

strength flexibility innovation

Longer Semi Trailers

Report Prepared May 2011



Contents

Dft Announces Longer Semi Trailer Consultation period 2

The Proposal 2

Payload Implications 3

Light Goods: 4

 Weight: 5

Heavy Goods 5

Medium Weight Operators 5

Steering 5

Steering Systems 6

 Self Tracking (Passive) 6

 Positive Steer (Active) 7

 Command Steer (Active) 7

 SCM (Active Steering Correction System) 8

Consultation Report Steering Proposals 8

Steering System Costs 8

Safer Aerodynamic Fronts 9

Summary 9

Dft Announces Longer Semi Trailer Consultation period

On 30th March 2011, the DfT (Freight Policy & Lorry Charging Division) announced a consultation period to discuss the possible revision of current legislation to extend the overall length of semi-trailers. This consultation period is due to end 21st June 2011.

Note that the DfT refers to the extended trailers as LST's – not LHV's (Longer Heavier Vehicles) due to the fact that maximum gross operating weight limits (44T) will remain unchanged.

The consultation document and impact assessment can be found on the DfT website at: <http://www.dft.gov.uk/consultations/open/2011-06/>

The research report can be found at: <http://www.dft.gov.uk/pgf/freight/research/longersemitrailer/>

The Proposal

In principal, the consultation document proposes:

- an increase of up to 2.05 metres in the length of semi-trailers authorised for operation on roads in Great Britain (referred to below as “longer semi-trailers”);
- an increase in the overall permitted length of an articulated vehicle to 18.75 metres – the same as for a rigid truck/drawbar trailer combination – in order to allow the development and use of tractor units with safer, more aerodynamic frontal designs in addition to longer semi-trailers.

In essence, this would enable tractor/trailer combination overall combined length to reach that of current legislation for Draw-Bar combinations. In addition to the 2.05m extension to the rear of the trailer unit, it also permits a 200mm extension to the front of the tractor unit – with the view to adding safety/aerodynamic “nosecones”.

Interestingly, the report refers to an increase in trailer length relative to a 13.6m trailer (ref 1.1.3 maximum trailer length) and suggests a maximum new trailer length of 15.65m (or 14.6m in accord with previous trial). As overall length is currently dictated as a combination of 12m (kingpin to rear) + 2.04m (swing radius), NOT as an overall length OR as a combination of 12m + 1.6m (kingpin to front as suggested in para 1.1.4), this figure is open to interpretation. Differences in design between curtainsided and box van trailer front bulkheads can alter their overall length whilst still remaining within the current C&U regulations.

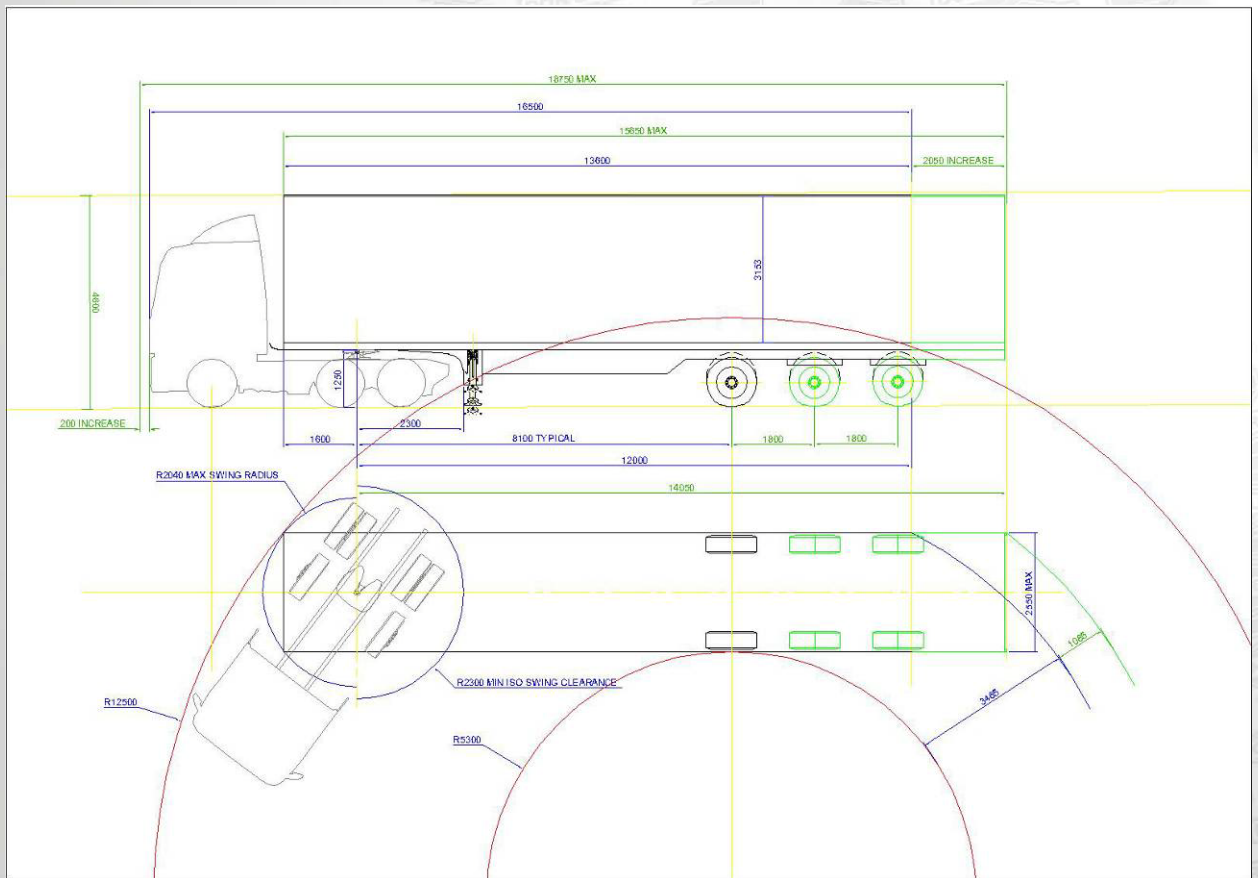


Illustration shows 13.6m long trailer: extended by 2050mm

Payload Implications

On first analysis, the additional trailer length will permit an additional 4 UK (GKN) pallets or 6 Euro Pallets on each loading deck. In the case of Double Decks, these figures would be 8 and 12 pallets respectively.

It is important to note however, that a maximum overall height limit is likely to be imposed at 4.6m (to minimise the potential increased effect of side winds).

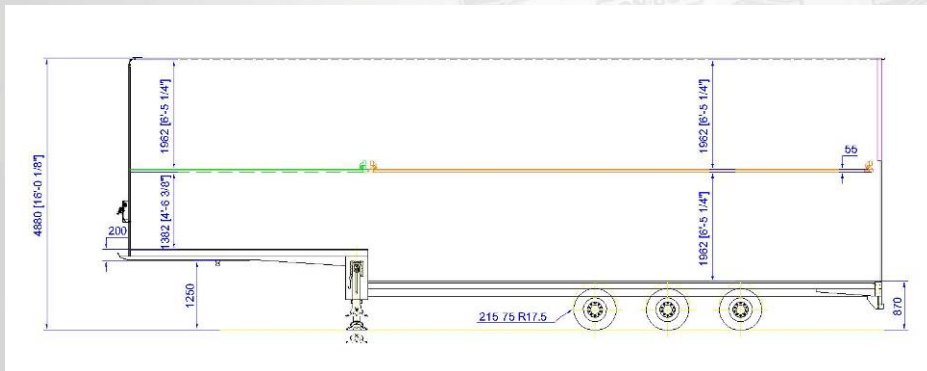
The combination of a height limit and a stay on the current 44T gross operating weight introduces several implications.

Light Goods:

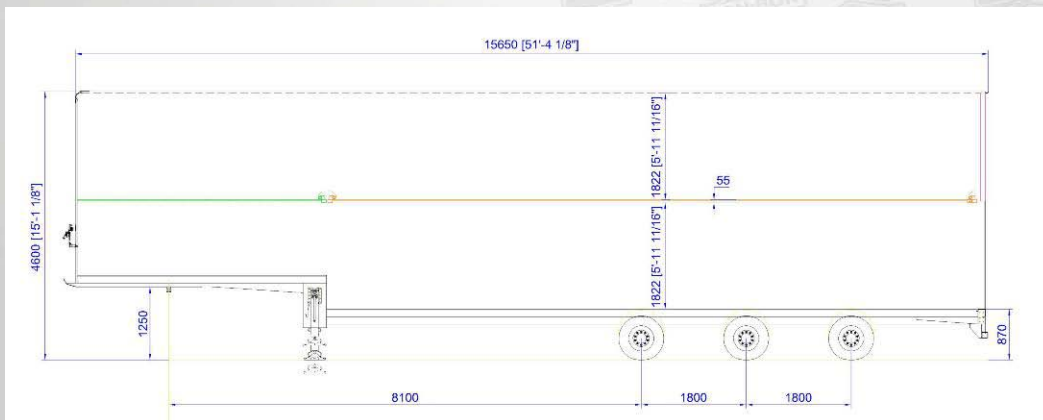
A large percentage of operators transporting light goods are already making use of double decks. Commonly, a step-frame trailer will have a 2/3rds length 2nd deck: increasing capacity from 26 UK pallets to 44 – a 69.2% increase.

A normal straight-frame double deck trailer with 13.6m length and 4.88m overall height will have an internal capacity of 115.7m³. A longer 15.65m trailer limited to 4.6m overall height will have 122.6m³ internal cube. However, the utilisation of that space is potentially more important.

A 4.88m high double deck step-frame box van trailer can have a max aperture on both decks of 1.962m (6' 5 1/4"): capable of storing the vast majority of stillages with ample head room. A 4.6m double deck can have a maximum of 1.822m (5' 11 11/16") on each deck which limits some load clearances and creates health & safety implications regarding head room.



Above: GA drawing showing max height Lifting Deck trailer.



Above: GA drawing showing 15.65m LST at 4.6m overall height.

This will restrict the application of double decks and thus (in many cases) limit additional UK pallets to just 4 on a single deck.



Thus, many operations currently using double decks would actually *reduce* capacity by taking advantage of the 2.05m length increase. For example, a 44 pallet double deck would be reduced to 30 pallets.

Weight:

Assuming an 8.5T tractor unit (tri-axle) and a generic 7T trailer weight, this offers a 28.5T payload at 44T gross.

Light goods are not generally affected by grossing out at 44T and many are downrated to run at, for example, 24T (urbans), 28T or 32T gross.

It is important to consider that the additional weight of increasing trailer length to 15.65m is likely to be 1.5T (further details later in this document). If an operator is near to the operating gross weight, this must be considered.

Heavy Goods

Operators carrying heavy payloads are predominantly limited by an operating weight of 44T gross and cannot take advantage of double decking. Even with 26 pallets, payload weight needs to be carefully monitored to ensure compliance.

As above, a longer trailer will weight circa 1.5T more. As the 44T gross will not be increased in the proposal, this will *reduce payload* by 1.5T.

Medium Weight Operators

Aside from light or heavy goods extremes are operators who run in the middle ground, such as garment carriers or perhaps parcel carriers.

Many of these operators currently run standard height trailers at 32T gross (example) with 4x2 tractors and tandem axle trailers. The potential for these operators to benefit is greater, as an extension of length, and therefore capacity, will not carry them over the 44T limit.

The reasons for limiting gross operating taxation class to 32T may however be because the routes do not warrant the increased payload or because of accessibility. In each case, the benefits of increased length are debatable.

Steering

The current C&U regulations stipulate a >5.3m and <12.5m turning circle for trailers. This is achieved on a 13.6m trailer with a 8.1m wheelbase. Assuming a uniformly distributed load, this also complies with weight distribution across kingpin/bogie.



A simple increase in length by 2.05m does not alter the turning circle if the wheelbase remains the same; however, it is probable that, as a result of more capacity at the rear of the trailer, this would shift the centre of gravity rearwards and overload the axles (unless retaining a 38T max gross weight). Moving the axle bogie rearwards will resolve these issues but will also, in itself, take the trailer outside the turning circle regulations.

The answer then is to move the virtual bogie rearwards whilst retaining an 8.1m effective wheelbase. This can be achieved in a number of ways.

Steering Systems

Self Tracking (Passive)

A fixed axle bogie at 8.1m rearwards of the kingpin and the addition of 1 or 2 self-tracking axles.

Self-tracking systems are unconnected to the tractor or bedplate/fifth wheel and, as a result, are only affected by the movement of the rear of the trailer. Each self-tracking axle has two wheels that effectively behave like casters: following the line of the trailer movement rather than scrubbing as the trailer turns. As each self-tracking axle does not fight against the road surface, they do not contribute to the bogie pivot point and the bogie position remains equal to the centre of any fixed axles.



True self-tracking systems only “drag” behind the trailer. As such, they do not contribute to the angle of motion and do not directly assist with swing-out or cut-in.

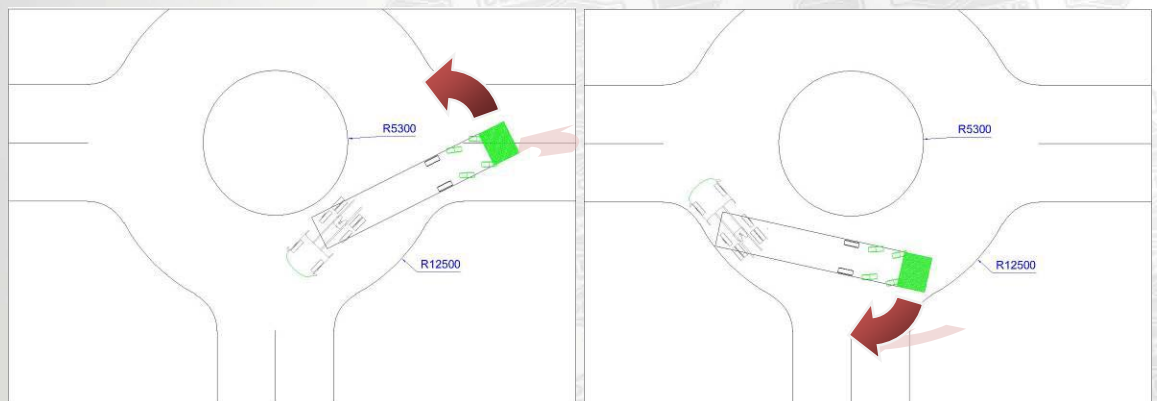
The problem with all current self-tracking systems is reversing. Without further controls, when a self-tracking system reverses, the tyres do not turn relative to the trailer direction and would make the trailer uncontrollable. To resolve this, a self-tracking system has to be locked in a parallel plane to the trailer when reversing. This effectively increases the wheelbase and makes maneuvering challenging.

Positive Steer (Active)



A fixed axle at 8.1m rearwards of the kingpin and the addition of 1 or 2 positive steer axels behind it at circa 1.8m axle spread.

Positive steer systems work by using the relative turning angle of the fifth wheel and the bedplate. As the tractor unit articulates, the bed plate rotates relative to the fifth wheel. This movement is then directly transferred by either electronic means or mechanic rod to the steering axles.



Analysis of positive steer axles on a test roundabout shows that the cut-in is greatly reduced as the trailer rear swings out to compensate. However, as the trailer rear swings out at the same time that the tractor unit turns, this proves problematic at roundabout or junction approach. When the tractor starts to turn into a roundabout, the rear will swing out, irrespective of whether the trailer rear has reached the roundabout or not.

As positive steer systems are connected with, and move relative to the tractor unit, reversing is more controlled than self-tracker systems.

Command Steer (Active)

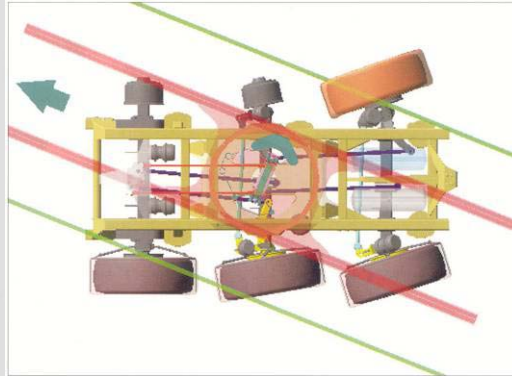
Command steer axles turn in response to an independent control located in the tractor cab and are connected electronically to the tractor unit via the electrical suzies.

Command steer axles are generally only used by heavy haulage contractors with very long trailers where careful control of the trailer rear is needed. As the controls are



independent of the normal steering system, another driver is usually required to control the axles.

SCM (Active Steering Correction System)



From the above systems described above, it becomes apparent that the best solution is one that is not directly affected by the tractor articulation – rather the movement of the trailer rear itself relative to the road surface.

In May 1999, in conjunction with Silvertip Design, Don-Bur manufactured the Steering Correction Mechanism or “SCM”.

The SCM system is a set of axles fixed to a turntable. As the trailer rear rotates relative to the road surface, so too does the axle turntable. As this turntable rotates, it also turns each wheel to compensate for the movement.

As a result, the trailer bogie follows the path of the tractor unit, rather than being directly steered as a result of tractor angle.



Consultation Report Steering Proposals

Under section 3.3 of the consultation report, the DfT are suggesting three options

- 1) Low Tech: A maximum vehicle length of 18.55m would be possible with an 8.1m wheelbase without steering axles; however, Max Gross Weight would be limited to 38T.
- 2) Medium Tech: Up to 44T with the use of existing steering systems.
- 3) High Tech: Cambridge University is developing an active steering system that may take a further 18 months to 2 years before it is ready for production. This new system is similar to the existing “SCM” system manufactured by Don-Bur and is claiming to minimise tail-swing to 0.2m at low speeds. This system is currently outside the scope of the technical requirements of UNECE Regulation 79. It is suggested that this solution may become mandatory for 44T LST’s which, with cornered supply, will inflate cost.

Steering System Costs

Aside from the additional weight of an active or passive steering system, they also introduce greater cost. In addition to the cost of extending the bodywork, an operator can expect to pay anything from £3,000 to £15,000 in capital expenditure for steering axles.



In addition to the capital cost, maintenance will also increase significantly. Yearly maintenance cost for a positive rear-steer system can be expected to reach £600 p.a.

Safer Aerodynamic Fronts

Referring to section 3.4 of the Consultation Report, the proposal also allows for the extension of tractor units by 200mm forwards. This extension is intended to improve aerodynamics and introduce better safety by means of greater energy absorption (crumple zones).

Aerodynamically, on first analysis, it has been found that, with a standard trailer, introducing a 200mm long “nosecone” to the tractor may actually reduce fuel efficiency. In our experience, we theorise that this may be as a result of increased surface attachment and therefore poorer separation at the rear of the trailer. Additionally, 200mm is a marginal increase considering overall dimensions. Aerodynamic shaping to the trailer (such as the Teardrop) may resolve this issue.

Please note that, under testing, a 500mm nosecone was required to achieve just 1% fuel saving at maximum authorised mass.

Summary

The current proposals to increase trailer length by 2.05m *may* be of benefit to some operations, but the implications of limited overall height, unladen weight increase and higher purchase/maintenance costs must lead any operator to think very carefully about the viability of such a move.