

**Health and Safety Executive
Technology Division**

SPECIALIST INSPECTOR REPORTS

**LANDING LEGS ON SEMI-TRAILERS OF
ARTICULATED VEHICLES**

by D C Edwards, C.Eng., Ml Mech.E
HM Specialist Inspector

Report No 18

529.114.3:
503 859 258
0894

The Health and Safety Executive employs a wide range of qualified and experienced Specialist Inspectors who, in the course of their work, acquire a substantial amount of information and expertise about workplace hazards. Much of this is used in the preparation of official HSE Guidance Notes and formal advice. However, other material which might be less developed could contain useful ideas and be helpful to people involved in health and safety. Such material could also stimulate discussions about problems and their solutions and encourage others to come forward with ideas and practical improvements. Specialist Inspector reports are designed to publish this material.



Enquiries regarding this publication should be addressed to:-

Health and Safety Executive
 Technology Division
 Room 315
 St Anne's House
 University Road
 Stanley Precinct
 Bootle
 Merseyside, L20 3LZ

Telephone: 051.951.4564

LANDING LEGS ON SEMI-TRAILERS OF
ARTICULATED VEHICLES

By

D C Edwards, C.Eng; MI.Mech.E

SUMMARY

This paper presents a study prompted by the overturning of a semi-trailer, due to the collapse of a landing leg, whilst the trailer was being unloaded by a fork lift truck. The common method of trailer support is discussed. Potential problem areas are identified and some suggestions made to prevent such problems recurring.

CONTENTS

TITLE	PAGE
Introduction	1
Trailer Support	1
Coupling and Uncoupling	2
Potential Problem Areas	2
Conclusion	4

INTRODUCTION

1. Articulated goods vehicles comprise a semi-trailer and a tractor unit. A number of different types of semi-trailer exist, eg flat deck trailer, box trailer, tankers or skeletal trailers on which freight containers are mounted. Loading and unloading usually occurs at factories, warehouses or docks but in some circumstances may occur in public places. Semi-trailers may also be parked in industrial premises and public places. They may be used as temporary "extra rooms" or for temporary storage and may be parked on a site for extended periods ranging up to several months.

2. This study was prompted by the overturning of a semi-trailer, due to the collapse of a landing leg, whilst it was being unloaded by a fork lift truck. Other such accidents have occurred in the North West of England and whilst no injuries have resulted the potential for injury is clear. This report identifies problems associated with the security of landing leg fixings, loading and unloading, wear and abuse and makes suggestions which should help to overcome these problems and help to prevent similar accidents.

TRAILER SUPPORT

3. A semi-trailer is supported at the rear on 1, 2, or 3 axles. At the front it is supported by its connection to the tractor unit which may have two or three axles. The loads which the axles may legally support in the UK are shown on the Ministry of Transport plating certificate which should be fixed to the semi-trailer. (These loads may not be the same as those shown on the plate provided by the manufacturer).

4. When uncoupled from the tractor unit a semi-trailer needs support at its front end. This is usually provided by a pair of "landing legs". There are other methods of support (eg automatic couplings in which the support is incorporated in an

undercarriage) but this report is concerned only with independent landing legs. The permissible load on landing legs is not certified by the Ministry of Transport but they may have a makers plate which indicates the rated static load.

5. The most common design of landing leg is a telescopic type operating on the screw jack principle. The leg usually comprises a length of rectangular (or sometimes round) hollow section which forms the fixed upper section and a second length which telescopes inside it to form a retractable lower section. The lower end of the leg is fitted with a foot or wheels. The design of the foot varies but in the main it is attached to the leg by a pin or rubber cushion to allow for flexibility. At the top of the upper section a back plate is provided for bolting the leg to a bracket on the main chassis member of the trailer. There is no British Standard for fixing the back plate but 3 standards are generally accepted in the industry.

(a) A UK back plate which is drilled with 10 holes for 16 mm diameter bolts.

(b) A continental back plate drilled with 10 holes for 14 mm diameter bolts.

(c) A Crane Fruehauf back plate drilled with 6 holes for 16 mm diameter bolts.

Lateral and longitudinal bracing, usually angle or tubular members, are also provided for additional support.

6. The legs are usually lowered or raised by manual winding with a handle attached to a drive shaft. This is usually at the rear side of the semi-trailer but can be at both sides. For light trailers the leg may be lowered at a single speed but for heavy trailers the drive shaft may be fitted with a gear box which may also provide a choice of two speeds. The drive is transmitted to

both legs by a cross shaft which in turn drives a vertical screw within the leg via bevel gears. The screw is usually suspended from a thrust bearing in the top of the upper section and engages in a nut fixed in the top of the lower section of the leg.

7. Most standard legs are currently designed to support 50 tonne static load per pair (ie 25 tonne on each leg) with the capacity to raise the front of a semi-trailer when loaded to approximately half this amount. Heavy duty legs may be supplied with slightly greater static capacity of 60 to 65 tonne which may also increase the lifting capacity. Some earlier legs were designed for static loads of 35 tonne per pair.

8. The legs must be positioned so that adequate clearance is provided for the rear of the tractor when turning. They are usually at the change in depth of chassis for the goose neck. The profile of the goose neck for interchangeability of tractor is given in ISO 1726. The distance from the centre of the king pin to the centre of the legs is usually between 2,200 and 2,400 mm. This puts the legs at about the quarter point of the load (see Fig 1).

COUPLING AND UNCOUPLING

9. Before uncoupling the tractor from a semi-trailer the trailer manual brake should be applied. The legs are then lowered to the ground. Air and electrical lines are disconnected. The fifth wheel safety catch is released and the coupling is then disconnected and the tractor driven slowly away.

10. Before coupling the operator should check that the semi-trailer brake is on and the height of the trailer is level with the tractor. The tractor is then reversed slowly under the trailer until the fifth wheel coupling engages. The tractor is then moved gently forward a small amount to test the coupling. The

king pin is checked to see that it is properly engaged and the safety catch applied. The air and electrical lines are connected and the air turned on. The landing legs should then be raised to their highest position and the trailer brake released.

*Note: The most common method of connecting a semi-trailer to a tractive unit is by a device known as a fifth wheel coupling. It is mounted on the tractive unit and comprises a support plate with a jaw and latch arrangement which engages the towing king pin on the trailer. Properly engaged the king pin is locked into the coupling which provides a large area for front support and the pivot for articulation.

POTENTIAL PROBLEM AREAS

Fixing of Legs to Chassis

11. It is important that the fixing of the legs to a semi-trailer chassis is adequate. The load on a leg depends on the length of the trailer, its gross weight and the number and centre of axles. The maximum gross weight of an articulated vehicle under current Regulations is 38 tonne. (This may be increased to 40 tonne under EC Regulations). The load on a pair of landing legs on a 40 ft semi-trailer would be of the order of 15.5 tonne, figure 1. On a semi-trailer with 3 axles this load would be reduced. The load on the legs of a typical 20 ft skeletal trailer with container would be of the order of 12 tonne per pair. This assumes the trailer load to be uniformly distributed.

12. Meeting the 50 tonne static rating of the legs requires fixing bolts of grade 8.8 (BSS 3692 or equivalent) and not less than 6 of 16 mm diameter or 8 of 14 mm diameter. On the older legs, with 35 tonne static capacity, 4 of 16 mm or 6 of 14 mm diameter bolts would suffice but this would leave little margin to cope with abuse or the longitudinal

loads applied when coupling particularly if the legs sink into soft ground or are on very rough ground. Unless they are marked these older legs are not easy to identify. It is therefore suggested that not less than 6 of the 16 mm diameter or 8 of the 14 mm diameter bolts should always be used. In practice between 4 and 10 bolts are seen.

13. Lateral and longitudinal bracing should always be fitted unless, as is the case on some trailers, the bottom of the fixed section of the leg can be bolted directly to the trailer chassis. The longitudinal bracing must be fitted at the rear of the leg so that it does not interfere with the tractor when turning.

Loading and Unloading

14. As loading or unloading of an uncoupled semi-trailer progresses the distribution of load changes. The shorter trailers may approach the point where they become balanced about the landing legs or front heavy if the load is not uniformly distributed. This may cause the trailer to "nose dive." Driving a fork lift truck on and off a semi-trailer aggravates this condition especially if a ramp is used, or, as on some refrigerated containers, a step at the entrance is not properly bridged. The acceleration and braking of the truck or impact with cargo it is picking up, results in a forward acting force placing extra load on the landing legs. Loading from the side tends to push the trailer sideways which again adds extra load on the legs. The legs may also be subjected to impact forces as the cargo is loaded, for example when a container is lowered suddenly onto twist locks by a container crane. Deflection of the semi-trailer suspension as a fork lift truck drives over the rear or as the suspension settles under the increasing load is not thought to have a significant effect on the landing legs providing they are adequately secured.

15. The tanks on tanker trailers may be divided into two or more separate compartments. To maintain the stability of these trailers it is important that when loading, the rear compartments are filled first and when unloading, the front compartments are discharged first.

16. To reduce risks arising during loading and unloading the occupier should always consider the use of safety jacks or other suitable support. This is particularly important where fork lift trucks are driven onto the uncoupled semi-trailer or where for any reason the trailer is likely to become unstable during loading or unloading. This recommendation is made in IMO/ILO "Guidelines for Packing Cargo in Freight Containers or Vehicles" and in BSS 5073 (1982) "Stowage of Goods in Freight Containers". Suitable proprietary jacks are available. They usually have a large diameter top plate which is pivoted to align with the trailer chassis. One jack forward of the king pin under the 5th wheel coupling skid plate may be sufficient but one on either side of the trailer under a suitable point on the chassis is preferable. The semi-trailer wheels should also be chocked. A safe system of work will be required to ensure removal of safety jacks before coupling a tractor unit to the trailer.

Abuse During Use

17. Trailer landing legs are vulnerable and often abused. If the landing legs are not fully lowered before uncoupling, the semi-trailer will drop onto them as the tractor is driven away. A tractor may sometimes pull away an excessive distance with the legs down to test the coupling. A trailer may be pushed backwards by a tractor when coupling if its brake is not properly applied particularly if the trailer is low. The legs may not be raised to their full extent and sometimes not raised at all especially if the trailer is only to

be moved a short distance in a factory yard. The legs may then be damaged if they strike a kerb when cornering or catch on any raised area of ground. On uneven or soft ground the load may not be transmitted equally to each leg. In the extreme all the load may be on one leg. On tanker semi-trailers which do not have a chassis heavy landings or other abuse may affect the fixing of the legs to the tank. The tank may be damaged and there is the possibility of puncturing the tank.

18. Vehicle drivers and others involved in loading or unloading procedures should be properly trained to ensure that they are aware of and avoid the above abuses. On uneven ground particular care needs to be taken to achieve even loading of the legs by means of suitable packing. Soft ground should be avoided.

Wear and Damage

19. Wear may occur where the screw and nut mesh. This may be accelerated by steam cleaning of legs which may remove lubrication and set up corrosion. Corrosion may also be caused by the ingress of rainwater or by spillage of corrosive cargos. Damage is inevitable in use as described above.

20. A regular visual examination of the landing legs should be made by the owner of the trailer. Regular visual examination of the legs should also be made by the vehicle operator and any defects reported to the trailer owner. Defective components should be repaired or replaced as necessary.

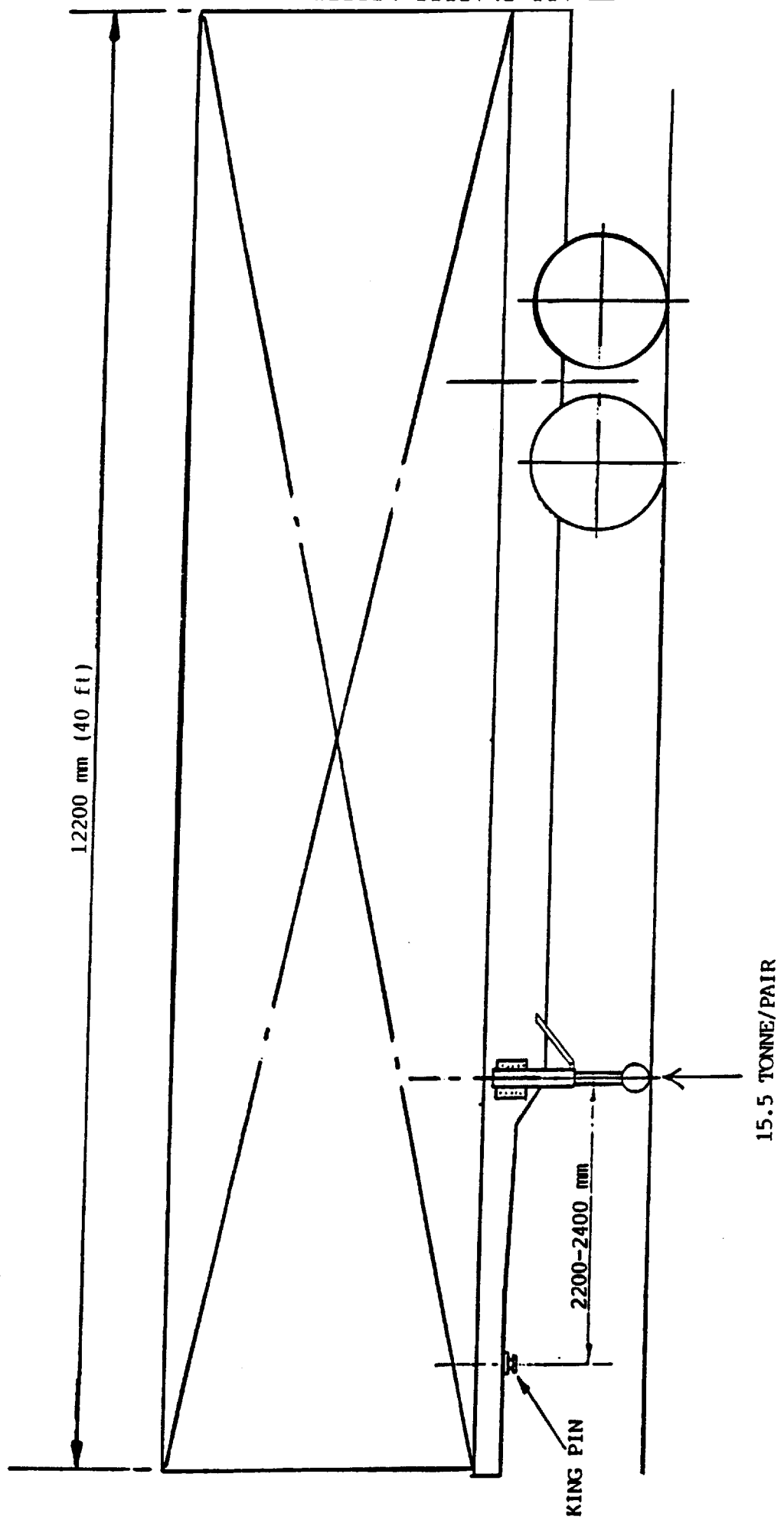
21. It is recommended that a periodic internal examination be made to ascertain the condition of the nut and screw. It is not practicable to carry out such an examination whilst the landing legs are on the semi-trailer and therefore they should be removed and stripped down. All components should be inspected and worn items replaced. The period between examinations should be not

more than 4 years and more frequently if operating conditions indicate that this might be necessary-for example if the trailer has been exposed to spillage of a corrosive load or has been operating in a corrosive environment.

CONCLUSION

22. The stability of a semi-trailer when uncoupled from a tractor unit depends not only on adequate design and installation of the landing legs but also on proper procedures for use and proper maintenance by vehicle operators and occupiers at points of loading and unloading. Critical areas are the connection of the legs to the chassis, the lateral and longitudinal bracing and the internal screw and nut.

23. Landing legs which are damaged or poorly maintained may not have the mechanical strength to resist the additional and dynamic loads applied when loading or unloading and collapse of a leg is foreseeable. The use of safety jacks or other suitable support should reduce this risk.



15.5 TONNE/PAIR
ASSUMING TRAILER LOAD UNIFORMLY DISTRIBUTED

FIG 1. TYPICAL POSITION OF LANDING LEGS ON 40 ft TRAILER