

# **National Standards and Specification**

**For**

## **Trailers / Semi-Trailers – General Requirements**

### **1. SCOPE**

This standard specifies the requirements for semi-trailers and full-trailers meant for transportation of freight containers and general cargo capable of operating at speeds above 30 km/h.

This standard does not cover the requirements of special purpose transport tractor trailers constructed for the transportation of goods of abnormal weight and dimensions, or agricultural trailers. Trailers for carrying petroleum products and other hazardous products are covered in a separate standard.

### **2. DEFINITIONS**

- 2.1 Semi-Trailer  
Trailer used in connection with truck tractor
- 2.2 Full-Trailer  
Truck trailer constructed so that all its own weight and that of its load rests upon its own wheels
- 2.3 Tractor or Prime Mover  
Truck portion of articulated vehicle (or combination or train)
- 2.4 Superstructure  
Any structure built above the truck or trailer bed. It can be container for storing goods or a crane mounted on the truck, etc.
- 2.5 Undercarriage  
Means all the components in a trailer or semi-trailer under the frame. This includes axles, suspension, brakes, electrical, landing legs, kingpin, rims, tires and turntable in the full-trailer.
- 2.6 Kingpin  
Front axle pin allowing wheels to steer vehicle. Kingpin is used in combination with 5<sup>th</sup> wheel.
- 2.7 Trailer Axle  
Non-driven axle. It is a beam running crosswise to and supporting chassis.

- 2.8 Tandem Axle  
When two axles are combined by means of balancer such that the axles work in tandem.
- 2.9 Suspension  
Attaching parts including springs for securing axle or axles to chassis frame and providing shock absorption to the vehicle. Trailer suspension may be mechanical leaf spring or air suspension.
- 2.10 Twist Locks  
Device to lock the container with the trailer or semi-trailer frame.
- 2.11 Turntable  
Steering arrangement for full-trailers.
- 2.12 Drawbar  
It is the front part of full-trailer which connects the full-trailer to the towing vehicle.
- 2.13 Tow-bar  
Bar or V-shaped device attached to the chassis of a trailer dolly or front axle.
- 2.14 Low-bed Trailer and Drop-bed trailer  
A low-bed trailer has a bed height lower than the flat bed trailer. To achieve the low height a hump has to be made to accommodate the prime mover. A drop-bed trailer is lower than the low-bed trailer and its bed height is so low that a hump has to be made around the trailer axles to accommodate the tires (in addition to the hump in the front).
- 2.15 Gooseneck  
It is hump at the front of a low-bed trailer.
- 2.16 Landing Gear  
Retractable supports for semi-trailer to keep trailer level when tractor is removed.
- 2.17 Tare Weight  
Empty weight of trailer without payload and without prime mover.
- 2.18 Payload  
Actual weight of useful cargo carried by vehicle. This will include superstructure (container or any other) and product.
- 2.19 GVW  
Gross Vehicle Weight. Total weight of fully equipped truck (or trailer) and payload.
- 2.20 GCW  
Gross combination weight. Total weight of fully equipped tractor, trailer or trailers and payload.

### **3. Trailer Types**

#### **3.1 According to construction**

##### **3.1.1 Semi-Trailer**

A semi-trailer is pulled by a truck tractor or a prime mover. The semi-trailer has a kingpin near the front end to couple with the prime mover and has axles at rear. Semi-trailers may have one, two or three axles. Semi-trailers may have more than three axles. Semi-trailers also have brakes, suspension and lights. A pair landing legs are fixed near the front end to support the semi-trailer after it is decoupled from the prime mover.

##### **3.1.2 Full-Trailer**

A full-trailer is like the semi-trailer with the difference that the full trailer has axles at the front end and rear end and therefore it can be parked on its own without the need of prime mover or landing legs to support it. The front axle (or axles) has steering capability. A drawbar is provided to couple with the prime mover.

#### **3.2 According to application**

##### **3.2.1 Container Carrier (Skeleton/Flatbed)**

Container carrier can be a semi-trailer or a full-trailer. The 40 ft container carrier shall have 4 twist locks. The 40 ft container carrier may be constructed to accommodate two 20 ft containers and in such a case it must have 8 twist locks. Alternatively, we can have a 20 ft container carrier with 4 twist locks. The container carrier may be constructed in such a way that it can be used for transporting general goods in that case it will have a full deck (flatbed) otherwise it will be a skeleton trailer.

##### **3.2.2 Cargo (flatbed / low-bed, drop-bed)**

The full-trailer or semi-trailer meant for carrying general cargo can be in numerous configurations. The trailer may be a flat deck type or a low bed type in which case it has gooseneck at the front to accommodate the prime mover. The trailer may have sidewalls and may have superstructure to cover it completely with tarpaulin. The manufacturer shall ensure that the superstructure complies with all the guidelines in this standard and other regulations.

### **4. Dimensions and clearances**

#### **4.1 Length**

The maximum length of the semi-trailer shall not exceed 13 meters and the maximum length of the tractor semi-trailer combination shall be 18 meters.

The maximum length of the full-trailer shall not exceed 13 meters and the maximum length of the tractor full-trailer combination shall be 21 meters.

4.2 Width  
The maximum width of the semi-trailer or full-trailer shall be 2.6 meters.

4.3 Height  
The maximum height with payload of the vehicle shall be no greater than 4.8 meters (laden or unladen).

4.4 Slope  
The semi-trailer should have a slope of about 0.5° to 1° in unladen condition. This is an approximate figure and may vary by application and from manufacturer to manufacturer. The slope is achieved by the difference in height of kingpin and fifth wheel. The slope is required for proper coupling of the prime mover and semi-trailer.

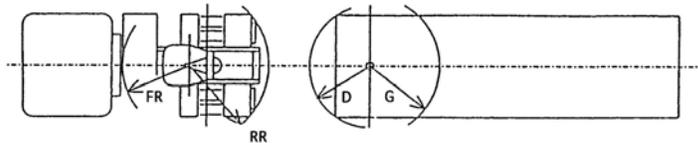
4.5 Clearances  
The trailer manufacturer shall ensure that proper clearances are incorporated in the design for the following:

4.5.1 Fitting Radius:

When the tractor is coupled with the trailer, following clearances should be maintained:

Minimum clearance between tractor and trailer

	TRACTOR	TRAILER	CLEARANCE
FRONT FITTING RADIUS	FR	D	$FR - D \geq 80 \text{ mm}$
REAR FITTING RADIUS	RR	G	$G - RR \geq 100 \text{ mm}$



4.5.2 Vertical Swing Clearance  
The tractor and trailer must be able to articulate at least ±7 degrees in a vertical plane without any interference.

4.5.3 King pin height  
The king pin height shall be less than the fifth wheel height of the prime mover. This is for provision of slope in the semi-trailer (see 4.4 above).

*Note: Each trailer is designed to be pulled by a specific prime mover. In case the operator changes the prime mover then it is the operator's responsibility to ensure compatibility between the prime mover and the trailer.*

**5. Load Distribution & Stability**

5.1 Axle Loading  
The trailers should be designed and built such that the axle loading remains within the NHA defined axle load limits.

5.2 Kingpin load  
The trailers should be designed such that the load on the kingpin is suitable for the prime mover that will be attached to the trailer and also complies with the NHA requirements for load on the rear axle (axles) of the prime mover.

- 5.3 Center of Gravity  
The overall center of gravity of the semi-trailer shall be calculated and shall be less than 95% the width of the outer edge of the tires, i.e., 95% of 2.5 meters is 2.165 meters from ground. For dangerous cargo, such as petroleum, the CG shall be less than 85% the width of the outer edge of the tires.

## 6. Trailer Components

All components shall be new and shall be of internationally recognized manufacturers.

- 6.1 Axles  
Newly built trailer should have new trailer axles. Axles should be minimum 12-ton load capacity. Used axles and axles not meant for trailers are not acceptable.
- 6.2 Brakes  
The trailer shall have 2-line pneumatic braking system with palm couplings, emergency valve (for applying brakes automatically in case leakage), automatic slack adjusters and quick release valves. All axles shall have brakes. The trailer shall have ABS brakes in case the prime mover has ABS brakes. Trailer ABS brake indication should be provided in the prime mover.
- 6.3 Parking Brakes  
Trailers shall have mechanical parking brake on one axle. The parking brake indication should be provided in the cabin.
- 6.4 Electrical System  
The trailer shall have 24-volt electrical system. The electrical system shall have the following equipment:
- 7-pin connector with 7-core cable going all the way to water-sealed junction box at the rear end.
  - Wiring covered in safety conduit and properly terminated so that no exposed loose wires are visible.
  - Rear lights including turn, brake, and taillights.
  - Side lights, at least 3 nos. on each side in amber color.
  - Number plate light.
  - Side and rear reflectors.
  - Rear fog lights shall be provided.
  - Reverse horn shall be provided.
  - The wire color coding is shown in figure 3.
- 6.5 Suspension  
The trailer shall have mechanical leaf spring suspension of suitable capacity on each axle. The suspension shall have adjustable tie-rods required for alignment of axles. Alternatively the trailer may have air suspension of suitable capacity. The suspension should be new and should be meant for trailers.
- 6.6 Kingpin  
Semi-trailer shall have king pin of suitable size of SAE standard. The trailer manufacturer shall determine the size of kingpin based on D-value calculations (see attached sheet). For new semi-trailers the kingpin shall be new and of internationally reputed brand.
- 6.7 Turntable

Full-trailers not having steer-able axle shall have turntable above the front axle. The turntable shall be of suitable size and capacity.

6.8 Landing Leg  
Semi-trailers shall have landing legs in the front. The landing legs should be of suitable capacity with gear mechanism to lift the loaded trailer when required.

6.9 Twist locks  
Trailers that transport shipping containers shall have twist locks to secure the container to the trailer. The twist locks may be lever type or screw type.

## 7. **Structural Integrity**

The trailer manufacturer must ensure the structural integrity of the trailer. The trailer manufacturer must have the engineering capability to analyze the loads and their effect on the structure and then design a proper structure based on the loads. Item 12 below refers to "Approval Requirements for Manufacturers" which lists detail requirements for trailer manufacturers.

## 8. **Trailer Attachments and Accessories**

8.1 Rear Impact Protection  
It is also called the rear bumper. Its purpose is to reduce the number of deaths or serious injuries occurring when light vehicles impact the rear of trailers. The configuration requirements of rear guard are shown in figure 1.

8.2 Side Protection  
Its purpose is to reduce the number of deaths or serious injuries occurring when light vehicles impact the side of trailers. The approximate configuration requirements of side protection are shown in figure 2. The figure is a guide only as trailers have various constructions. While constructing the side protection, the trailer manufacturer must ensure that minimum open space is left on the sides of the trailer.

8.3 **Spare Wheel Carrier**  
The trailer may have one or two spare wheel carriers. The spare wheel carrier(s) may be of winch type or cage type and may be mounted under the deck or above the deck.

8.4 Toolbox and Accessories  
The trailer may have a toolbox. The size of toolbox may vary as per requirement. The trailer should have the following tools:

- a) Hub nut spanner
- b) Wheel nut spanner
- c) Jack of sufficient capacity
- d) Wheel chocks
- e) Traffic cones (at least 4)

## 9. **Registration**

The trailer must have a unique registration with the motor vehicle department.

## 10. **Road Worthiness**

10.1 Initial

Approved manufacturer shall issue a road worthiness certificate at the time of delivery of the trailer.

10.2 Periodic

The operator shall obtain road worthiness certificate from authorities/approved workshops every year.

**11. Vehicle Identification Number**  
*[SYSTEM TO BE DEVELOPED]*

**12. Approval requirements for manufacturers**  
*[SYSTEM TO BE DEVELOPED]*

**13. Labeling**

The manufacturer shall mention the following in a permanent and visible manner on the trailer:

- Description (application)
- Vehicle Identification
- Manufacturer Identification
- GVW
- Payload capacity
- Kingpin load
- Kingpin height

**14. D-Value Calculations for Kingpin selection:**

The maximum forces which are applied to a kingpin can be calculated by means of the D-value formula as follows:

$$D = g \times (0.6 \times Mk \times Ma) / (Mk + Ma - A) \text{ in kN}$$

Mk = maximum permissible total weight of tractor in tons.

Ma = maximum permissible total weight of semi-trailer in tons.

A = maximum permissible load on main plate in tons.

g = 9.81

**15. Testing**

Testing requirements are stated in the table below:

CRITERIA	TEST	REQUIREMENT	STANDARD
Overall length	Certificate at delivery and annual inspection	Max. semi-trailer = 13 m Max. semi-trailer/tractor combination = 18 m Max. full-trailer = 13 m Max. full-trailer/tractor combination = 21 m	Approved manufacturer to issue certificate.
Overall width	Certificate at delivery	Maximum 2.5 m	
Overall height	Certificate at delivery	Maximum 4.8 m	
Axles	Certificate at delivery and every year	OEM plate and visual check	Approved manufacturer to issue certificate.
Alignment	Certificate at delivery and	Shall be adjusted within ±3mm tolerance	Approved manufacturer or

	every year		approved workshop to check and issue certificate
Brakes system integrity	Certificate at delivery and every year	Operation check and visual check. Brake system should be as per this standard.	Approved manufacturer or approved workshop to check and issue certificate
Payload capacity	Certificate	Manufacturer should be able to prove by calculations and testing, if required.	Approved manufacturer to issue certificate
Electrical system	Certificate at delivery and visual check every year	Operation check. Lighting arrangement should as per this standard	Approved manufacturer to issue certificate.
Steering System (for full-trailers only)		Road test	Approved manufacturer to issue certificate.
Structural integrity		Visible check for cracks and bends	Approved manufacturer to issue certificate.
Kingpin		Visual check	Approved manufacturer to issue certificate.
Landing legs		OEM plate and visual check	Approved manufacturer to issue certificate.
Rear Impact		Must fulfill requirements laid out by this standard	
Side Protection		Must fulfill requirements laid out by this standard	

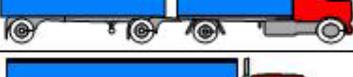
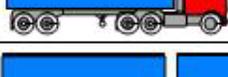
## 16. NHA Axle Load Regime



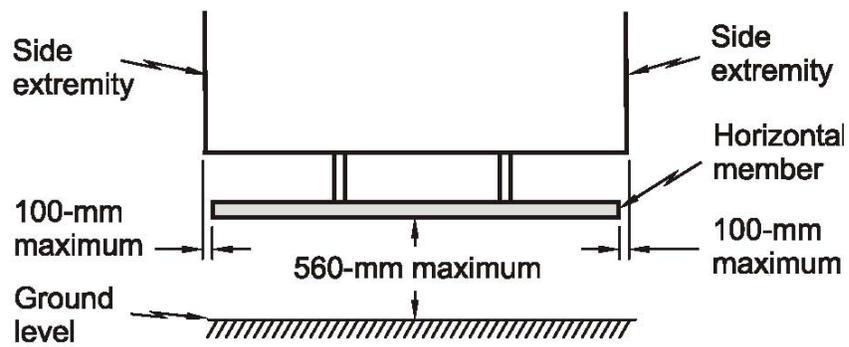
**National Highway Authority**

**Axle Load Limits**

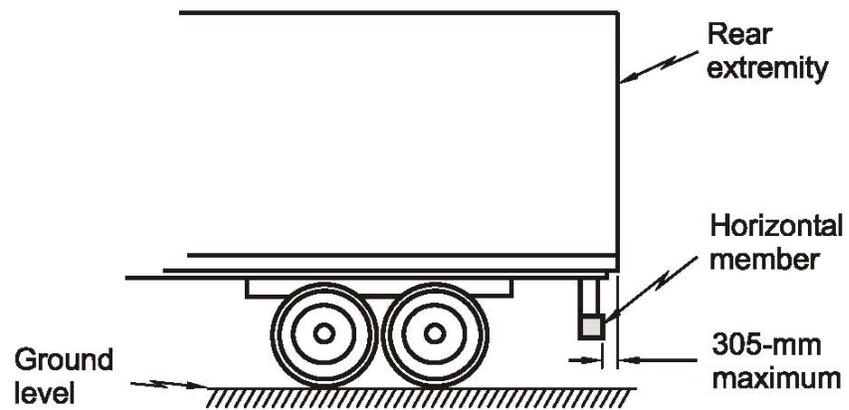
Since its establishment in 1991, NHA carried out studies not only to determine axle load limits but also prepared standard specifications and established design standards based on AASHTO standard specifications. The axle load limits and gross weight recommended for enforcement on the highways in Pakistan are presented as:-

TRUCK TYPE	Permissible Gross Vehicles Weight (In Tons)
 <span data-bbox="446 304 763 346">2 AX SINGLE (Bedford)</span>	17.5
 <span data-bbox="446 396 815 438">2 AX SINGLE (Hino/Nissan)</span>	17.5
 <span data-bbox="479 489 725 531">3 AX TENDEM</span>	27.5
 <span data-bbox="462 581 657 623">3 AX SINGLE</span>	29.5
 <span data-bbox="511 674 873 716">4 AX SINGLE-TENDEM</span>	39.5
 <span data-bbox="511 766 898 808">4 AX TENDEM-SINGLE</span>	39.5
 <span data-bbox="576 858 815 900">4 AX SINGLE</span>	41.5
 <span data-bbox="548 951 896 993">5 AX SINGLE-TRIDEM</span>	48.5
 <span data-bbox="548 1043 927 1085">5 AX TENDEM-TENDEM</span>	49.5
 <span data-bbox="553 1136 987 1178">5 AX SINGLE-SINGLE-TENDEM</span>	51.5
 <span data-bbox="565 1228 1024 1270">5 AX TENDEM-SINGLE-SINGLE</span>	51.5
 <span data-bbox="586 1320 976 1362">6 AX TENDEM-TRIDEM</span>	58.5
 <span data-bbox="646 1413 1097 1455">6 AX TENDEM-SINGLE-TENDEM</span>	61.5

**Rear view of trailer**

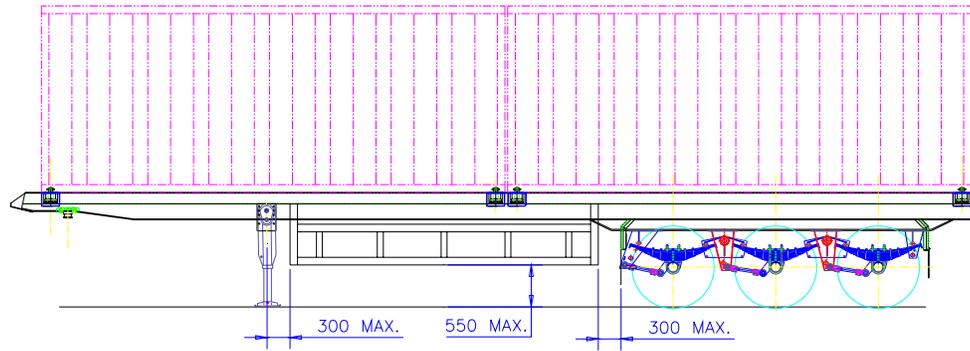


**Side view of trailer**

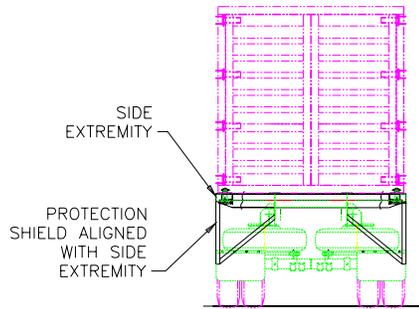


Note:  
Drawings not to scale

**Figure 1: Rear Impact – Configuration Requirements**



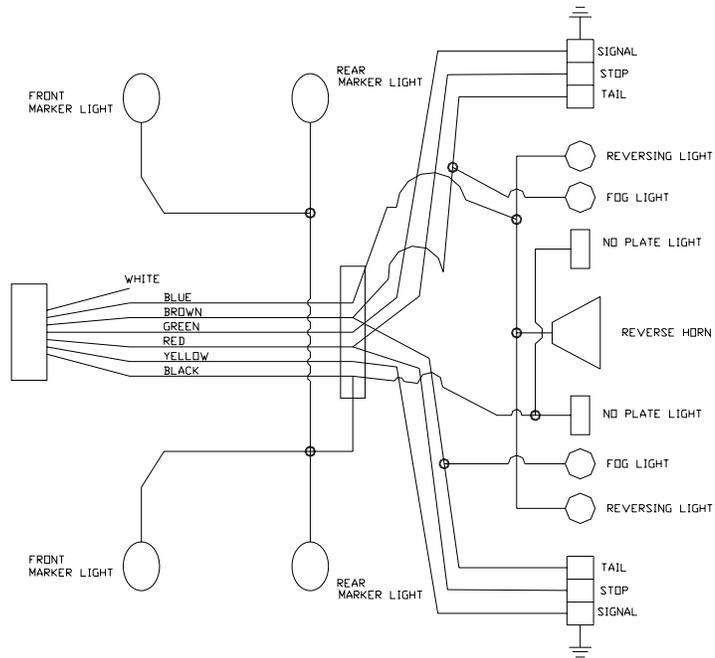
**SIDE VIEW**



**REAR VIEW**

Note: Do not scale the drawing.

**Figure 2: Side Protection – Configuration Guidelines**



**Figure 3: Wiring Diagram**