



SURFACE VEHICLE RECOMMENDED PRACTICE

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Towability Design Criteria and Equipment Use -
Passenger Cars, Vans, and Light-Duty Trucks

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Foreword—This Document has also changed to comply with the new SAE Technical Standards Board format.

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1. Scope—This SAE Recommended Practice describes the type of equipment commonly used with towing equipment, provides information to calculate safe steering loads, and outlines design criteria.

1.1 Purpose—To provide guidelines for equipment usage and the design of vehicles to minimize damage in the towing of vehicles up to 4173 kg (9200 lb) GVWR in the event of disablement.

NOTE—See Section 3 for glossary.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J179—Labeling—Disc Wheel and Demountable Rims—Trucks

SAE J208—Safety for Agricultural Tractors

SAE J254—Instrumentation and Techniques for Exhaust Gas Emissions Measurement

SAE J274—Rated Suspension Spring Capacity

SAE J284—Safety Alert Symbol for Agricultural, Construction, and Industrial Equipment

SAE J670—Vehicle Dynamics Terminology

SAE J687—Nomenclature—Truck, Bus, Trailer

SAE J706—Rating of Winches

SAE J743—Pipelayers and Side Booms, Tractor—Mounted—Specifications List

SAE J853—Vehicle Identification Numbers

SAE J980—Bumper Evaluation Test Procedure—Passenger Cars

SAE J1041—Brake Test Procedure and Brake Performance Criteria for Agricultural Equipment

SAE J1085—Test for Dynamic Properties of Elastomeric Isolators

SAE J1143—Towed Vehicle/Tow Equipment Attachment Test Procedure—Passenger Cars, Vans, and Light-Duty Trucks

SAE J1213—Glossary of Reliability Terminology Associated with Automotive Electronics

SAE J1229—Truck Identification Terminology

SAE J1451—A Dictionary of Terms for the Dynamics and Handling of Single Track Vehicles (Motorcycles, Mopeds, and Bicycles)

SAE J1473—Braking Performance—Rubber-Tired Earthmoving Machines

2.1.2 FEDERAL PUBLICATIONS—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Federal Motor Carrier Regulations 393.70 and 393.71

Federal Highway Administration Title 49, Section 393.102(b), Securement Systems

Federal Highway Administration Title 49, Section 393.106, Front-end Structure

2.1.3 OTHER PUBLICATIONS—Public Law 89-563

3. Definitions

3.1 Above Cab Carrier—A platform above the cab, which may be in a fixed or hydraulically adjustable position, for transporting vehicles.

3.2 Aero-Skirting—Aero-designed panels attached to lower side, or surrounding the lower side of the vehicle. See Air Dam, Fascia, Valence, and Cladding.

3.3 Air Dam—Flexible air deflecting panel usually located below radiator support.

- 3.4 Air Resistance**—A measure of the "drag" on a vehicle moving through air. Air resistance increases as a square of the speed, thus power requirements increase much faster than vehicle speed.
- 3.5 Ambient Temperature**—The temperature of the environment surrounding the test specimen. (See SAE J1085.)
- 3.6 Anchoring Device**—Used to attach cable ends, snatch blocks, safety chains, and tie-down assemblies to the towing vehicle.
- 3.7 Approach Angle**—Angle between the plane of the platform and the ground.
- 3.8 Auxiliary Braking Device**—A device which attaches to the disabled vehicle to assist the tow truck's brakes in retarding or stopping both vehicles.
- 3.9 Auxiliary Equipment**—Equipment that is not necessary to perform the basic function of the primary equipment.
- 3.10 Auxiliary Fuel Tanks**—Fuel tanks installed in addition to the standard equipment tank.
- 3.11 Auxiliary Towing Lights**—Stop, tail, and turn signal lights attached to the trailing end of the towed vehicle and operated as part of the towing vehicle lighting system.
- 3.12 Axle Covers**—Device used to cover drive axle shaft openings to eliminate contamination or loss of wheel bearing lubrication during transporting operations.
- 3.13 Axle (Dead)**—A dead axle is merely a means of support for the wheels at each end. This is contrasted to a "live" axle which is connected to the wheels and rotates with the wheels.
- 3.14 Axle (Drive)**—Axle designed to support a portion of the vehicle weight and to transmit a driving force to the wheels. (See SAE J687c.)
- 3.15 Axle (Tandem)**—Any group of two or more axles, any of which may be powered, and/or steering, and which are attached one behind the other to the same vehicle and associated through a mechanism designed to provide a specific relationship between loading. (See SAE J687c.)
- 3.16 BA (Bumper to Axle)**—The distance from the foremost point on the front bumper to the centerline of the front axle. See Chassis Manufacturer's Dimensions.
- 3.17 Baffle**—A plate or shield used for deflecting, checking, or regulating the flow of liquids, gases, or air.
- 3.18 Barrel**—A cylindrical component of the hydraulic cylinder (piston chamber).
- 3.19 Battery**—A DC voltage source which converts chemical, nuclear, thermal, or solar energy into electrical energy. (See SAE J1213.)
- 3.20 BBC (Bumper to Back of Cab)**—The distance from the foremost point on the front bumper to the back of the cab. See Chassis Manufacturer's Dimensions.
- 3.21 Bending Moment**—The force times the distance from a reference point to the point the force is applied causing bending.
- 3.22 BHP**—Brake Horsepower.
- 3.23 Body**—The structure mounted on a chassis cab or that portion of the vehicle that carries the load.

- 3.24 Body Hinge**—The attachment mechanism connecting the body to the hinge pin at the pivot axis about which the body rotates into the tilt position.
- 3.25 Body Subframe**—Another term for body understructure or mounting subframe.
- 3.26 Body Understructure**—Crossmembers and longitudinal members under body floor.
- 3.27 Body Weight**—Unmounted weight of body with applicable options.
- 3.28 Bogie Axle**—See Tandem Axle.
- 3.29 Bolsters**—The transverse members that are used to define the horizontal support for the diagonal braces of a vertical mast.
- 3.30 Boom**—The structural member that supports the load. (See SAE J743.)
- 3.31 Boom Angle**—The boom angle is measured between a horizontal line and a line through the boom pivot and the center of the sheave.
- 3.32 Boom Head**—The structural member at one end of the boom which can swivel and support the load lifted through the sheave and sheave support device.
- 3.33 Brake, Engine**—The engine's compression pressure is used for retarding the truck.
- 3.34 Brakes—Parking**—A system used to hold a stopped machine in a stationary position. (See SAE J1473.)
- 3.35 Brakes—Service**—The primary brake system used for retarding and stopping the truck. (See SAE J1041.)
- 3.36 Bridle**—A V or Y type coupling device used to attach and center a cable in recovery, loading, and unloading operations.
- 3.37 Bumper Systems**—A system, the primary function of which is to provide protection against damage affecting the performance of front and rear external lamps and other components during low-speed impacts, as in vehicle parking maneuvers. (See SAE J980a.)
- 3.38 CA (Cab to Axle)**—The distance from the back of the truck cab to the center of the rear axle. See Chassis Manufacturer's Dimensions.
- 3.39 Cab**—The driver/passenger carrying compartment.
- 3.40 Cab Protector**—Reference to Federal Highway Administration Title 49, Section 393.106.
- 3.41 Cab Control Levers**—Control handles to engage power takeoff and hydraulic valve, usually located in truck cab convenient to driver's hand.
- 3.42 Cable**—Steel wire rope used for pulling or support.
- 3.43 Camber**—The inclination of the wheel plane to the vertical. It is considered positive when the wheel leans outward at the top and negative when it leans inward. (See SAE J670c.)
- 3.44 Car Carrier**—Vehicles equipped to transport other vehicles mounted on a flat platform and/or with an additional assembly attached to the rear to facilitate towing a second vehicle. These units are also known as slidebacks, rollbacks, transporting equipment carriers, and flatbeds. See Carrier.

- 3.45 CG (Center of Gravity)**—If the vehicle is supported at this point, it will not rotate due to the force of gravity. (See SAE J1451.)
- 3.46 Carrier**—A platform body with a winch for loading.
- 3.47 Caster**—The angle in side elevation between the steering axis and the vertical. It is considered positive when the steering axis is inclined rearward (in the upward direction) and negative when the steering axis is inclined forward. (See SAE J670.)
- 3.48 Certification Label**—Required by Public Law 89-563, which states that a motor vehicle or item of motor vehicle equipment complies to all applicable Federal Motor Vehicle Safety Standards (FMVSS) in effect on the date of manufacture.
- 3.49 Chassis Cab**—A vehicle consisting of a chassis on which is mounted a cab, capable of being driven by the addition of wheels or other items of running gear, but lacking a body or load-carrying structure.
- 3.50 Cladding**—See Aero-Skirting.
- 3.51 Classification of Trucks by Ground Contact**—Trucks are classified by the number of wheels and the number of driving wheels. If a truck is designated as a 4 x 2, it has four wheels and two driving wheels. A 4 x 4 truck has four wheels and four driving wheels. A 6 x 4 truck has six wheels and four driving wheels. Wheels are considered a unit whether they have single or dual tires.
- 3.52 Claws**—See Wheel Arm.
- 3.53 COE (Cab Over Engine)**—Cab design where driver is actually as far forward as possible. Engine directly under cab.
- 3.54 Completed Vehicle**—A vehicle that requires no further manufacturing operations to perform its intended function, other than minor finishing operations such as painting.
- 3.55 Control Lever**—A device for imparting motion into control linkage.
- 3.56 Crossbar**—See Lift Bar.
- 3.57 Cross-Members**—General term applied to transverse members in the understructure.
- 3.58 Curb Weight**—The weight of a vehicle in operational status, with all standard and commonly installed equipment and the gas tank filled to capacity. (See SAE J254.)
- 3.59 Cylinder**—A complete hydraulic cylinder assembly.
- 3.60 Cylinder Base**—End of hydraulic cylinder opposite to header or rod end.
- 3.61 Cylinder Head**—End of a hydraulic cylinder through which the piston rod extends. Also called header.
- 3.62 Damage Resistance**—Increases in resistance due to damage to the load. See Resistance.
- 3.63 Deflector**—See Snatch Block.
- 3.64 D-Ring**—See Anchoring Device.
- 3.65 Disabled Vehicle**—Any vehicle that cannot operate under its own power.

- 3.66 Displacement**—Volume of oil required to extend piston rod through its working stroke. Product of multiplying the area times the length of stroke, usually measured in cubic inches.
- 3.67 Diverter Valve**—Auxiliary valve to provide hydraulic power from the hydraulic pump by switching the oil flow from its usual passageways into additional pieces of equipment such as snow plows or other lifting cylinders. Also called diversion or selector valve.
- 3.68 Dolly**—A four-wheeled carriage used in towing to support the trailing end of the towed vehicle.
- 3.69 Dolly Towing**—Procedure used to support wheels, not supported by sling or wheel-lift towing equipment, that should not touch road surface as damage to driveline may result. (See 4.5.1.)
- 3.70 DOT (Department of Transportation)**—A federal agency dealing with regulations concerning both the manufacture and operation of motor vehicles and motor vehicle equipment. See NHTSA.
- 3.71 Driveline**—The driveshaft and associated joints.
- 3.72 Drivetrain**—Combination of a specific transmission (make, model, size, type), a specific differential assembly (make, model, size, type), and a specific driveline, if required.
- 3.73 Dynamic Application**—Reference to rating specifications.
- 3.74 Electrical Power**—Derived from energy produced by electricity. See Power.
- 3.75 Equipment Carrier**—See Car Carrier.
- 3.76 Extension Cylinder**—Reference to Slide Back Extension Cylinder.
- 3.77 Fascia**—Flexible material commonly used as a bumper cover (could extend below bumper).
- 3.78 FC (Frame to Cab)**—Distance from the top of the frame rail to the top of the cab.
- 3.79 Final Stage Manufacturer**—A person, firm, or corporation who performs such manufacturing operations on an incomplete vehicle that it becomes a completed (end-user) vehicle. (See SAE J1229.)
- 3.80 FMVSS (Federal Motor Vehicle Safety Standard)**—Regulations promulgated by NHTSA under Public Law 89-563, which are mandatory and must be complied with when motor vehicles or items of motor vehicle equipment are manufactured and certified thereto.
- 3.81 Frame Cutoff**—Centerline of rear axle(s) to the rearmost point of the chassis frame as modified for body installation.
- 3.82 Frame Lift**—See Underlift.
- 3.83 Free Spool**—The operation of unspooling wire rope from a drum by pulling on the end of the rope while the winch is stationary. The drum is disconnected (declutched) from its powertrain during this operation.
- 3.84 Forks**—A device attached to the lift bar for lifting a vehicle by the tires, axle, frame, or structural member. May be classified as chain, axle, or frame forks.
- 3.85 Full Drum**—A drum containing the maximum permissible number of layers of cable as defined in SAE J706, paragraph 4.5.
- 3.86 FW (Frame Width)**—Overall width of the chassis frame measured outside-to-outside.

- 3.87 GAWR (Gross Axle Weight Rating)**—The value specified by the manufacturer as the load-carrying capacity of a single-axle system as measured at the tire-roadway interface. (See SAE J1451.)
- 3.88 GCWR (Gross Combination Weight Rating)**—Represents the entire weight of a vehicle on the ground with a trailer or trailers including vehicle, equipment, driver, fuel, and payload (everything that moves with the vehicle). Gross combination weights published represent maximum allowed.
- 3.89 Grab Hook**—For use with safety chains and some tow-sling hookups. (See 4.1.1.)
- 3.90 Grade Resistance**—Increases in resistance due to grade (slope, angle). See Resistance.
- 3.91 GVWR (Gross Vehicle Weight Rating)**—The maximum total vehicle rated capacity, measured at the tire ground interface, as rated by the chassis manufacturer.
- 3.92 GVW (Gross Vehicle Weight)**—Value specified by the manufacturer as the maximum loaded weight of a single vehicle including all equipment, fuel, body, payload, driver, etc. (See SAE J1451.)
- 3.93 HCG (Horizontal Center of Gravity)**—See CG (Center of Gravity).
- 3.94 Headboard**—Reference to Federal Highway Administration Title 49, Section 393.106.
- 3.95 Hydraulic Control Valve**—A mechanical device to divert or control the flow of fluid in a hydraulic system.
- 3.96 Hydraulic Hose**—Flexible oil lines used to transmit fluid.
- 3.97 Hydraulic Oil**—Fluid used in operation of hydraulic systems.
- 3.98 Hydraulic Power**—Derived from energy produced by fluid under pressure. See Power.
- 3.99 Hydraulic Relief Valve**—A mechanical device used to limit the pressure in a hydraulic circuit.
- 3.100 Incomplete Vehicle**—An assemblage consisting, as a minimum, of a frame and chassis structure, powertrain, steering system, suspension system, and braking system to the extent that those systems are to be part of the completed vehicle that requires further manufacturing operations.
- 3.101 Intermediate Manufacturer**—A facility, other than the incomplete vehicle manufacturer or the final stage manufacturer, who performs manufacturing operations on an incomplete vehicle.
- 3.102 J-Hook**—Attachment device used for towing. (See 4.1.1.)
- 3.103 JIC Standard (Joint Industry Committee)**—An organization set up to standardize hydraulic fittings specifications and symbols.
- 3.104 L-Arm**—See Wheel Arm.
- 3.105 LCG (Lateral Center of Gravity)**—See CG (Center of Gravity).
- 3.106 Lift Bar**—A transverse horizontally pivoting member attached to the boom of a wheel-lift or under-lift for attaching towing accessories.
- 3.107 Lift Cylinder**—See Tilt Cylinder.
- 3.108 Lift Forks**—See Forks.

- 3.109 Lift Tow Rating**—Maximum steering towing load. (See 4.2.1.1 and 4.3.2.1.) Refer to towing equipment manufacturer's specifications.
- 3.110 Emergency Light Bar**—An array of lamps used in accordance with local ordinances.
- 3.111 Light Pylon**—Structure on which an emergency light bar is mounted.
- 3.112 Load Cell**—A device used to measure a load.
- 3.113 Longitudinals**—The lengthwise structural members of the body understructure. Also called long beams, long members, stringers.
- 3.114 Manufacturer (Vehicle)**—Any facility engaged in the manufacturing or assembling of motor vehicle or motor vehicle equipment, including any facility importing same, for resale as defined by DOT for vehicle certification.
- 3.115 Marker Lights**—Small amber and red lights attached to bodies to indicate overall clearance at night.
- 3.116 Mast**—Structure that houses the boom and winches. Also called a winch frame or wrecker frame.
- 3.117 Maximum Load Rating**—TIRES—The load rating at the maximum permissible inflation pressure for that tire.
- 3.118 Maximum Permissible Inflation Pressure**—TIRES—The maximum cold inflation pressure to which a tire may be inflated when fitted on the rim or wheel. (See SAE J179.)
- 3.119 Mechanical Power**—Work accomplished by a machine or other mechanical device. The source of power may be energy produced by electricity, hydraulics, or other means, such as an engine. See Power.
- 3.120 Motor Vehicle Safety Standards**—See FMVSS.
- 3.121 Mounting Brackets**—Attaching fittings used to fasten equipment to the chassis. Also called mounting clip, angles, or bars.
- 3.122 Mounting Height**—Distance from top of chassis cab frame at the back of the cab to a reference point on a body.
- 3.123 Mounting Subframe**—Subframe members securely affixed to a truck chassis frame. See Body Subframe.
- 3.124 Mud Flaps**—Splash-deflecting shields at rear of wheels.
- 3.125 NHTSA (National Highway Traffic Safety Administration)**—The federal agency responsible for promulgating and insuring compliance of regulations dealing with the manufacture and certification of motor vehicles or items of motor vehicle equipment. See DOT.
- 3.126 Overhang**—The horizontal distance from the centerline of a single rear axle or center point of a tandem rear axle where the vertical component load is imposed.
- 3.127 Overall Vehicle Height**—Distance from the ground to the highest point on the vehicle with equipment in stowed position.
- 3.128 Overall Vehicle Width**—The design dimension of the widest part of the vehicle, exclusive of signal lamps, outside rearview mirrors, flexible fender extensions, and mud flaps, determined with doors and windows closed and the wheels in the straight ahead position.