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**Vehicle Standards – Specification for Vehicle Roadworthiness –
Part 6: Roadworthiness – Requirements for combinations of
vehicles**

Version *[Insert Version Number]*

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Foreword

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This document was prepared by *[insert name of committee or subcommittee]*.

This *[Insert edition number]* edition cancels and replaces the edition *[Insert edition number]*, which has been technically revised. It also incorporates the Amendments *[Insert edition number(s)]*.

The main changes compared to the previous edition are as follows:

— *[List changes here]*

Foreword (Cont.)

This specification consists of the following parts under the general title “Specification for vehicle Roadworthiness”

Part 1: Roadworthiness of vehicles already in service

Part 2: Roadworthiness of vehicles prior to entry into service and thereafter

Part 3: Roadworthiness – Supporting information

Part 4: Roadworthiness – Requirements for vehicle examiners

Part 5: Roadworthiness – Requirements for testing equipment

Part 6: Roadworthiness – Requirements for combinations of vehicles

0 Introduction

0.1 Reference to Part 1.

The Foreword and Introduction of Part 1 of this specification are also relevant to this Part 4 which specifies requirements for vehicle examiners.

0.2 Principles in the 6 Parts:

The principles incorporated in the 3 parts of this specification are as follows

Part 1: Covers roadworthiness of vehicles already in service, some being very old, others possibly brand new, and deals mainly with wear and tear and deterioration of the basic parts of vehicles which need to be continually maintained to a reasonable level of safety. Because of the many sources and specifications of new and used vehicles it is necessary to ensure that no requirements are included which could result in failure of some vehicle designs which have been operating safely and successfully for many years.

Part 2: Provision is made in this Part 2 for the subsequent mandatory introduction of design safety standard requirements intended to ensure higher standards of safety for vehicles entering into service in the future and thereafter whenever roadworthiness testing is required.

Part 3: Is intended as an advisory publication to throw light on the considerations involved in Parts 1, 2, 4 and 5 and to provide information which may be of assistance to some vehicle examiners.

Part 4: Covers requirements for vehicle examiners.

Part 5: Covers requirements for equipment for testing equipment.

Part 6: Covers requirements for combinations of vehicles.

Vehicle Standards – Specification for Vehicle Roadworthiness – Part 6: Roadworthiness – Requirements for combinations of vehicles

0 Introduction

0.1 Application of this Part of the specification

This part of the specification is intended to be applied to vehicle combinations at a roadside inspection, or whilst the combination is standing idle at a weighbridge or customs post or similar and may be used as a walk-around visual check by any party including the operator, driver or an official.

No testing equipment nor special premises are required, although the availability of flat road or of an inspection pit will enhance the extent of the inspection that is possible.

0.2 Related application re loading.

In cases where the combination is loaded and its compliance with the bridge formula is in doubt, a comprehensive example of how to apply the bridge formula is provided.

1 Scope

1.1 Scope of Part 6

This Part 6 of the specification contains information to aid vehicle examiners or any person wishing to perform a visual inspection to determine whether a vehicle combination exhibits features or conditions which would result in it being classed as unroadworthy,

It also provides an example of the application of the bridge formula to a vehicle combination which may assist staff in control of overloading legislation.

The contents of this Part 6 are not mandatory.

NOTE Additions to this part of the specification are intended to be provided at a later date.

2 Visual Inspection

The following list of items to be inspected or observed is provided to assist in achieving a comprehensive inspection and yet in the knowledge that due to time or other constraints it will not always be possible to inspect each and every item on the list:-

2.1 Walk-around checks:

- 1) Check license and number plates.
- 2) Check inside cab for any obvious risk to safety – damaged or missing controls.
- 3) Check inside cab for loose seats, bunk beds and any other loose vehicle equipment
- 4) Check that doors can be opened and closed without using excessive force

- 5) Check for data plate with GVM, GCM etc. –
- 6) Check presence and condition and cleanliness of exterior mirrors
- 7) Check presence and condition and cleanliness of windscreen and side glass
- 8) Check operation of windscreen washers and condition of wipers.
- 9) Check engine bonnets are properly closed and the cab on cab-over-engine is properly secured.
- 10) Check chassis for signs of distortion, cracks or missing or loose bolts or rivets on body mountings
- 11) Check that the batteries are properly secured and that no battery cables have damaged sleeves.
- 12) Record the front tyre load index – or Size is.....
- 13) Check condition of all tyres for cuts, tread depth etc all the way round the whole combination.
- 14) Check function of all lights, indicators, brake lights.
- 15) Check chevron and yellow contour tape for presence and cleanliness.
- 16) Check wheels for damage and check that all wheel nuts are present and properly fitted
- 17) Check that the landing gear on a semitrailer for signs of damage and that it can be operated
- 18) Check for excessive smoke when the engine is under load
- 19) Check if tyres of vehicle follow in straight line or if there is crabbing evident.
- 20) Check that inner walls of dual wheels do not touch and that all tyres on an axle are the same size
- 21) Check pneumatic couplings and electrical couplings – whether connected, damaged, missing?
- 22) Examine brake chambers that can be easily seen for bad lever adjustment, unmatched sizes of chambers or “wound-off” spring brakes.
- 23) Check tool kit for the presence of a clevis or special tool for the release of the spring-brakes.
- 24) Ask driver to repeatedly apply and release the brakes and observe movement of visible slack adjusters on all axles
- 25) Ask driver to rock the combination forward and backwards and study the movement at the 5th wheel(s) or at the mechanical couplings.
- 26) Check the mounting of the 5th wheel to the chassis
- 27) Ask the driver to rock the steering ¼ turn and observe wheel movement of the steered axle and listen to abnormal noises

2.2 Checks only if the site is absolutely flat and chocks are available, then: -

- 1) Position chocks at front and rear wheels

- 2) Ask driver to ensure reservoirs are charged and record how many full brake applications he can make before any warnings of low pressure.
- 3) Then record how long it takes to recharge to full pressure.
- 4) Listen for obvious air leaks
- 5) Check that air reservoirs have drain plugs which can be reached easily

2.3 Checks if a suitable inspection pit is available: -

- 1) Examine for excessive corrosion, excessive wear, damage, missing or loose parts that would result in a failure at a full roadworthiness test.
- 2) Check suspension springs and mountings for any damage or cracks, also pots and bellows with air suspension
- 3) Check for oil leaks which result in a larger spot than about DVD size (on the floor) during the inspection
- 4) Check transmission and propshaft for worn mountings or any other visible damage
- 5) Examine brake chambers for bad lever adjustment, unmatched sizes of chambers or “wound-off” spring brakes or brake chambers that are clearly too small for the axle or brake.
- 6) If a load-sensing valve is fitted check that its movement is not impeded.
- 7) Check brake pipes and electric wiring for looseness or chafing marks, especially near the suspension
- 8) If brake linings or discs are exposed, then check for presence of linings and shoes.
- 9) Check condition of inner sides of tyres for cuts, damage or obvious under-inflation.
- 10) If hydraulic brakes, check for leaks or sweating on all pipe connections and on the wheel brakes.

3. Method of assessing compliance to the Bridge Formula

3.1 Follow the procedure as below:-

- 1) Appreciate the fact that the Bridge Formula was derived after carefully studying the data on the strengths of bridges in Southern Africa, the strengths of their supporting pillars, the distances between supports, design data and other considerations such as point loading and evenly distributed loading, and the from this information deriving the simple formula known as the “Bridge Formula”.

- 2) The simple formula that was derived results in a straight line graph:-

$$\text{Max load (t)} = [(\text{Distance between outermost axle centrelines in any group}) \times (2.1)] + 18t$$

- 3) When applied to a rigid truck or a combination or even an abnormal load vehicle the results of the formula which are obtained above the line mean bridge strength or life is jeopardised, and

results deduced which fall below the line are acceptable loadings for bridges on main arteries throughout Southern Africa and in some countries beyond.

- 4) Step one is to have each axle group weighed and the results recorded.
- 5) Step two is to ensure that the combination has been parked in a straight line before measuring the dimensions
- 6) Step three is to measure and write down the distance from the centreline of front axle A to the next axle centreline B then to the next axle centreline C and so on until the centre to centre of each axle in the combination has been covered.
- 7) Step four is to derive the measurement from axle centreline A to the rearmost axle centreline of the truck tractor (or drawing vehicle) then if unsure of which portion of the combination is likely to be critical in terms of the Bridge Formula, to derive the dimension for axles A to B, A to C, A to D, A to E, A to F, and A to G. Then again for B to C, B to D, B to E, B to F, and B to G. Then again for C to D, C to E, C to F, and C to G. Then again for D to E, D to F, and D to G. Then for E to F and E to G. Then finally for F to G.
- 8) Since the tandem axles are so close together their limiting bridge factor is for example Axle B to C, distance about 2m giving a bridge limit on them of $(2.4m \times 2.1) + 18t = 23t$. Now since the legal limit is 18t then each set of tandem axles is limited to 18t whereas the Bridge formula would have allowed them to carry 23t. Therefore there is no need to calculate and record the results for B to C, D to E, and F to G.
- 9) Note that Step 4 can be simplified into:-
 - i) Axle A to G for the whole combination, as if it were all on the bridge.
 - ii) Axle A to E as if only the truck tractor and the first semi-trailer are on the bridge.
 - iii) Axle B to G as if the front axle has passed off the bridge and the rest was still on the bridge.
 - iv) Axle B to E as if only the tandem axle units of the truck tractor and of the 1st semi-trailer are on the bridge.
 - v) Axle D to G as if only the two tandem axle units of the semi-trailers are on the bridge.
- 10) The dimensions for the cases in g) above are:-
 - i) A to G = 19,25m
 - ii) A to E = 12,0m
 - iii) B to G = 16m
 - iv) B to E = 8,75m
 - v) D to G = 8,75m
- 11) Since we do not know the actual axle loads, then assume the maximum legally permissible loads of 7,7t for a steering axle with suitable tyres and 18t for each tandem axle on the combination. The bridge formula results then work out as follows:-

i) $A \text{ to } G = (19.25\text{m} \times 2.1) + 18\text{t} = 58.4\text{t}$

ii) $A \text{ to } E = (12.0\text{m} \times 2.1) + 18\text{t} = 43.2\text{t}$

iii) $B \text{ to } G = (16,0 \times 2.1) + 18\text{t} = 51.6\text{t}$

iv) $B \text{ to } E = (8.75 \times 2.1) + 18\text{t} = 36.4\text{t}$

v) $D \text{ to } G = (8.75 \times 2.1) + 18 = 36.4\text{t}$

The table below summarises the steps so far:-

Note from compiler - A cleaner way of explaining and tabulating the procedure and the results is being developed for inclusion.

Axle Group		
A-G	Whole combination	58.4t
A-E	Truck tractor & 1 st semitrailer	43.2t
B-G	Whole combination except front axle	51.6t
B-E	Tandem units of both truck tractor & semi-trailer	36.4t
D-G	Tandem units of both semi-trailers	36.4t

Axle Group			Truck Front Axle	Truck Tandem Axle	1 st Semitrailer Tandem Axle	2 nd Semitrailer Tandem axle	Total load onto road		
	Legally permissible values		7 700	1 8000	1 8000	18 000	61 700		
	Limits imposed by Bridge Formula						58 400		
A-G	Whole combination	58.4t							
A-E	Truck tractor & 1 st semitrailer	43.2t							
B-G	Whole combination except front axle	51.6t							
B-E	Tandem units of both truck tractor & semi-trailer	36.4t							
D-G	Tandem units of both semi-trailers	36.4t							

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