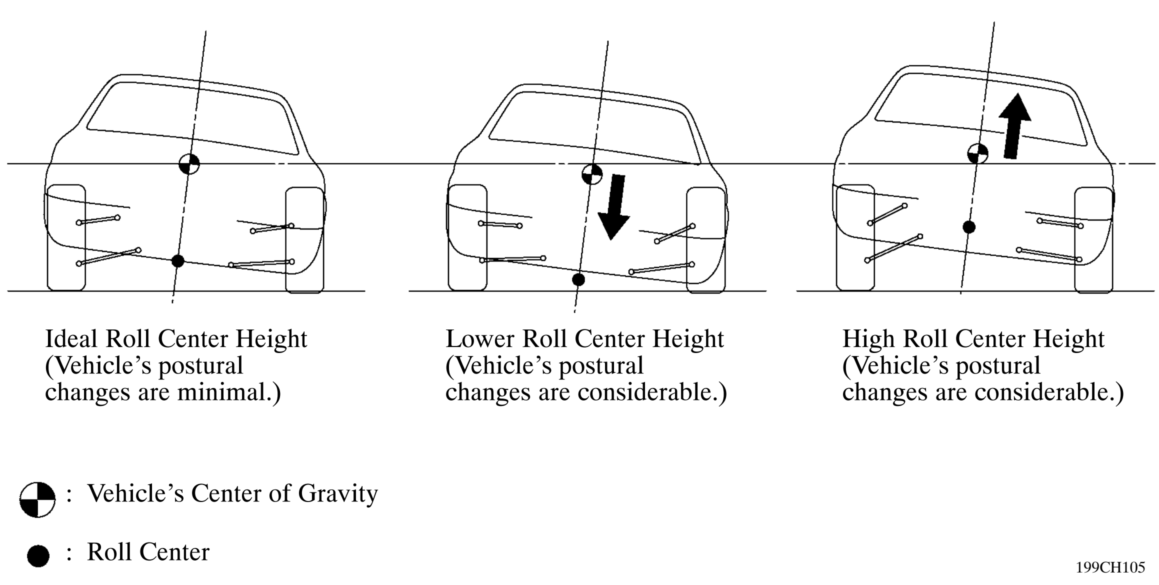
General

- A multi-link type rear suspension that consists of two upper and lower arms and a toe control arm.
- Cast-aluminum axle carriers are used for weight reduction.
- The coil springs are placed at the bottom of the shock assembly to ensure ample luggage space.



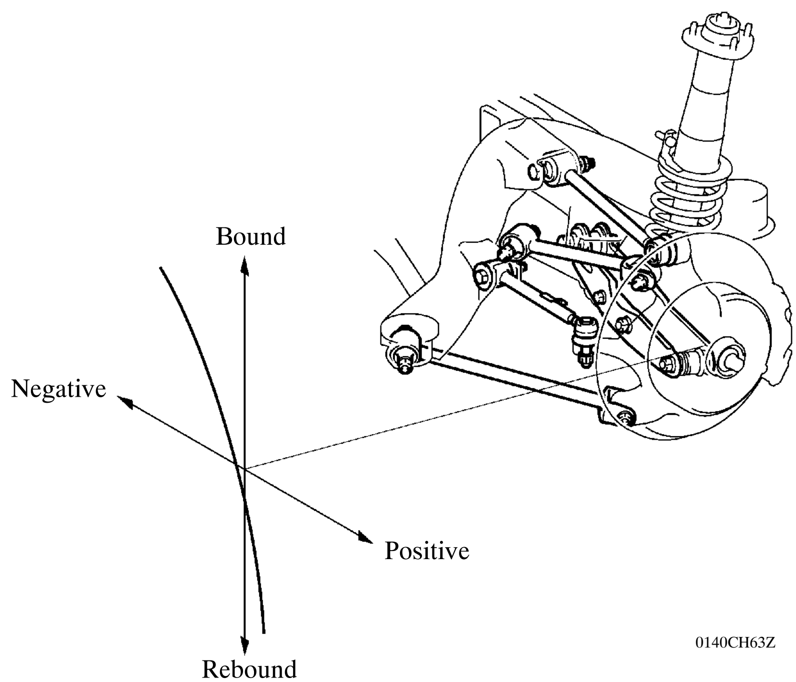
Optimized Roll Center

During a roll, a difference in the change in the height of the center of gravity is created geometrically depending on the setting of the roll center height and its rate of change. For this reason, the arms have been placed appropriately to achieve an optimal setting. As a result, the change in the height of the center of gravity is minimized and an excellent roll posture is ensured.



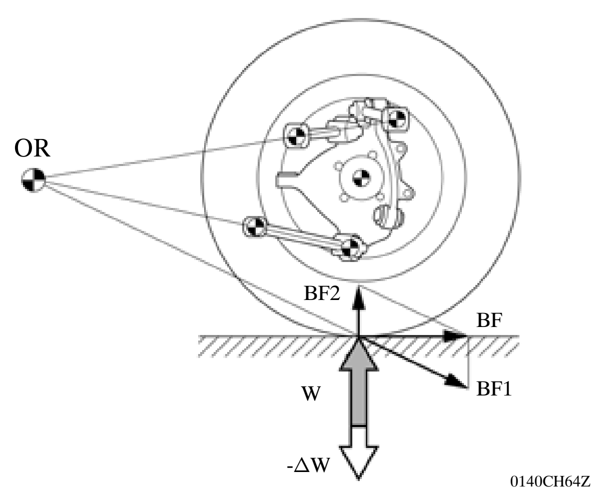
Optimized Camber

Both the initial camber and the camber change rate have been optimized to ensure excellent driving stability.



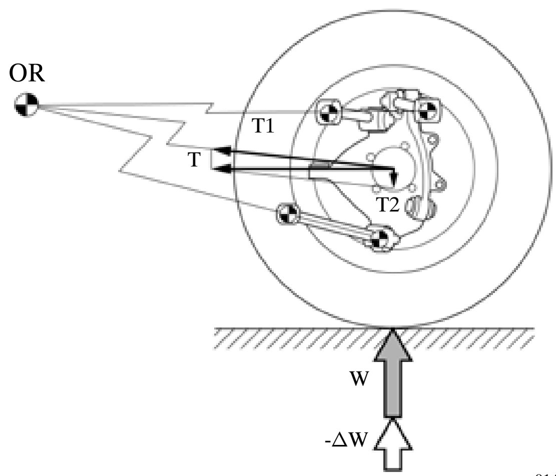
Anti-Lift

- During braking, the inertial force causes the center of gravity of the vehicle body to move, and reduces the load on the rear wheels. As a result, the back of the rear end of the vehicle lifts up.
- The vehicle body attempts to use the geometric intersecting point OR of the suspension to sustain the braking force that is generated at the road surface. Then, the braking force BF generates the following components: the force BF1 that acts on the intersecting point OR, and the force BF2 that acts in the direction of the ground surface. The direction and the intensity of this force, which acts in the direction of the ground surface, can be changed by changing the height of the intersecting point OR. Thus, by setting it at a position higher than the road surface, it acts in the opposite direction of the load movement Δ W, and suppresses the lifting of the rear end of the vehicle.



Anti-Squat

- During a start off or acceleration, the inertial force causes the center of gravity of the vehicle body to move. This increases the load on the rear wheels, causing the rear end of the vehicle to squat.
- The vehicle body uses the geometric intersecting point OR of the suspension to sustain the drive force that acts on the axle center. Then, the drive force T generates the following components: the force T1 that acts in the direction of the intersecting point, and the force T2 that acts in the direction of the ground surface. By setting the intersecting point OR at a position higher than the axle center, the force that acts in the direction of the ground surface will cancel out the load Δ W that increases with the start off or acceleration. As a result, it suppresses the squatting of the rear end of the vehicle.



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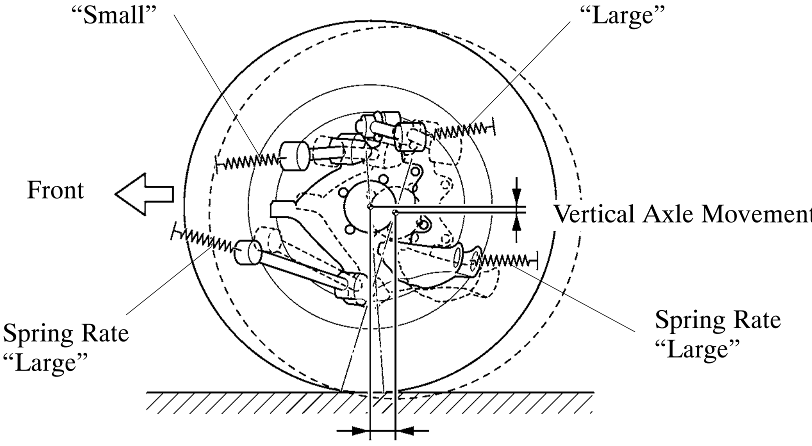
Optimizing Longitudinal Compliance

When the vehicle goes over a bump on the road, a load is input to the axle center in the rear direction of the vehicle. The longitudinal movement of the axle in response to the load that is input from the road surface at this time is called “longitudinal compliance”. The ride comfort can be improved by setting a large compliance. For this reason, the spring constant of the bushing in the upper arm No. 1, which bears a small input load during braking, is reduced to ensure ample longitudinal compliance. Furthermore, the spring constant of the lower arm bushing is increased to suppress the changes in the toe angle during a braking load. As a result, both excellent ride comfort and high levels of driving stability are realized.



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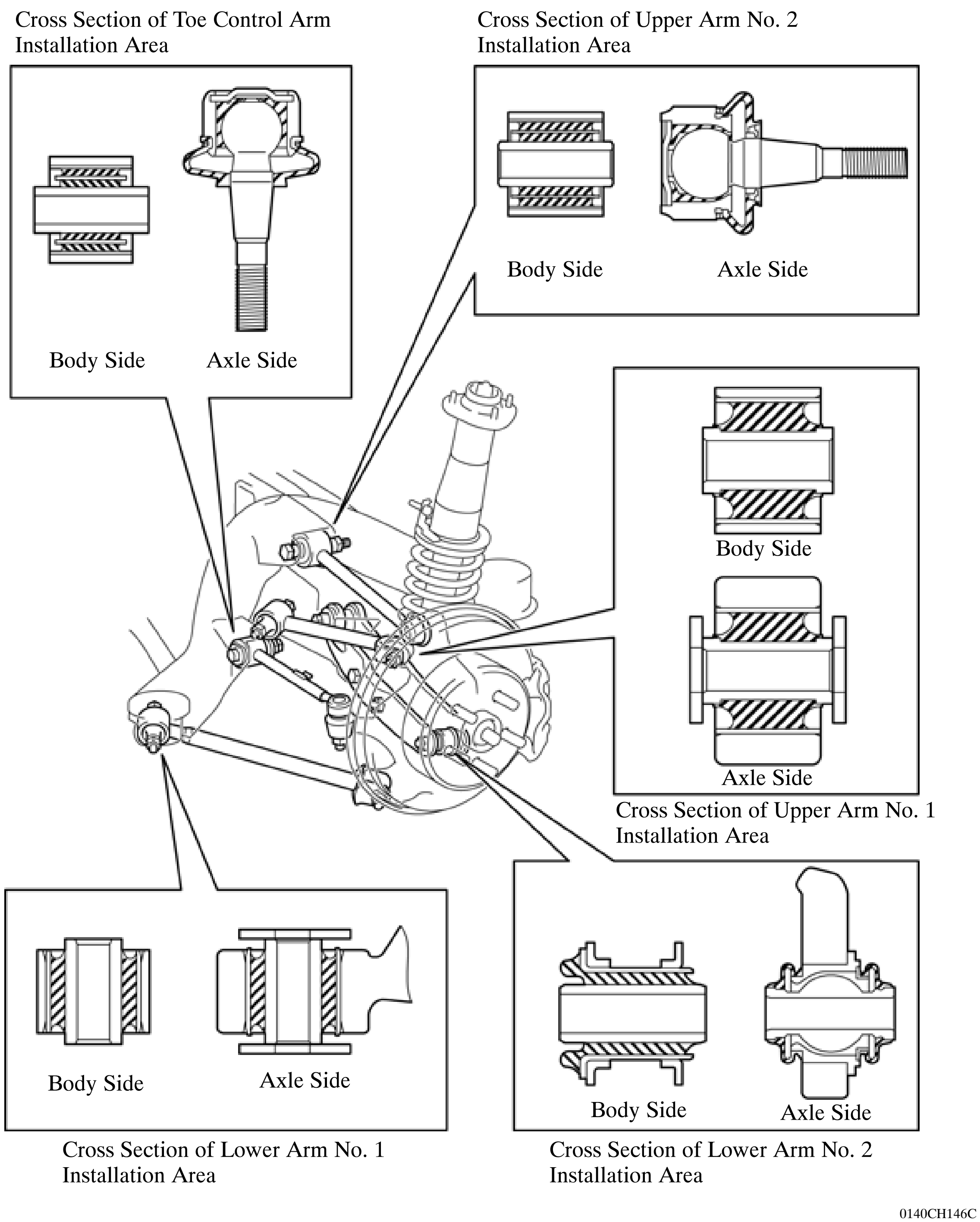
Longitudinal Compliance

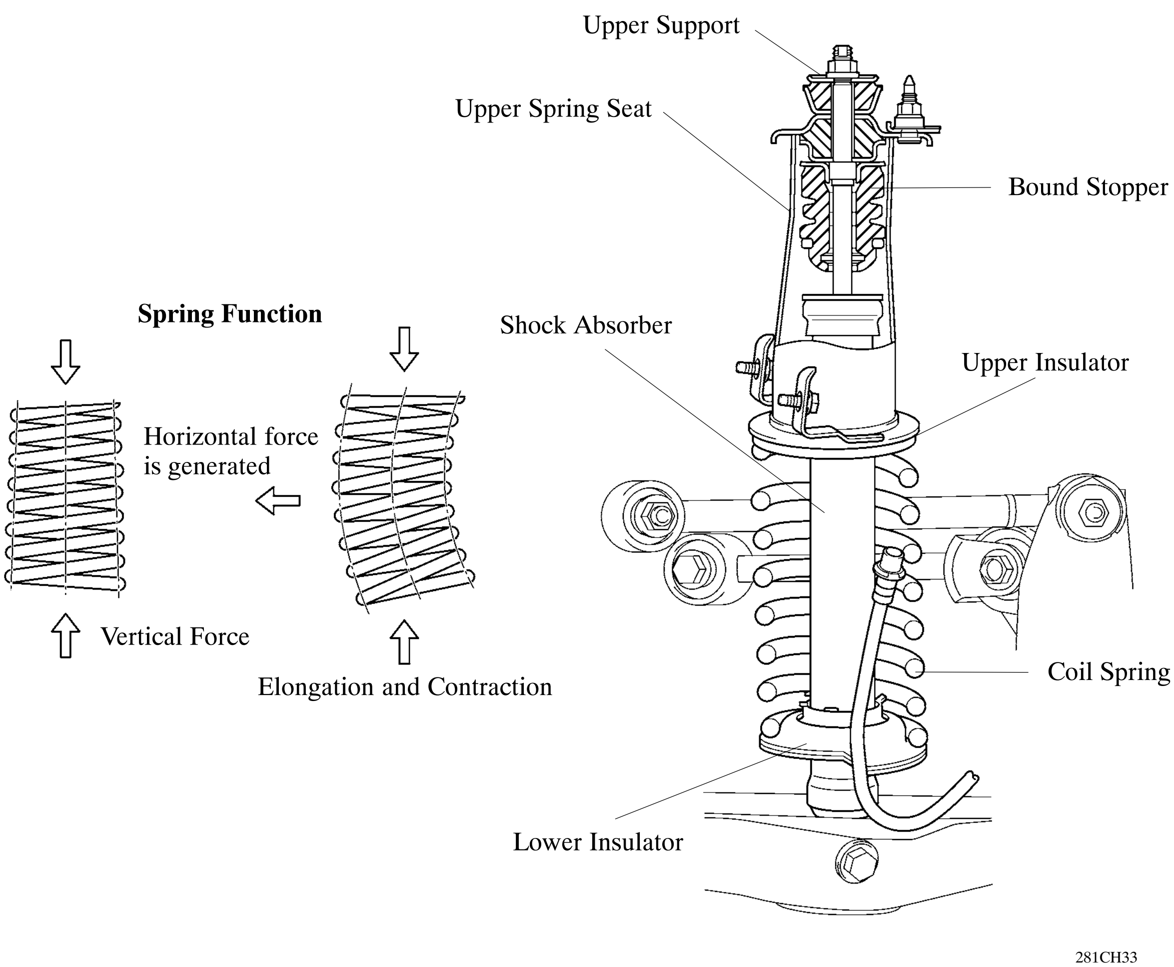
Upper Arm, Lower Arm and Toe Control Arm

- An upper arm No. 1 and lower arm No. 1 made of high-strength pipe material are used to ensure high rigidity and weight reduction.
- An upper arm No. 2 made of high-strength pipe material and a ball joint at one end are used to ensure high rigidity and weight reduction.
- A lower arm No. 2 made of stamped high-strength sheet steel is used to ensure high rigidity. On the body side, a bushing with an external cylinder is used, and on the axle side, a pillow ball bushing is used to realize high support rigidity and excellent ride comfort.
- A forged iron toe control arm with an elliptical cross section is used to optimize the rigidity.



Upper Support, Coil Spring and Shock Absorber

- An upper support with separate inputs is used to realize both excellent ride comfort and driving stability.
- A horizontal force is created by the deviation of the center axis at the landing point or the angle of the spring seat during the contraction or elongation of the coil spring. This force is separate from the vertical force, which is the primary movement of the spring. Thus, by positioning the spring seat in the lower area of the shock absorber, the shock absorber can slide smoothly to ensure excellent ride comfort.
- Along with the lowered position of the coil spring, a cylindrical, upper spring seat is used. Furthermore, the shape of the bound stopper made of urethane is optimized to realize both excellent ride comfort and driving stability.
- A mono-tube type shock absorber is used to optimize the damping characteristics.
- An upper insulator is provided in the upper spring area to ensure stability to counter disturbance.
- A lower insulator is provided in the lower spring area to reduce noise and vibration.



Stabilizer Bar

- A highly rigid, solid type stabilizer bar is used.
- A ball-joint type stabilizer link is used to ensure excellent response and rigidity.