Title: Impact Assessment of Longer Semi-Trailers Lead department or agency: **Department for Transport** Other departments or agencies:	**Impact Assessment (IA)** **IA No:** DFT00062 **Date:** 15/12/2010 **Stage:** Consultation **Source of intervention:** Domestic **Type of measure:** Secondary legislation **Contact for enquiries:** Deborah Phelan (Deborah.Phelan@dft.gsi.gov.uk)

Summary: Intervention and Options

What is the problem under consideration? Why is government intervention necessary?

Determining the most socially beneficial length of Heavy Goods Vehicle semi-trailers. Government intervention currently exists to limit the maximum permitted length due to a variety of external costs associated with their use, and would be required to amend relevant regulations. The current maximum permitted length of semi-trailers, effectively 13.6m, limits the volume of low mass goods that may be carried. Analysis shows that lighter weight palletised, general cargo and mail/parcels currently comprise around 39% of the road haulage market in terms of tonne-km. An increase in permitted semi-trailer length, with no increase in gross vehicle weight (which has been previously studied and ruled out) would have impacts on freight transport costs and wider social and environmental goals.

What are the policy objectives and the intended effects?

The objective is to allow an increase in the maximum permitted length of semi-trailers if this results in net gains to society. Such an increase could reduce freight transport costs (for volume constrained goods), reduce HGV miles on the roads and thereby also bring social and environmental benefits. However, there may also be increases in costs for some businesses, safety or congestion implications, and mode-shift from rail. Hence a detailed assessment has been undertaken to consider the balance of these impacts.

What policy options have been considered? Please justify preferred option (further details in Evidence Base)

The assessment considers an extension of semi-trailer length of up to 2.05m, within the existing maximum permitted gross vehicle weight (gvw) of 44 tonnes. (Government has already ruled out heavier goods vehicles or vehicles longer than 18.75m) Four regulatory options are available, combining an increase of either 1m or 2.05m (allowing one or two rows of extra pallets respectively) with options to either leave other regulatory standards in place or to additionally require the longer vehicles to match the existing performance of the current longest vehicles. Within these 4 regulatory options, there is a variety of technology options available to industry, which would not be subject to regulation. The impact of restricting vehicle height for longer semi-trailers has also been considered as a scenario. The preferred option is for an increase of up to 2.05 metres, matching all other existing regulatory standards. The evidence base indicates this would optimise the benefits and be a net reduction in regulation, offering a net present value of over £4bn over 15 years in the best estimate (compared to £1.5bn-£2bn for a 1m increase)

When will the policy be reviewed to establish its impact and the extent to which the policy objectives have been achieved?	It will be reviewed 01/2014
Are there arrangements in place that will allow a systematic collection of monitoring information for future policy review?	Yes

Ministerial Sign-off For consultation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister: .... Date: ....

Summary: Analysis and Evidence — Policy Option 1

Description:

1m increase (14.6m semi-trailer length), matching current regulatory standards; technical solution by fixed-steer

Price Base Year **2009**	PV Base Year **2011**	Time Period Years **15**	Net Benefit (Present Value (PV)) (£m)		
			Low: **-496**	High: **743**	Best Estimate: 381

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	0		50	**496**
High	0		6	**34**
Best Estimate	0		15	**138**

Description and scale of key monetised costs by 'main affected groups'

The measure is deregulatory and is not expected to cause a net increase in industry operating costs. However, environmental costs are likely from this option as fixed steer technology effectively limits the gross vehicle weight to 40 tonnes. These environmental costs arise from increases in HGV-kilometres and the associated external cost components, such as increased congestion and emissions, and are estimated to be valued at £15m per annum in the Best Estimate scenario.

Other key non-monetised costs by 'main affected groups'

Potential additional infrastructure costs at some service/rest areas owing to increased space requirements unquantified. However, proposal is within existing permitted length for rigid draw-bar combinations, and demand for parking LSTs at service areas is expected to be low. No change in cost of enforcement.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	0		0	**0**
High	0		69	**778**
Best Estimate	0		45	**520**

Description and scale of key monetised benefits by 'main affected groups'

Net decrease in annual average industry operating costs (£45m). No net external social and environmental annual average benefits are created by this option arising from changes in HGV-kilometres.

Other key non-monetised benefits by 'main affected groups'

No key non-monetised benefits

Key assumptions/sensitivities/risks — **Discount rate (%)**: 3.5

Option 1 - fixed steer technology effectively restricts LST to 40 tonnes gvw.
Demand growth using the Great Britain Freight Model - version 5.
Existing length intermodal units are assumed.
Impact Assessment period 2011-2025 as 15 years is the earliest time at which the majority of the HGV fleet in existence today will have been replaced
Potential for further net benefit by also introducing safer aerodynamic fronts by allowing 0.2m extension to the length of tractors; best estimate of net benefit £7.5m per year due to reduced injuries and fatalities and reduced operating costs (see Annex 10)

Impact on admin burden (AB) (£m):			Impact on policy cost savings (£m):	In scope
New AB: **0**	AB savings: **0**	Net: **0**	Policy cost savings:	**No**

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			Great Britain		
From what date will the policy be implemented?			01/01/2011		
Which organisation(s) will enforce the policy?			VOSA/Police		
What is the annual change in enforcement cost (£m)?			0		
Does enforcement comply with Hampton principles?			Yes		
Does implementation go beyond minimum EU requirements?			No		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:**	**Non-traded:** +0.059	
Does the proposal have an impact on competition?			Yes		
What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?			**Costs:**	**Benefits:**	
Annual cost (£m) per organisation (excl. Transition) (Constant Price)	**Micro** 0.0006	**< 20** 0.0006	**Small** 0.0066	**Medium** 0.0263	**Large** 0.0682
Are any of these organisations exempt?	No	No	No	No	No

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

Please note this checklist is not intended to list each and every statutory consideration that departments should take into account when deciding which policy option to follow. It is the responsibility of departments to make sure that their duties are complied with.

Does your policy option/proposal have an impact on…?	Impact	Page ref within IA
Statutory equality duties[1] Statutory Equality Duties Impact Test guidance	No	
Economic impacts		
Competition Competition Assessment Impact Test guidance	Yes	96
Small firms Small Firms Impact Test guidance	Yes	97
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	Yes	100
Wider environmental issues Wider Environmental Issues Impact Test guidance	Yes	48
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	57
Human rights Human Rights Impact Test guidance	No	
Justice system Justice Impact Test guidance	No	
Rural proofing Rural Proofing Impact Test guidance	No	
Sustainable development Sustainable Development Impact Test guidance	Yes	57

[1] Race, disability and gender Impact assessments are statutory requirements for relevant policies. Equality statutory requirements will be expanded 2011, once the Equality Bill comes into force. Statutory equality duties part of the Equality Bill apply to GB only. The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Summary: Analysis and Evidence

Policy Option 2

Description:

1m increase (14.6m semi-trailer length), matching current regulatory standards; technical solution by single self-steer axle

Price Base Year **2009**	PV Base Year **2011**	Time Period Years **15**	Net Benefit (Present Value (PV)) (£m)		
			Low: **206**	High: **2,768**	Best Estimate: 2,055

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	0		17	**152**
High	0		0	**0**
Best Estimate	0		0	**0**

Description and scale of key monetised costs by 'main affected groups'

The measure is deregulatory and causes no net increase in industry operating costs for any of the scenarios. For the Best Estimate and High scenarios, no net external social and environmental costs are imposed by this option but in the Low Take-up scenario the external costs increase relative to the Base Case, due mainly to increased congestion and emissions, and are estimated to be valued at £17m per annum.

Other key non-monetised costs by 'main affected groups'

Potential additional infrastructure costs at some service/rest areas owing to increased space requirements unquantified. However, proposal is within existing permitted length for rigid draw-bar combinations, and demand for parking LSTs at service areas is expected to be low. No change in cost of enforcement.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	0		31	**357**
High	0		246	**2,768**
Best Estimate	0		181	**2,055**

Description and scale of key monetised benefits by 'main affected groups'

Net decrease in annual average industry operating costs (Best Estimate £142m per annum). Net external social and environmental annual average benefits are created by this option arising from changes in HGV-kilometres (Best Estimate £39m per annum).

Other key non-monetised benefits by 'main affected groups'

No key non-monetised benefits

Key assumptions/sensitivities/risks | **Discount rate (%)** | 3.5

Demand growth using the Great Britain Freight Model - version 5.
Existing length intermodal units.
Impact Assessment period 2011-2025 as 15 years is the earliest time at which the majority of the HGV fleet in existence today will have been replaced
Potential for further net benefit by also introducing safer aerodynamic fronts by allowing 0.2m extension to the length of tractors; best estimate of net benefit £7.5m per year due to reduced injuries and fatalities and reduced operating costs (see Annex 10)

Impact on admin burden (AB) (£m):			Impact on policy cost savings (£m):	In scope
New AB: **0**	AB savings: **0**	Net: **0**	Policy cost savings:	**No**

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			Great Britain		
From what date will the policy be implemented?			01/01/2011		
Which organisation(s) will enforce the policy?			VOSA/Police		
What is the annual change in enforcement cost (£m)?			0		
Does enforcement comply with Hampton principles?			Yes		
Does implementation go beyond minimum EU requirements?			No		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:**	**Non-traded:** -0.116	
Does the proposal have an impact on competition?			Yes		
What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?			**Costs:**	**Benefits:**	
Annual cost (£m) per organisation (excl. Transition) (Constant Price)	**Micro** -0.001	**< 20** -0.001	**Small** -0.009	**Medium** -0.036	**Large** -0.094
Are any of these organisations exempt?	No	No	No	No	No

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

Please note this checklist is not intended to list each and every statutory consideration that departments should take into account when deciding which policy option to follow. It is the responsibility of departments to make sure that their duties are complied with.

Does your policy option/proposal have an impact on…?	Impact	Page ref within IA
Statutory equality duties[2] Statutory Equality Duties Impact Test guidance	No	
Economic impacts		
Competition Competition Assessment Impact Test guidance	Yes	96
Small firms Small Firms Impact Test guidance	Yes	97
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	Yes	100
Wider environmental issues Wider Environmental Issues Impact Test guidance	Yes	48
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	57
Human rights Human Rights Impact Test guidance	No	
Justice system Justice Impact Test guidance	No	
Rural proofing Rural Proofing Impact Test guidance	No	
Sustainable development Sustainable Development Impact Test guidance	Yes	57

[2] Race, disability and gender Impact assessments are statutory requirements for relevant policies. Equality statutory requirements will be expanded 2011, once the Equality Bill comes into force. Statutory equality duties part of the Equality Bill apply to GB only. The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Summary: Analysis and Evidence — Policy Option 3

Description:

1m increase (14.6m semi-trailer length), matching or exceeding existing performance

Price Base Year **2009**	PV Base Year **2011**	Time Period Years **15**	Net Benefit (Present Value (PV)) (£m)		
			Low: **80**	High: **2,204**	Best Estimate: 1,616

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	0		17	**151**
High	0		0	**0**
Best Estimate	0		0	**0**

Description and scale of key monetised costs by 'main affected groups'

The measure is deregulatory and causes no net increase in industry operating costs for any of the scenarios. For the Best Estimate and High scenarios, no net external social and environmental costs are imposed by this option but in the Low Take-up scenario the external costs increase relative to the Base Case, due mainly to increased congestion and emissions, and are estimated to be valued at £17m per annum.

Other key non-monetised costs by 'main affected groups'

Potential additional infrastructure costs at some service/rest areas owing to increased space requirements unquantified. However, proposal is within existing permitted length for rigid draw-bar combinations, and demand for parking LSTs at service areas is expected to be low. No change in cost of enforcement.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	0		19	**231**
High	0		195	**2,204**
Best Estimate	0		142	**1,616**

Description and scale of key monetised benefits by 'main affected groups'

Net decrease in annual average industry operating costs (best estimate £105m). Net external social and environmental annual average benefits are created by this option arising from changes in HGV-kilometres (best estimate £28m).

Other key non-monetised benefits by 'main affected groups'

No key non-monetised benefits

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5

Demand growth using the Great Britain Freight Model - version 5.
Existing length intermodal units.
Impact Assessment period 2011-2025 as 15 years is the earliest time at which the majority of the HGV fleet in existence today will have been replaced
Potential for further net benefit by also introducing safer aerodynamic fronts by allowing 0.2m extension to the length of tractors; best estimate of net benefit £7.5m per year due to reduced injuries and fatalities and reduced operating costs (see Annex 10)
Assumes that active-steer axle technology can be successfully introduced to the market.

Impact on admin burden (AB) (£m):			Impact on policy cost savings (£m):	In scope
New AB: **0**	AB savings: **0**	Net: **0**	Policy cost savings:	**No**

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			Great Britain		
From what date will the policy be implemented?			01/01/2010		
Which organisation(s) will enforce the policy?			VOSA/Police		
What is the annual change in enforcement cost (£m)?			0		
Does enforcement comply with Hampton principles?			Yes		
Does implementation go beyond minimum EU requirements?			No		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:**	**Non-traded:** -0.112	
Does the proposal have an impact on competition?			Yes		
What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?			**Costs:**	**Benefits:**	
Annual cost (£m) per organisation (excl. Transition) (Constant Price)	**Micro** -.0003	**< 20** -.0003	**Small** -0.003	**Medium** -0.012	**Large** -0.032
Are any of these organisations exempt?	No	No	No	No	No

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

Please note this checklist is not intended to list each and every statutory consideration that departments should take into account when deciding which policy option to follow. It is the responsibility of departments to make sure that their duties are complied with.

Does your policy option/proposal have an impact on…?	**Impact**	**Page ref within IA**
Statutory equality duties[3] Statutory Equality Duties Impact Test guidance	No	
Economic impacts		
Competition Competition Assessment Impact Test guidance	Yes	96
Small firms Small Firms Impact Test guidance	Yes	97
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	Yes	100
Wider environmental issues Wider Environmental Issues Impact Test guidance	Yes	48
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	57
Human rights Human Rights Impact Test guidance	No	
Justice system Justice Impact Test guidance	No	
Rural proofing Rural Proofing Impact Test guidance	No	
Sustainable development Sustainable Development Impact Test guidance	Yes	57

[3] Race, disability and gender Impact assessments are statutory requirements for relevant policies. Equality statutory requirements will be expanded 2011, once the Equality Bill comes into force. Statutory equality duties part of the Equality Bill apply to GB only. The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Summary: Analysis and Evidence

Policy Option 4

Description:

2.05m increase (15.65m semi-trailer length), matching current regulatory standards; technical solution by two self-steer axles

Price Base Year **2009**	PV Base Year **2011**	Time Period Years **15**	Net Benefit (Present Value (PV)) (£m) Low: **582**	High: **5,859**	Best Estimate: 4,387

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	0		30	**277**
High	0		0	**0**
Best Estimate	0		0	**0**

Description and scale of key monetised costs by 'main affected groups'

The measure is deregulatory and causes no net increase in industry operating costs for any of the scenarios. For the Best Estimate and High scenarios, no net external social and environmental costs are imposed by this option but in the Low Take-up scenario the external costs increase relative to the Base Case, due mainly to increased congestion and emissions, and are estimated to be valued at £30m per annum.

Other key non-monetised costs by 'main affected groups'

Potential additional infrastructure costs at some service/rest areas owing to increased space requirements unquantified. However, proposal is within existing permitted length for rigid draw-bar combinations, and demand for parking LSTs at service areas is expected to be low. No change in cost of enforcement.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	0		75	**859**
High	0		522	**5,859**
Best Estimate	0		389	**4,387**

Description and scale of key monetised benefits by 'main affected groups'

Net decrease in annual average industry operating costs (Best Estimate £317m). Net external social and environmental annual average benefits are created by this option arising from changes in HGV-kilometres (Best Estimate £72m per annum).

Other key non-monetised benefits by 'main affected groups'

No key non-monetised benefits

Key assumptions/sensitivities/risks | **Discount rate (%)** 3.5

Demand growth using the Great Britain Freight Model - version 5.
Existing length intermodal units.
Impact Assessment period 2011-2025 as 15 years is the earliest time at which the majority of the HGV fleet in existence today will have been replaced
Potential for further net benefit by also introducing safer aerodynamic fronts by allowing 0.2m extension to the length of tractors; best estimate of net benefit £7.5m per year due to reduced injuries and fatalities and reduced operating costs (see Annex 10)

Impact on admin burden (AB) (£m):			Impact on policy cost savings (£m):	In scope
New AB: **0**	AB savings: **0**	Net: **0**	Policy cost savings:	**No**

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			Great Britain		
From what date will the policy be implemented?			01/01/2011		
Which organisation(s) will enforce the policy?			VOSA/Police		
What is the annual change in enforcement cost (£m)?			0		
Does enforcement comply with Hampton principles?			Yes		
Does implementation go beyond minimum EU requirements?			No		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:**	**Non-traded:** -0.163	
Does the proposal have an impact on competition?			Yes		
What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?			**Costs:**	**Benefits:**	
Annual cost (£m) per organisation (excl. Transition) (Constant Price)	**Micro** -0.002	**< 20** -0.002	**Small** -0.026	**Medium** -0.105	**Large** -0.274
Are any of these organisations exempt?	No	No	No	No	No

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

Please note this checklist is not intended to list each and every statutory consideration that departments should take into account when deciding which policy option to follow. It is the responsibility of departments to make sure that their duties are complied with.

Does your policy option/proposal have an impact on…?	Impact	Page ref within IA
Statutory equality duties[4] Statutory Equality Duties Impact Test guidance	No	
Economic impacts		
Competition Competition Assessment Impact Test guidance	Yes	96
Small firms Small Firms Impact Test guidance	Yes	97
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	Yes	100
Wider environmental issues Wider Environmental Issues Impact Test guidance	Yes	48
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	57
Human rights Human Rights Impact Test guidance	No	
Justice system Justice Impact Test guidance	No	
Rural proofing Rural Proofing Impact Test guidance	No	
Sustainable development Sustainable Development Impact Test guidance	Yes	57

[4] Race, disability and gender Impact assessments are statutory requirements for relevant policies. Equality statutory requirements will be expanded 2011, once the Equality Bill comes into force. Statutory equality duties part of the Equality Bill apply to GB only. The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Summary: Analysis and Evidence — Policy Option 5

Description:

2.05m increase (15.65m semi-trailer length), matching current regulatory standards; technical solution by one command-steer axle

Price Base Year **2009**	PV Base Year **2011**	Time Period Years **15**	Net Benefit (Present Value (PV)) (£m)		
			Low: **585**	High: **5,856**	Best Estimate: 4,384

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	0		32	**294**
High	0		0	**0**
Best Estimate	0		0	**0**

Description and scale of key monetised costs by 'main affected groups'

The measure is deregulatory and causes no net increase in industry operating costs for any of the scenarios. For the Best Estimate and High scenarios, no net external social and environmental costs are imposed by this option but in the Low Take-up scenario the external costs increase relative to the Base Case, due mainly to increased congestion and emissions, and are estimated to be valued at £32m per annum.

Other key non-monetised costs by 'main affected groups'

Potential additional infrastructure costs at some service/rest areas owing to increased space requirements unquantified. However, proposal is within existing permitted length for rigid draw-bar combinations, and demand for parking LSTs at service areas is expected to be low. No change in cost of enforcement.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	0		76	**879**
High	0		522	**5,856**
Best Estimate	0		388	**4,384**

Description and scale of key monetised benefits by 'main affected groups'

Net decrease in annual average industry operating costs (Best Estimate £321m per annum). Net external social and environmental annual average benefits are created by this option arising from changes in HGV-kilometres (Best Estimate £67m per annum).

Other key non-monetised benefits by 'main affected groups'

No key non-monetised benefits

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5

Demand growth using the Great Britain Freight Model - version 5.
Existing length intermodal units.
Impact Assessment period 2011-2025 as 15 years is the earliest time at which the majority of the HGV fleet in existence today will have been replaced
Potential for further net benefit by also introducing safer aerodynamic fronts by allowing 0.2m extension to the length of tractors; best estimate of net benefit £7.5m per year due to reduced injuries and fatalities and reduced operating costs (see Annex 10)

Impact on admin burden (AB) (£m):			Impact on policy cost savings (£m):	In scope
New AB: **0**	AB savings: **0**	Net: **0**	Policy cost savings:	**No**

Enforcement, Implementation and Wider Impacts

<table>
<tr><td colspan="3">What is the geographic coverage of the policy/option?</td><td colspan="3">Great Britain</td></tr>
<tr><td colspan="3">From what date will the policy be implemented?</td><td colspan="3">01/01/2011</td></tr>
<tr><td colspan="3">Which organisation(s) will enforce the policy?</td><td colspan="3">VOSA/Police</td></tr>
<tr><td colspan="3">What is the annual change in enforcement cost (£m)?</td><td colspan="3">0</td></tr>
<tr><td colspan="3">Does enforcement comply with Hampton principles?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="3">Does implementation go beyond minimum EU requirements?</td><td colspan="3">No</td></tr>
<tr><td colspan="3">What is the CO_2 equivalent change in greenhouse gas emissions?
(Million tonnes CO_2 equivalent)</td><td>**Traded:**</td><td colspan="2">**Non-traded:**
-0.097</td></tr>
<tr><td colspan="3">Does the proposal have an impact on competition?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="3">What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?</td><td>**Costs:**</td><td colspan="2">**Benefits:**</td></tr>
<tr><td>Annual cost (£m) per organisation
(excl. Transition) (Constant Price)</td><td>**Micro**
-0.002</td><td>**< 20**
-0.002</td><td>**Small**
-0.027</td><td>**Medium**
-0.108</td><td>**Large**
-0.280</td></tr>
<tr><td>Are any of these organisations exempt?</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td></tr>
</table>

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

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Does your policy option/proposal have an impact on…?	Impact	Page ref within IA
Statutory equality duties[5] Statutory Equality Duties Impact Test guidance	No	
Economic impacts		
Competition Competition Assessment Impact Test guidance	Yes	96
Small firms Small Firms Impact Test guidance	Yes	97
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	Yes	100
Wider environmental issues Wider Environmental Issues Impact Test guidance	Yes	48
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	57
Human rights Human Rights Impact Test guidance	No	
Justice system Justice Impact Test guidance	No	
Rural proofing Rural Proofing Impact Test guidance	No	
Sustainable development Sustainable Development Impact Test guidance	Yes	57

[5] Race, disability and gender Impact assessments are statutory requirements for relevant policies. Equality statutory requirements will be expanded 2011, once the Equality Bill comes into force. Statutory equality duties part of the Equality Bill apply to GB only. The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Summary: Analysis and Evidence — Policy Option 6

Description:

2.05m increase (15.65m semi-trailer length), matching current regulatory standards; technical solution by two command-steer axles

Price Base Year **2009**	PV Base Year**2011**	Time Period Years**15**	Net Benefit (Present Value (PV)) (£m) Low: **502**	High: **5,499**	Best Estimate: 4,106

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	0		32	**292**
High	0		0	**0**
Best Estimate	0		0	**0**

Description and scale of key monetised costs by 'main affected groups'

The measure is deregulatory and causes no net increase in industry operating costs for any of the scenarios. For the Best Estimate and High scenarios, no net external social and environmental costs are imposed by this option but in the Low Take-up scenario the external costs increase relative to the Base Case, due mainly to increased congestion and emissions, and are estimated to be valued at £32m per annum.

Other key non-monetised costs by 'main affected groups'

Potential additional infrastructure costs at some service/rest areas owing to increased space requirements unquantified. However, proposal is within existing permitted length for rigid draw-bar combinations, and demand for parking LSTs at service areas is expected to be low. No change in cost of enforcement.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	0		69	**793**
High	0		489	**5,499**
Best Estimate	0		363	**4,106**

Description and scale of key monetised benefits by 'main affected groups'

Net decrease in annual average industry operating costs (Best Estimate £296m per annum). Net external social and environmental annual average benefits are created by this option arising from changes in HGV-kilometres (Best Estimate £67m per annum).

Other key non-monetised benefits by 'main affected groups'

No key non-monetised benefits

Key assumptions/sensitivities/risks — **Discount rate (%)** 3.5

Demand growth using the Great Britain Freight Model - version 5.
Existing length intermodal units.
Impact Assessment period 2011-2025 as 15 years is the earliest time at which the majority of the HGV fleet in existence today will have been replaced
Potential for further net benefit by also introducing safer aerodynamic fronts by allowing 0.2m extension to the length of tractors; best estimate of net benefit £7.5m per year due to reduced injuries and fatalities and reduced operating costs (see Annex 10)

Impact on admin burden (AB) (£m):			Impact on policy cost savings (£m):	In scope
New AB: **0**	AB savings: **0**	Net: **0**	Policy cost savings:	**No**

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			Great Britain		
From what date will the policy be implemented?			01/01/2011		
Which organisation(s) will enforce the policy?			VOSA/Police		
What is the annual change in enforcement cost (£m)?			0		
Does enforcement comply with Hampton principles?			Yes		
Does implementation go beyond minimum EU requirements?			No		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:**	**Non-traded:** -0.104	
Does the proposal have an impact on competition?			Yes		
What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?			**Costs:**	**Benefits:**	
Annual cost (£m) per organisation (excl. Transition) (Constant Price)	**Micro** -0.002	**< 20** -0.002	**Small** -0.023	**Medium** -0.092	**Large** -0.239
Are any of these organisations exempt?	No	No	No	No	No

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

Please note this checklist is not intended to list each and every statutory consideration that departments should take into account when deciding which policy option to follow. It is the responsibility of departments to make sure that their duties are complied with.

Does your policy option/proposal have an impact on…?	Impact	Page ref within IA
Statutory equality duties[6] Statutory Equality Duties Impact Test guidance	No	
Economic impacts		
Competition Competition Assessment Impact Test guidance	Yes	96
Small firms Small Firms Impact Test guidance	Yes	97
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	Yes	100
Wider environmental issues Wider Environmental Issues Impact Test guidance	Yes	48
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	57
Human rights Human Rights Impact Test guidance	No	
Justice system Justice Impact Test guidance	No	
Rural proofing Rural Proofing Impact Test guidance	No	
Sustainable development Sustainable Development Impact Test guidance	Yes	57

[6] Race, disability and gender Impact assessments are statutory requirements for relevant policies. Equality statutory requirements will be expanded 2011, once the Equality Bill comes into force. Statutory equality duties part of the Equality Bill apply to GB only. The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Summary: Analysis and Evidence

Policy Option 7

Description:

2.05m increase (15.65m semi-trailer length), matching or exceeding existing performance

Price Base Year **2009**	PV Base Year **2011**	Time Period Years **15**	Net Benefit (Present Value (PV)) (£m) Low: **369**	High: **5,123**	Best Estimate: 3,789

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	0		32	**293**
High	0		0	**0**
Best Estimate	0		0	**0**

Description and scale of key monetised costs by 'main affected groups'

The measure is deregulatory and causes no net increase in industry operating costs for any of the scenarios. For the Best Estimate and High scenarios, no net external social and environmental costs are imposed by this option but in the Low Take-up scenario the external costs increase relative to the Base Case, due mainly to increased congestion and emissions, and are estimated to be valued at £32m per annum.

Other key non-monetised costs by 'main affected groups'

Potential additional infrastructure costs at some service/rest areas owing to increased space requirements unquantified. However, proposal is within existing permitted length for rigid draw-bar combinations, and demand for parking LSTs at service areas is expected to be low. No change in cost of enforcement.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	0		57	**662**
High	0		456	**5,123**
Best Estimate	0		335	**3,789**

Description and scale of key monetised benefits by 'main affected groups'

Net decrease in annual average industry operating costs (Best Estimate £268m per annum). Net external social and environmental annual average benefits are created by this option arising from changes in HGV-kilometres (Best Estimate £67m per annum).

Other key non-monetised benefits by 'main affected groups'

No key non-monetised benefits

Key assumptions/sensitivities/risks | **Discount rate (%)** 3.5

Demand growth using the Great Britain Freight Model - version 5.
Existing length intermodal units.
Impact Assessment period 2011-2025 as 15 years is the earliest time at which the majority of the HGV fleet in existence today will have been replaced
Potential for further net benefit by also introducing safer aerodynamic fronts by allowing 0.2m extension to the length of tractors; best estimate of net benefit £7.5m per year due to reduced injuries and fatalities and reduced operating costs (see Annex 10)
Assumes that active-steer axle technology can be successfully introduced to the market.

Impact on admin burden (AB) (£m):			Impact on policy cost savings (£m):	In scope
New AB: **0**	AB savings: **0**	Net: **0**	Policy cost savings:	**No**

Enforcement, Implementation and Wider Impacts

<table>
<tr><td colspan="3">What is the geographic coverage of the policy/option?</td><td colspan="3">Great Britain</td></tr>
<tr><td colspan="3">From what date will the policy be implemented?</td><td colspan="3">01/01/2011</td></tr>
<tr><td colspan="3">Which organisation(s) will enforce the policy?</td><td colspan="3">VOSA/Police</td></tr>
<tr><td colspan="3">What is the annual change in enforcement cost (£m)?</td><td colspan="3">0</td></tr>
<tr><td colspan="3">Does enforcement comply with Hampton principles?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="3">Does implementation go beyond minimum EU requirements?</td><td colspan="3">No</td></tr>
<tr><td colspan="3">What is the CO_2 equivalent change in greenhouse gas emissions?
(Million tonnes CO_2 equivalent)</td><td colspan="2">Traded:</td><td>Non-traded:
-0.100</td></tr>
<tr><td colspan="3">Does the proposal have an impact on competition?</td><td colspan="3">Yes</td></tr>
<tr><td colspan="3">What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?</td><td colspan="2">Costs:</td><td>Benefits:</td></tr>
<tr><td>Annual cost (£m) per organisation
(excl. Transition) (Constant Price)</td><td>Micro
-0.002</td><td>< 20
-0.002</td><td>Small
-0.019</td><td>Medium
-0.07</td><td>Large
-0.192</td></tr>
<tr><td>Are any of these organisations exempt?</td><td>No</td><td>No</td><td>No</td><td>No</td><td>No</td></tr>
</table>

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

Please note this checklist is not intended to list each and every statutory consideration that departments should take into account when deciding which policy option to follow. It is the responsibility of departments to make sure that their duties are complied with.

Does your policy option/proposal have an impact on…?	Impact	Page ref within IA
Statutory equality duties[7] Statutory Equality Duties Impact Test guidance	No	
Economic impacts		
Competition Competition Assessment Impact Test guidance	Yes	96
Small firms Small Firms Impact Test guidance	Yes	97
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	Yes	100
Wider environmental issues Wider Environmental Issues Impact Test guidance	Yes	48
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	57
Human rights Human Rights Impact Test guidance	No	
Justice system Justice Impact Test guidance	No	
Rural proofing Rural Proofing Impact Test guidance	No	
Sustainable development Sustainable Development Impact Test guidance	Yes	57

[7] Race, disability and gender Impact assessments are statutory requirements for relevant policies. Equality statutory requirements will be expanded 2011, once the Equality Bill comes into force. Statutory equality duties part of the Equality Bill apply to GB only. The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Evidence Base (for summary sheets) – Notes

Use this space to set out the relevant references, evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Please fill in **References** section.

References

Include the links to relevant legislation and publications, such as public impact assessment of earlier stages (e.g. Consultation, Final, Enactment).

No.	Legislation or publication
1	The Likely Effects of Permitting Longer Semi-Trailers in the UK: Vehicle Specification, Performance and Safety
2	Industry Evidence Gathering and International Review • Appendix A – FTA Submission • Appendix B – Rail Freight Group and Freight on Rail Submissions
3	Economic Assessment • Annex - Data Tables
4	Safer Aerodynamic Frontal Structures for Trucks
5	Comparing the Results of Cost Benefit Analysis for the Longer Semi-Trailer and previous LHV Studies All the above are available via http://www.wspgroup.com/en/Welcome-to-WSP-UK/WSP-UK/Press-centre-UK/News-Archive-UK/2011/DfT-Study/
6	Longer Semi-trailer Feasibility Study Final Summary Report: available at http://www.dft.gov.uk/pgr/freight/research/longersemitrailer/
7	Consultation on the possibility of allowing a small increase in the length of articulated lorries: available at http://www.dft.gov.uk/consultations/open/2011-06/

Evidence Base

Ensure that the information in this section provides clear evidence of the information provided in the summary pages of this form (recommended maximum of 30 pages). Complete the **Annual profile of monetised costs and benefits** (transition and recurring) below over the life of the preferred policy (use the spreadsheet attached if the period is longer than 10 years).

The spreadsheet also contains an emission changes table that you will need to fill in if your measure has an impact on greenhouse gas emissions.

Annual profile of monetised costs and benefits* - (£m) constant prices

	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9
Transition costs										
Annual recurring cost										
Total annual costs										
Transition benefits										
Annual recurring benefits										
Total annual benefits										

* For non-monetised benefits please see summary pages and main evidence base section

Annual LST costs & emissions_Best Estim

Evidence Base (for summary sheets)

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Summary table of options and findings

The table on the following 3 pages brings together all the options and the assessments major findings for comparison. The evidence base follows.

Summary Comparison of options according to research

Regulatory Option	**Industry options for technical approach** **(Identified options in Impact Assessment)**	**Safety implications**	**Carbon implications** ***Annual average CO_2 impact***	**Implications for domestic intermodal rail freight**	**Financial Impact on industry** ***Annual, present value, 2010 prices, best estimate***	**Other monetised impacts (environmental / social etc)** ***Annual, present value, 2010 prices, best estimate***	**Net impact over appraisal period** ***Total 2011-2025, present value, 2010 prices, best estimate***
1 metre increase, existing standards	Fixed steer (Option 1) - GVW reduced to 40 tonnes	No statistically significant impacts on safety	**58.7 thousand tonnes increase due to reduction in effective loading weight**	Modelling suggests rail freight would rise by **466%** by 2025 instead of by **732%** in base case – losing 5.2m tonnes to road	Net benefit of **£45m** (Marginal extra cost per vehicle[1] **£514 - £590**[2])	Net costs of **£15m** due to increased HGV miles	Best estimate: **£381m benefit** (range -£496m to £743m benefit)
	Single self-steer axle (Option 2) +£2,300 per axle	No statistically significant impacts on safety	**115.7 thousand tonnes** reduction	As above	Net benefit of **£142m** (Marginal extra cost per vehicle **£2814 - £2890)**	Net benefit of **£39m**	Best estimate: **£2,055m benefit** (range £206m to £2,768m benefit)
1 metre increase,	Active steering	No statistically significant impacts on	**112.6 thousand**	As above	Net benefit of **£105m**	Net benefit of **£28m**	Best estimate: **£1,616m benefit**

[1] The increased cost per vehicle should be offset by the smaller number of vehicles required to carry the same volume of goods. However, there may be an additional cost element if operators replace their existing fleets in advance of need, in effect writing off their previous investments early. We are not able easily to assess this potential cost in advance of consultation.

[2] Additional cost varies depending on height of semi-trailer

Regulatory Option	Industry options for technical approach **(Identified options in Impact Assessment)**	Safety implications	Carbon implications ***Annual average CO_2 impact***	Implications for domestic intermodal rail freight	Financial Impact on industry ***Annual, present value, 2010 prices, best estimate***	Other monetised impacts (environmental / social etc) ***Annual, present value, 2010 prices, best estimate***	Net impact over appraisal period ***Total 2011-2025, present value, 2010 prices, best estimate***
existing performance[3]	(Option 3) +£6000 per semi-trailer	safety	**tonnes** decrease		(Marginal extra cost per vehicle **< £6590)**		(range £80m to £2,204m benefit)
< 2.05 metre increase, existing standards	Two self-steer axles (Option 4) +£2300 per axle	These options would increase tail swing at roundabouts beyond that currently generated (para 189) – but safety implications likely to be statistically insignificant. Longer wheel-base vehicles more susceptible to cross-winds.	163.3 thousand tonnes reduction	Modelling suggests rail freight would rise by **262%** by 2025 instead of by **732%** in base case – losing 9.2m tonnes to road. *(NB This makes no assumption on the potential for the rail industry to mitigate by investing in longer ILUs – however, Annex 6 of the IA covers this.)*	Net benefit of **£296m - £321m** depending on technical solution chosen Marginal extra cost per vehicle: **Option 4 < £5810** **Option 5 < £5210** **Option 6 < £7810**	Net benefit of **£67m - £72m** depending on technical solution chosen	Best estimate: **£4,106m - £4,387m benefit** dependent on technical solution (range £502m to £5,859m benefit)
	one command-steer axle (Option 5) +£4000 per semi-trailer		97.3 thousand tonnes reduction				
	two command-steer axles (Option 6) +£6,600 per semi-trailer		103.6 thousand tonnes reduction				

[3] Many vehicles currently achieve better performance than is mandated by the standards in force. Requiring consistency with existing performance would therefore mean mandating stricter standards.

Regulatory Option	Industry options for technical approach (Identified options in Impact Assessment)	Safety implications	Carbon implications ***Annual average CO_2 impact***	Implications for domestic intermodal rail freight	Financial Impact on industry ***Annual, present value, 2010 prices, best estimate***	Other monetised impacts (environmental / social etc) ***Annual, present value, 2010 prices, best estimate***	Net impact over appraisal period ***Total 2011-2025, present value, 2010 prices, best estimate***
< 2.05 metre increase, existing performance	Active steer (Option 7) +£6,000 per semi-trailer	No statistically significant impacts on safety	100.4 thousand tonnes reduction	Modelling suggests rail freight would rise by **262%** by 2025 instead of by **732%** in base case – losing 9.2m tonnes to road. *(NB This makes no assumption on the potential for the rail industry to mitigate by investing in longer ILUs – however, Annex 6 of the IA covers this.)*	Net benefit of **£268m** Marginal extra cost per vehicle: < **£7210**	Net benefit of **£67m** due to decreased HGV miles	Best estimate: **£3,789m benefit** (range £369m to £5,123m benefit)
<2.05 metre increase in semi-trailer + 0.2 metre increase in cab unit	As options 4-6 above (This option assessed at Annex 10)	Would enable introduction of aerodynamic fronts with potential improvements in pedestrian safety, while maintaining overall limit of 18.75m (as long as this does not also apply to rigids)	Small potential additional reduction in CO_2 (c 2%) – but also allows for small CO_2 savings where high-volume semis not adopted	As above	Minor improvements to above from minor potential CO_2 reductions plus potential improvements in road safety.		

1. Introduction

1. This evidence base has the following structure: Section 1 introduces the issue and context. Section 2 discusses and explains the options which have been considered. In order to undertake cost benefit analysis a baseline needs to be constructed, which for this impact assessment involves quantifying the current and future freight market; Section 3 describes how this was done and then goes on to explain how the options have been analysed against this baseline. Section 4 summarises the results from the cost benefit analysis and discusses the implications. Section 5 lists the specific impact tests conducted, pointing to the detailed tests in the annexes. Section 6 presents the conclusions drawn from this research. Finally, annexes 1-10 present background evidence used, more detailed results and specific impact tests, as referred to in the main evidence base text.

Background

2. In 2006 the Department commissioned research to scope the use of longer heavier vehicles: *Longer and/or Longer and Heavier Goods Vehicles (LHVs) - a Study of the Likely Effects if Permitted in the UK.* The study report highlighted a number of issues that make the introduction of LHVs impractical on either a permanent or trial basis. Consequently, the Secretary of State ruled out their implementation. However, the analysis indicated that there may be affordable benefit in introducing longer semi-trailers, which may not require changes to the UK road network. As the 2006 study considered a wide range of options for longer-heavier vehicles, it was felt that a narrower, more focused approach was needed to understand the costs and benefits of the introduction of longer semi-trailers. Therefore, in June 2009, the Freight and Logistics Division (FLD) of the Department for Transport (DfT) commissioned a study (of which this Impact Assessment is part) to examine the feasibility and impacts of allowing longer semi-trailers to operate within the British road haulage market.
3. This Impact Assessment evidence base provides a summary of the analysis and findings of the research conducted. This assessment is supported by a series of more technical reports that encapsulate the full methodology, analysis and results of the work undertaken. Some of that body of research is included in the annexes.

Current Regime

4. European legislation, particularly Council Directive 96/53/EC, places major constraints on the size of vehicles that Member States may permit in national or international traffic. For example, for tractor unit/semi-trailer articulated combinations Council Directive 96/53 specifies that the maximum length of a combination is 16.5m and that the maximum length of semi-trailer is effectively 13.6m (12m to the rear +1.6m to the front of the kingpin). Rigid and drawbar trailer combinations are permitted up to a maximum length of 18.75m. The schematic on the next page illustrates these technical maxima.
5. Existing regulations also prescribe manoeuvrability requirements.

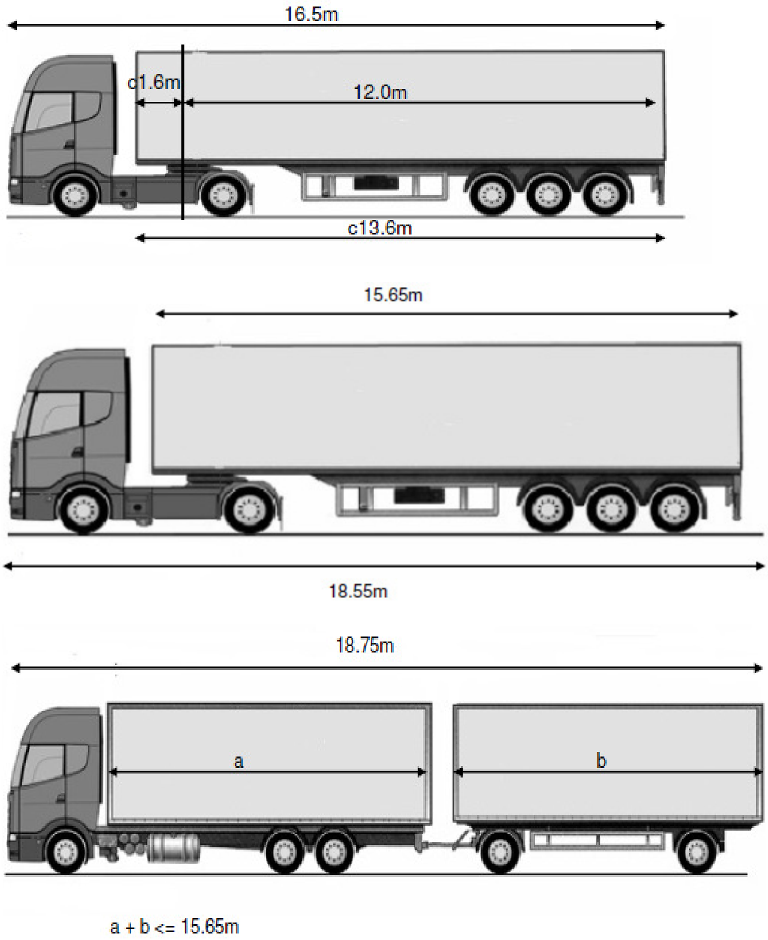
Rationale for Intervention and scope of study

6. Government intervention already exists to mandate the maximum dimensions of Heavy Goods Vehicles, because there is a variety of external costs associated with vehicle length and weight. These include accident risk, damage to infrastructure and impacts on congestion. The private market would not be expected to produce the use of the optimum sized vehicles from society's perspective.
7. This assessment's focus considers an extension in the currently allowed UK maximum 13.6 metre semi-trailer length by up to an additional 2.05m, leading to an overall maximum semi-trailer length of 15.65m and total vehicle length of 18.55m, while remaining within the existing maximum permitted gross vehicle weight (gvw) of 44 tonnes. However, such a vehicle would have to comply with all other regulations, including those limiting the gross vehicle weight (gvw). This would consequently bring an articulated heavy goods vehicle (HGV) broadly in-line with a rigid/draw-bar trailer combination (in terms of total vehicle length and the load-platform length). The reason for this focus and the options considered are explained in section 2 below. Providing an additional 2.05m to the length of a semi-trailer would therefore allow an additional two rows of pallets to be conveyed (four pallets single-stack or eight pallets double-stack given sufficient height availability).
8. The current maximum weight restriction for a tractor unit/semi-trailer articulated combination is 44 tonnes gvw. Some road transport operations, particularly those conveying lighter consumer/fast-moving consumer goods (FMCG) type cargoes, tend to reach their payload volume capacity before

the gvw restriction. The additional 2.05m would therefore potentially allow such operations to convey more cargo within the existing gvw restrictions (thereby providing for efficiency gains, lower CO2 emissions per tonne lifted etc.), though the increase in the weight of the semi-trailer would lead to a reduction in the maximum payload weight carried.

9. For the purposes of this Impact Assessment, it has been assumed that the change would come into effect in 2011.

10. The schematic below illustrates the differences between a current standard articulated lorry (top), the proposed articulated lorry with longer semi-trailer (centre) and the standard rigid truck / drawbar trailer combination (bottom) already permitted to operate in the UK. Hence the proposed articulated lorry with longer semi-trailer would be no longer than the rigid truck/drawbar trailer combination overall and allow for the same overall loading length. The proposed option is deregulatory in effect because it allows a vehicle option that is not currently available to operators and which may provide operational benefits.



Objectives and Methodology

11. The primary objective of this assessment was to establish whether the introduction of longer semi-trailers (LSTs) would deliver overall economic, environmental and societal benefits or disbenefits. A variety of options was considered, described in the section below. The main aims and objectives are therefore to examine the following:

- The extent to which longer semi-trailers would be used by different freight sectors and journey types (e.g. primary, secondary and tertiary distribution);
- What configuration (e.g. magnitude of length increase, overall height etc) of longer articulated vehicle would be used. What implications this would have for vehicle design (need for steering axles etc) and safety (tail-swing and stability);
- The effects on fatalities and serious injuries;
- The impact for road networks and for the current and potential use of non-road modes;

- The overall environmental impact including but not restricted to CO2 emissions across freight modes as a whole;
- Compatibility with existing infrastructure, including road networks, distribution centres and retail outlet loading bays;
- The impact on the cost and any wider economic impact of transporting goods by road.

12. The study methodology comprised three main tasks. The first was an initial assessment of vehicle specification and performance data, based on mathematical modelling techniques and interpretation of existing data. This included assessments of low speed manoeuvrability, dynamic (high-speed) stability, susceptibility to rollover in crosswinds, fuel economy and emissions performance. The simulations of the impacts of longer vehicles on casualty rates identified the estimated effect of any changes in physical performance.
13. The second was evidence gathering from industry and operators as part of an in-depth investigation of the potential take-up and operational issues associated with the use of longer semi-trailers. A review of international experience and studies in their use was made. These have clarified which vehicle configurations are likely to be of greatest interest to operators.
14. The third was a quantitative analysis of the likely level of usage of longer semi-trailers in future years and an estimate of their economic and environmental impacts.
15. Long-term outcomes include the optimum environmental and economic performance of the logistical system. Specific elements of Government policy will benefit from contributions from this project, in particular Sustainable Distribution, including reducing CO2 emissions and reducing congestion.

Groups and Sectors Affected

16. The main groups affected will be:

- Road freight vehicle owners and operators
- Rail freight industry
- Industry end users
- Other road users and wider public
- Trailer manufacturers

17. The main sector to consider for this project is the haulage sector, especially companies who operate larger goods vehicles. This will impact on capital and operating costs for switching to LSTs.
18. The rail freight industry is also affected by the proposition. This is expected to affect certain sectors (described below). There is a particular potential impact depending on whether the intermodal sector adapts in response to the use of longer semi-trailers. The Best Estimate impact assessment takes account of scenarios where this change is not adopted, and Annex 6 documents an alternative scenario where this is adopted.
19. There is a potential impact of the introduction of LSTs on waterways and coastal shipping. However, following an analysis of the data on the types of commodities moved currently on road, based on the Continuing Survey of Road Goods Transport (CSRGT), it was concluded that waterways and coastal shipping are unlikely to compete for significant volumes of the fast moving, low mass, volume-constrained commodities likely to be attracted to LSTs. Therefore, no further analysis was undertaken of potential mode shift effects.
20. The objective of improving logistics efficiency through reducing transport costs affects all sectors of industry where movement of goods forms a significant proportion of costs and therefore has a significant potential impact on the economy as a whole.
21. The impact on the environment and road safety has potential ramifications for society as a whole. Any significant changes to the volume of HGV traffic (vehicle-km) could have an impact on congestion (road user journey times and reliability), road safety, noise, air pollution, carbon, etc, as well as on infrastructure maintenance costs.

Principal Sources of Evidence

22. The impact assessment study evidence base includes:

- Reviews of international trials and other published studies regarding use of similar vehicle types;
- Analysis of vehicle performance, including safety, fuel consumption, emissions and manoeuvrability;
- Evidence gathering from industry on potential demand and use of longer semi-trailers;
- Economic assessment.

23. The reviews of recent desk studies and trials were mainly within the European Union. From these, factors and experience affecting the potential introduction of longer semi-trailers into the UK can be derived. Although these studies were mainly focused on longer heavier vehicles, they nonetheless provide broad indications of the types of issues that would need to be addressed for the successful introduction into the UK of longer semi-trailers.

24. The analysis on the vehicle specification, vehicle performance and safety aspects of the work involved:

- A review of scientific and commercial literature on trailer specification, performance and cost;
- Evidence gathering from the vehicle industry;
- Computer modelling and simulation of static load distribution, low speed manoeuvrability, dynamic stability, and susceptibility to cross winds;
- Quantification of the implications on running costs;
- Analysis of accident data.

25. Additional analysis was conducted on the potential for safer aerodynamic fronts.

26. It was also necessary to conduct a wide-ranging 'evidence gathering' exercise with the logistics sector and other key stakeholders. The evidence gathering sought to identify the potential market for LSTs, and then to quantify that market by meeting a reasonable spread of interested parties within the industry, such as operators, third party logistics (3PLs), trade bodies and other stakeholders, businesses and organisations. In particular, the structure of the industry required that representatives of a wide range of company sizes were contacted.

27. The evidence gathering from industry sought first to identify and assess industry need through discussion with the logistics sector, both the shippers of cargo and the providers/suppliers of transport services. In particular, it addressed the following issues:

- Identifying operations reaching cube capacity before the gross vehicle weight limits;
- Whether or not longer semi-trailers will result in fewer HGV trips and in cost savings;
- Validation of the assumptions and desk-top conclusions reached concerning the types of commodities, sectors and types of journeys likely to adopt longer semi-trailers; and
- Identification of likely vehicle combinations and assessment of potential ‘switch’ rates to longer semi-trailers.

28. The evidence gathering also collected quantitative operational data and information from operators to support/demonstrate the case for or against longer semi-trailers, and cost and performance data to validate the modelled costs produced by the economic modelling tasks and other assumptions. To address other key issues and identify other factors which could influence the project's findings, it particularly asked:

- Why do operators not upgrade to rigid and draw-bar trailer combinations? The longest rigid and draw-bar combinations already provide an additional 2.05m (approx) load-platform length compared with existing maximum length semi-trailers; and
- Why do operators not upgrade to double-deck (4.9m tall) semi-trailers? These are able to offer nearly double capacity, compared with standard single-deck semi-trailer, by their ability to double stack fully loaded pallets.

29. In addition, the exercise sought the views and opinions of other interested stakeholders. These included intermodal rail freight operators who, while not directly involved in the shipment or transport of cargo by road, could potentially be affected by the change.

2 Options

Introduction

30. This impact assessment follows on from previous work on the appropriate dimensions for Heavy Goods Vehicles in the UK, with a study commissioned in 2006 on a full range of options: *Longer and/or Longer and Heavier Goods Vehicles (LHVs) - a Study of the Likely Effects if Permitted in the UK.* The study report highlighted a number of issues that make the introduction of LHVs impractical on either a permanent or trial basis. However, the analysis indicated that there may be affordable benefit in introducing longer semi-trailers that would allow articulated HGVs with an overall load-platform length similar to that of rigid/draw-bar trailer combinations permitted across the EC. Hence length increases of up to 2.05m have been considered, as this represents the limit of what can be achieved under EU rules without the risk of having to accept much longer combination vehicles (see schematic on page 22).

31. Within the overall envelope of a potential 2.05m increase, there could be a number of interim loading lengths useful in different market sectors. Therefore, if amended regulations were to increase maximum length of articulated vehicles to 18.55m, then the road haulage industry would be free to specify any trailer length that suited their operation up to a maximum of 15.65m. There have been several proposals for additional length. For example:

- An additional 12-15 cm would be more suited to the carriage of 45 foot containers;
- An additional 20cm to allow better airflow and improved temperature control without reducing capacity in the refrigerated haulage sector;
- An increase of 0.95m would allow one additional row of pallets to be accommodated;
- In Germany, semi-trailers of 14.9m (an increase of 1.3m) have been permitted on a trial basis.

32. Depending on the density of the load carried, operators may choose to use different vehicle/axle configurations, for example:

- 38 tonnes gvw on 4 axles;
- 40 tonnes gvw on 5 axles;
- 44 tonnes gvw on 6 axles.

33. The use of a range of trailer heights depends on the density of the load, the routes taken and the available loading and unloading requirements. Some operators may choose trailers of 4m height, to be consistent with the maximum permitted to circulate freely in Europe. Some may choose to maximise available volume within the constraints of UK trunk road bridge heights with an overall height of up to approximately 4.9m. Others may choose heights between these extremes, to suit the loads that they carry and the infrastructure constraints on the roads and at the depots they use.

34. In addition to this, there are already a number of permitted exceptions to the rules on UK roads. For example, car transporters can have exceptionally long overhangs and low loaders can be permitted to be longer than 16.5m (<18m). Both of these vehicle types have at least partial exemptions to turning circle requirements.

Base Case (Do Nothing)

35. The Base Case for this assessment is a Do Nothing case with no changes to the existing regulations. The maximum permitted length for a semi-trailer would remain at 13.6m.

36. Assuming longer semi-trailer equipment is not introduced, the main output produced was an estimate of total annual operating costs of road freight activity for the forecast years 2015, 2020 and 2025 in the identified sectors and markets. Similarly, the total annual cost of moving goods by domestic intermodal rail freight in the forecast years was also estimated.

Vehicle Performance and Technology

37. The cost and weight implications of longer semi-trailers have been well defined in cooperation with the vehicle industry and increasing the length of semi-trailers to 15.65m would be likely to increase unladen mass by between approximately 575kg and 1,750kg. Capital costs could increase by between about £3,300 and £7,200. Both would depend on the level of steering technology applied and cheaper, lighter solutions would be available for length increases of less than 2m. Further details on vehicle technology findings are provided in the TRL Deliverable 3 report for the study: "The likely effects of permitting longer semi-trailers in the UK: vehicle specification performance and safety".

38. Increasing vehicle length without steering axles is only possible within current regulations if the maximum load carried is reduced or the load is unevenly distributed to avoid overloading the trailer axles. Longer, **fixed steer** vehicles at reduced weight will have greater tailswing than current vehicles.

39. The appropriate use of existing (non active, **self steer** or **command steer**) steering axle technology can allow vehicles to comply with all existing regulations at a gvw of 44 tonnes and a length of up to 18.55m (semi-trailer length 15.65m) but the tailswing will be greater than for current vehicles. Prototype **active steer** systems have the potential to allow 18.55m vehicles at 44 tonnes while improving tailswing performance with respect to current vehicles.

40. Longer vehicles that make use of steering axles to achieve compliance will tend to have longer wheelbases. Those using fixed steering and reduced weight will have shorter wheelbases, close to those of existing vehicles.

41. The susceptibility of vehicles to crosswinds is not sensitive to vehicle length but is sensitive to wheelbase. Thus, vehicles that achieve increased length with a longer wheelbase will tend to be more susceptible to crosswinds than existing vehicle but those with shorter wheelbases will be comparable to existing vehicles. Vehicles with a longer wheelbase will tend to have a slightly inferior rollover threshold in steady state cornering compared to otherwise identical vehicles with shorter wheelbases. Vehicles with a longer wheelbase will tend to have better dynamic performance in transient manoeuvres such as a lane change than those with shorter wheelbases. The analyses suggest that it would be very difficult for a longer vehicle to provide a better performance than an existing vehicle in all metrics considered. However, the analyses also suggest that there are no combinations where all performance measures get worse – there is a trade-off between performance measures based on wheelbase such that the measures that are adversely affected are offset by other measures where there is an improvement relative to existing vehicles.

42. The findings of the simulation work helped identify three regulatory possibilities:

    (i) Retain existing length limits (do nothing);

    (ii) Increase length, require compliance with all other existing regulations

    (iii) Increase length, require longer vehicles to match or exceed actual performance of existing vehicles

43. Within the regulatory constraints of (ii), it would be possible for industry to react in a number of different ways:

- Low technology – A maximum length of up to approximately 18.25m would be possible with a wheelbase of approximately 8m without steering axles. However, the gross vehicle weight would need to be limited to 38 tonnes to avoid trailer axle overload. Forty tonnes would be possible at a length of 17.8m. Both types would have reduced stability in dynamic manoeuvres such as lane changes.
- Medium technology – Vehicles could be up to 44 tonnes gvw and up to 18.55m overall length if existing steer axle technology was to be used. Such vehicles would suffer an increase in the susceptibility to cross winds of approximately 5% at 17.5m and approximately 10% at 18.55m, with a reduction of just under 2% in steady state rollover threshold, compared with a 13.6m vehicle. Other vehicle dynamics parameters such as rearward amplification or path error would match or outperform those of the standard vehicle. The dynamic performance assumes that like all existing systems the steer axles are locked at speed. New regulation may be required to enforce this condition.

44. Within the regulatory constraints of (iii), only one, high technology, approach would be possible. Vehicles would need to be fitted with a new generation of active trailer steering systems. Vehicles of up to 44 tonnes and 18.55m overall length (15.65m semi-trailer length) could be considered. Maximum length vehicles would have a 10% increase in load transfer during crosswinds and just

under 2% reduction in steady state rollover threshold compared with a 16.5m vehicle, although it is possible that tuning the system could improve some dynamic performance by around 20%.

45. A conservative analysis was undertaken to assess the potential casualty effects of these changes. This analysis has suggested that:

- Regulatory possibility ii) would be likely to result in an increase in the casualty risk per vehicle km but that this increase would be so small as to be unmeasurable in casualty data after implementation. A small reduction in the maximum height of the vehicle would be enough to offset this increase in risk.
- Regulatory possibility iii) would be likely to result in a small reduction in the casualty risk per vehicle km but again this is likely to be so small as to be unmeasurable.

Options

46. A total of seven longer semi-trailer options were considered. These reflect two length increases (1.0m and 2.05m) and alternative steering axle technology (fixed, self-steer, command steer or active steer depending on additional length). The options are summarised in Table 1a.

Table 1a: Summary of Modelled Options

Option	Trailer Length	Axle Type	Intermodal Units	Gross veh. weight
1	+1.00m	Fixed	Existing	40 tonnes
2	+1.00m	Single Self Steer	Existing	44 tonnes
3	+1.00m	Active Steering	Existing	44 tonnes
4	+2.05m	2 Self Steer Axles	Existing	44 tonnes
5	+2.05m	1 Command Steer Axle	Existing	44 tonnes
6	+2.05m	2 Command Steer Axles	Existing	44 tonnes
7	+2.05m	Active Steering	Existing	44 tonnes

47. Traffic forecasts are on the basis that the rail freight sector continues to utilise existing length intermodal units up to 2025 (i.e. 13.6m or 45ft). In this case, the road haulage market would benefit from the greater payload capacity offered by the introduction of longer semi-trailers, but the rail freight sector would not. This helps to identify any 'modal switch' impact as a result of introducing longer semi-trailer equipment, but with rail not taking advantage of the additional length opportunities. However, in an alternative scenario reported in Annex 6, the modelling was repeated with longer intermodal units being operated by the rail freight sector, enabling rail also to obtain efficiency benefits from the introduction of LSTs.

48. The core results for +1.0m and +2.05m LSTs are presented in this Impact Assessment for the options shown in Table 1a. However, the Impact Assessment also presents some important alternative scenarios and sensitivity tests in the Annexes. Annexes 3 and 4 explore the sensitivity of results to variations in underlying assumptions about the characteristics and take-up of the market for LSTs, while Annex 5 considers the effect of limiting LSTs to single decks (nominal height 4.0m).

49. These options and their alternatives can be grouped in terms of the ‘regulatory options’ (ii) match existing standards / (iii) match existing performance described under the ‘Vehicle Performance and Technology’ section above. Table 1b maps the modelled options (including those in Annexes 5 and 6) to the regulatory possibilities. The Existing Standards Regulatory Option contains more than one reported modelled option. The modelled Option labels 1-7 from Table 1a are used throughout this report to refer to test runs based on use of existing length intermodal units on rail, with labels 8-14 used for the corresponding Options for test runs based on use of longer intermodal units on rail (Annex 6).

Table 1b: Summary of how Modelled Options relate to Regulatory Options

Regulatory Option	LST Length Change		4m (Single-deck) LST Height Limited?	Complementary Longer Inter Modal Units?
	+1.00m	+2.05m		
Match Existing Standards	1, 2	4, 5, 6	No	No
	1, 2 (Annex 5)	4, 5, 6 (Annex 5)	Yes	No
	8, 9 (Annex 6)	11, 12, 13 (Annex 6)	No	Yes
Match Existing Performance	3	7	No	No
	3 (Annex 5)	7 (Annex 5)	Yes	No
	10 (Annex 6)	14 (Annex 6)	No	Yes

Rejected Options: Intermediate Length Options

50. As explained at the beginning of this section, length increases of over 2.05m have not been considered because this would provide an articulated HGV with an overall load-platform length greater than that of the rigid/draw-bar trailer combinations permitted across the EC. The two length increases studied have been picked because they allow full extra rows of pallets to be conveyed. Any other length increases have not been included because for the large majority of the traffic conveyed in the relevant sectors they would provide no benefit, only costs. A length increase of between 1.0m and 2.0m would only allow an additional one row of standard ISO pallets to be conveyed. Similarly, length increased below 0.95m would not increase the pallet capacity. As a result, other intermediate length increases have not been considered further. Although these fixed increments would not be relevant to non-palletised loads, these are likely to be a small proportion of LST use.

3. Costs and Benefits

Introduction

51. This section provides a summary of the economic assessment undertaken. It provides an explanation of the methodology adopted together with the key assumptions applied and data sources utilised. The overall aim of the economic assessment is to estimate the likely cost savings (or increased costs) that would accrue to the freight transport industry, both rail and road, following the introduction of longer semi-trailers, including quantifying any modal shift effects between rail and road transport. Importantly, the assessment also considers rail and road transport externalities (such as congestion) on wider society and the environment arising from changes in the transport of freight due to the introduction of LSTs.

52. The assessment excludes taxation and subsidy, including Fuel Duty, Vehicle Excise Duty, and Mode Shift Revenue Support grant, as overall these impacts are transfers and make no difference to the net present value of the options.

53. For this assessment, the Present Values (PV) are calculated for the fifteen year period 2011 to 2025. The discount factor is 3.5%. A 15 year period has been chosen because this is the earliest time at which the majority of the HGV fleet in existence today will have been replaced (on average HGVs have a lifetime of 7-10 years but a significant proportion continue until 15 years).

54. A summary of the overall costs and benefits for Options 1 to 7 is provided in the "Summary: Analysis & Evidence" Tables on pages 2-15. The Total Cost entry appearing in these Tables comprises the net transport industry (road and rail) capital and operating costs. The Annual Average Cost and Benefit is that for the period 2011-2025 (not discounted).

55. The external cost changes for road and rail are attributed either to the Costs row (where the external costs increase), or to the Benefits row (where the external costs decrease), as appropriate for each Option. The method of calculation of these costs is presented below.

Constructing the baseline: Identifying Key Market Sectors

56. The first task in an economic assessment is to construct the baseline from which other options are assessed. In this case this first requires identifying those sectors of the inland logistics market which potentially might utilise longer semi-trailer equipment (i.e. would derive cost and other benefits), described below. The next stage is to quantify and monetise that market so that alterations to it can be assessed – the following sections explain the approach step by step.

57. The sectors that are unlikely to be affected by the longer semi-trailer proposition are summarised in Table 2.

Table 2: Commodities/Operations Not Included in Assessment

Sector/Operation	Commodities	Notes
Bulk Liquid	Petroleum Spirit, Gas Oil, Water, Beer, etc	Currently weight constrained. If permitted, load could be increased within existing length regulations.
Dry Bulk Tipper	Coal, Granite (crushed), Gravel, Sand (dry)	Ditto
Flat-bed Semi-Trailer	Semi-bulk commodities: Steel, Aluminium Alloy, Redwood, Canadian Pine	Ditto
International Traffic	Roll on/Roll off Ferry, Channel Tunnel	Longer semi-trailers will be confined to domestic flows only.
Maritime Containers	Deep sea containers (40'/12.2m) and Short-sea (45'/13.75m).	Can be carried within existing regulations
Rigid Vehicles and Shorter Trailers	Restricted access operations	Can already upgrade within existing regulations

58. Having eliminated the above operations/markets, this effectively leaves shippers of lighter weight palletised consumer goods (including goods in roll cages), general cargo and mail/parcels as the

market sectors that potentially would take advantage of the additional cargo capacity that longer semi-trailers will provide. Within this sector of the market, operators generally utilise existing maximum length goods vehicles, either curtain-sided, box-body (including reefer) or double-deck, as follows:

- 4x2 tractor unit and twin-axle semi-trailer (maximum 34 tonnes gvw);
- 4x2 tractor unit and tri-axle semi-trailer (maximum 40 tonnes gvw);
- 6x2 tractor unit and tri-axle semi-trailer (maximum 44 tonnes gvw); and
- Rigid and draw-bar trailer equipment (maximum 44 tonnes gvw).

59. Vehicles conveying these types of commodities are often volume constrained, i.e. they reach their 'cube' capacity well before the maximum gross vehicle weight limit. Mean cargo loads are around 600kg per pallet, meaning that a pallet stacked to 1.8m would have a density of around 277kg per cubic metre. Even at 300kg per cubic metre a standard 13.6m semi-trailer (4m external height) would reach the cube capacity before the maximum gross vehicle weight limit.

60. Taking the above into account, this implies increased vehicle length would benefit movements of consumer type cargo undertaking the following flows:

- Factories to National Distribution Centres (NDCs) and Regional Distribution Centres (RDCs)
- Flows between NDCs and RDCs;
- From NDCs to retail stores;
- From RDCs to retail stores;
- Mail/parcels;
- Palletline trunking operations; and
- Low density industrial products moving between factories.

61. However, the shipment of lighter weight palletised consumer goods is also a key and growing market sector for domestic intermodal rail freight. This is particularly the case for flows between Midlands NDCs and RDCs and Scotland. As new rail-linked warehousing developments are created, shorter distance flows by rail within England and Wales are also likely to become more viable. Forecasts produced by the Freight Transport Association / Rail Freight Group (FTA/RFG) and by the rail freight operators suggest that domestic intermodal rail freight is likely to be one of the largest growth sectors over the medium to longer term. If the road haulage sector were to gain significant competitive benefits from the introduction of longer semi-trailers, this may result in some intermodal traffics switching to road transport, or to traffics that would have transferred to rail remaining on road. It has therefore been vital that the study fully assess the potential impact on the rail freight sector, including the cost and viability of rail freight services and modal shift.

Constructing the baseline: Quantifying the Current Market

62. The Continuing Survey of Road Goods Transport (CSRGT) database, containing data on tonnes lifted, vehicle-kilometres and tonne-kilometres, was used to quantify the markets and sectors identified above as being potentially relevant for LSTs. A total of four years (2004-2007) combined data was supplied by DfT in order to minimise potential dataset gaps and lessen the risk of being able to identify individual flows and companies. An average (mean) of the four years data was used to represent current road freight activity.

63. Table 3 presents current annual road goods vehicle activity in Great Britain by vehicle type, in terms of tonnes lifted and tonne-kilometres, for all commodities.

Table 3: Current Annual Road Goods Vehicle Activity

	000s tonnes lifted	million tonne-kilometres
2 axles, rigid	213,838	12,413
3 axles, rigid	189,720	7,870
4 axles, rigid	388,155	11,785
Other, rigid	6,851	248
2 axles lorry + 1 axle trailer	623	30

	000s tonnes lifted	million tonne-kilometres
2 axles lorry + 2 axles trailer	7,871	1,034
2 axles lorry + 3 axles trailer	4,792	785
3 axles lorry + 2 axles trailer	10,045	1,136
3 axles lorry + 3 axles trailer	9,009	951
Other, lorry + trailer	4,085	464
2 axles road tractor + 1 axle semi-trailer, artic	4,204	291
2 axles road tractor + 2 axles semi-trailer, artic	51,595	6,255
2 axles road tractor + 3 axles semi-trailer, artic	146,921	18,292
3 axles road tractor + 2 axles semi-trailer, artic	14,449	1,433
3 axles road tractor + 3 axles semi-trailer, artic	730,984	91,231
Other, road tractor + semi-trailer, artic	9,700	1,217
Total	**1,792,840**	**155,436**
% Rigid	45%	21%
% Rigid and draw-bar	2%	3%
% Artic HGVs	53%	76%

Source: CSRGT 2004-7

64. The analysis shows that articulated tractor unit/semi-trailer combinations account for around 53% of the road haulage market in terms of tonnes-lifted and 76% of the market when expressed as tonne-kilometres. This suggests that semi-trailers have a significant part of the total market, particularly for the longer distance trunk activities. It also highlights that rigid and draw-bar combinations currently only have a very small market share.

65. Taking the above conclusions into account concerning the identified in-scope market likely to require or adopt longer semi-trailers, the CSRGT data was further filtered to remove liquid and dry bulk products, semi-bulk commodities and all goods moved in rigid HGVs and single-axle articulated combinations. Table 4 shows the result.

Table 4: Current Road Goods Vehicle Activity – Articulated and Rigid/Draw-bar

	000s tonnes lifted	million tonne-kilometres
2 axles lorry + 2 axles trailer	5	681
2 axles lorry + 3 axles trailer	955	162
3 axles lorry + 2 axles trailer	3,095	382
3 axles lorry + 3 axles trailer	598	56
Other, lorry + trailer	0	0
2 axles road tractor + 2 axles semi-trailer, artic	41,701	5,364
2 axles road tractor + 3 axles semi-trailer, artic	93,780	12,029
3 axles road tractor + 2 axles semi-trailer, artic	10,160	1,064
3 axles road tractor + 3 axles semi-trailer, artic	275,487	41,163
Total	**430,834**	**60,901**
% Rigid/draw-bar	2%	2%
% Artic HGV	98%	98%
% all traffic lifted/moved	24%	39%

Source: CSRGT 2004-7

66. The analysis shows that lighter weight palletised, general cargo and mail/parcels moved in existing maximum length equipment currently comprise around 24% of the road haulage market in tonnes-lifted and 39% in tonne-kilometres, i.e. they have an above-average length of haul. Again, it is obvious that rigid and draw-bar combinations currently occupy only a very small market share.

67. The initial outputs produced were a record of all road freight activity measured by annual grossed tonnes lifted, vehicle-kilometres, tonne-kilometres and vehicle type. Vehicle trips associated with each record were estimated using the vehicle-kilometres divided by the distance derived from the

tonnes and tonne-kilometres data. For records with zero tonnes, distances were taken from the zone-to-zone average distance.

68. This data was then further filtered to extract only records of freight activity by the vehicle and trailer/semi-trailer combinations modelled above and for the identified markets and sectors and for the following modes of appearance distinguished in the CSRGT database:

- Other Freight Containers including Stillages;
- Palletised goods;
- Pre Slung goods;
- Roll Cages;
- This code is not allocated, use for empty; and
- Other cargo types.

69. Outputs were also divided into the following classifications:

- Volume constrained;
- Weight constrained; and
- Neither volume nor weight constrained.

70. While most bulk and semi-bulk cargoes generally are weight constrained, it may be the case that there are some niche flows and commodities within these sectors that are volume constrained. A further filter was therefore undertaken to identify and quantify any other commodities not listed above which are volume constrained and are moved on pallets, roll-cages, pre-slung and other containers/stillages.

71. The principal output produced was a record of current road freight activity in the identified market/sectors as follows (Baseline Output):

- Annual tonnes lifted;
- Annual tonne-km;
- Annual vehicle-km;
- Annual vehicle trips;
- Vehicle type;
- Commodity and cargo type; and
- Volume or weight constrained or neither.

72. The domestic intermodal rail freight market was identified as the key competitor sector. In addition, therefore, the domestic intermodal rail market for 2009 was also quantified using raw Network Rail billing data (processed by MDS Transmodal). From these results, it was possible to quantify total domestic unit load traffic (road and domestic intermodal traffic combined) within the identified markets.

Operating Cost Models: baseline and policy options

73. Operating cost models were developed for existing goods vehicles and trailer/semi-trailer combinations, for various longer semi-trailer options and for domestic intermodal rail freight services. A key component of the *MDS Transmodal GB Freight Model (GBFMv5)* is a series of operating cost models for goods vehicles and rail freight which replicate rates in the market and explain mode choice by route. These models have been further developed and extended specifically for this assessment, to reflect existing operating conditions and operations in future years with both existing length semi-trailers and potential longer semi-trailer equipment. The cost models have been developed for the following tasks:

- To compare the capital costs and operating costs of existing tractor unit/semi-trailer combinations with longer semi-trailer equipment;

- To compare the operating costs of longer semi-trailer equipment with intermodal rail freight (assess the cost and viability of rail freight services with longer semi-trailers);
- As an input component to the various traffic forecasts (to assess the modal shift impact and externalities); and
- To estimate the total annual operating costs of road freight activity and rail freight in the identified sectors and markets, both for the current year and forecast years with various combinations of longer semi-trailers.

74. Based on the markets and sectors identified and informed by the CSRGT, cost models were developed for the most popular vehicle combinations in the identified sectors and markets, accounting for around 98% of tonnes lifted. All vehicle combinations are based on curtain-sided trailers/semi-trailers used for transporting general cargo, palletised goods, roll-cages and mail/parcels. All the individual cost components and assumptions which form the basis of the models have been collected from a number of robust sources, including industry survey results and actual published costs, including:

- Motor Transport Cost Tables – the weekly road transport journal publishes a twice yearly survey of goods vehicle operating costs which are a representative reflection of actual industry operating costs;
- RHA Costs – the Road Haulage Association publishes an annual survey of its members' operating costs;
- Government departments and agencies – Taxes and other costs charged by the Government are published by the Treasury and DVLA; and
- Published costs from other sources, for example AA online for fuel prices, suppliers of tyres etc.

75. In addition, capital costs of equipment and fuel consumption rates were sourced from industry during the evidence gathering exercise. These have been used to validate these particular model components. Fuel consumption rates have also been verified by TRL.

76. The principal outputs produced from the models are as follows (Baseline Output):

- The capital costs of tractor unit, rigid, and trailer/semi-trailer equipment;
- Fixed operating costs – total per annum (equated as per operating hour) based on 2,750 operating hours per annum (11 hours per day, 5 days per week and 50 weeks per year);
- Running costs – per kilometre (km);
- Total operating cost per km – assuming an annual distance operated of 130,000km; and
- Cost per pallet-km – total operating cost per km divided by the pallet capacity of the vehicle combination type.

77. All the individual cost elements contained in the models are in constant (2009) prices through to 2025, with the exception of fuel costs and drivers' wages. *WebTAG Unit 3.5.6* (issued by DfT in April 2009) and *HM Revenue & Customs Hydrocarbon Oils Duty Rates note* (April 2009) were used to estimate the value of these costs in real terms going forward for each forecast year.

78. In order to estimate the future costs for longer semi-trailers, the relevant cost models for existing maximum length goods vehicles in the forecast years 2015, 2020 and 2025 were amended to reflect the following:

- The higher capital costs of longer semi-trailers, resulting from the additional length and steering axle technology; and
- Higher fuel consumption rates due to the additional tare weight associated with the extra length and axle technology and extra aerodynamic drag.

79. It was assumed that all other capital and operating costs in the forecast years would be the same as for existing maximum length goods vehicles. Based on TRL evidence, capital costs are assumed to increase as shown in the bullets and table below.

- Length at standard height – an additional £514 per metre length increase;
- Length at 4.9m height – an additional £590 per metre length increase;
- Self-steer axles +£2,300 per axle;

- Single command-steer axle +£4,000 per semi-trailer;
- Two command-steer axles +£6,600 per semi-trailer; and
- Active-steer technology +£6,000 per semi-trailer.

Table 4a: Additional capital costs per trailer

Option	Trailer Length	Axle Type	Additional cost above current maximum length semi-trailer
1	+1.00m	Fixed	£514 - £590
2	+1.00m	Single Self Steer	£2814 - £2890
3	+1.00m	Active Steering	£6514 - £6590
4	+2.05m	2 Self Steer Axles	£5654-£5810
5	+2.05m	1 Command Steer Axle	£5054-£5210
6	+2.05m	2 Command Steer Axles	£7654-£7810
7	+2.05m	Active Steering	£7054-£7210

80. Fuel consumption rates were verified by TRL and reflect a penalty of around 2.8% (depending on trailer Option) compared with the fuel consumption rates of existing length vehicles. All other costs remain as for existing vehicles; they are constant into the future except for fuel costs, fuel efficiency and wage changes, to which the same adjustments as for existing length vehicles were applied. Again, costs for years 2015, 2020 and 2025 are quoted in constant (2009) prices.

81. Operating cost models were also required for rail freight domestic intermodal flows. The intermodal rail freight model (a component of the GB Freight Model) was developed and extended specifically for this assessment, to reflect existing operating conditions and operations in future years. The model is based on a Class 66 diesel locomotive hauling a rake of Megafret intermodal platform wagons together with the use of open access terminals.

82. Rail freight operating costs can be divided into four broad categories, namely:

- Locomotive traction costs;
- Wagon costs (including intermodal unit costs);
- Track Access Charges; and
- Terminal costs.

83. These categories are reflected in the structure of the cost model. The individual cost components were obtained from a number of sources, including costs in the public domain. They were validated during evidence gathering with the rail freight industry and by cost data held by DfT used to value the current Mode Shift Revenue Support (MSRS) grants. The same WebTAG growth rates, described above for the road cost models, were adopted.

Total Annual Operating Costs: baseline

84. The next stage in the analysis was to estimate the current total annual operating costs of road freight activity in the identified sectors and markets (i.e. for those vehicle combinations and commodities which might switch to longer semi-trailer equipment). The total annual cost of moving goods by domestic intermodal rail freight was also calculated. These combined figures represent the total cost to industry of moving goods in the identified sectors and domestic intermodal rail freight, and produce the base-line (Do Nothing) cost against which options/scenarios can be compared. The following data was known from CSRGT for road transport by vehicle type and commodity:

- Annual vehicle-km;
- Annual vehicle trips;
- Fixed cost per operating hour; and

- Running cost per km.

85. Dividing annual *vehicle-km* by annual *vehicle trips* allowed an estimation of *mean kilometres per vehicle trip* to be calculated (by vehicle type and commodity). Assuming an average vehicle speed of 65km/h, this allowed an estimate of mean driving time per vehicle trip (by vehicle type and commodity) to be calculated. Adding a further two hours to each trip to account for loading/discharge etc, a *mean trip time per vehicle trip* was calculated (by vehicle type and commodity). From this data, an estimate of the *mean operating cost per vehicle trip* (by vehicle type and commodity) was calculated, as follows:

- Mean trip time per vehicle trip x fixed cost per operating hour; plus
- Mean kilometres per vehicle trip x running cost per kilometre; equals
- Mean operating cost per vehicle trip.

86. The *mean operating cost per vehicle trip* (by vehicle type and commodity) was multiplied by the *annual vehicle trips* to produce the *total annual operating costs* for that vehicle type and commodity. The *total annual operating costs* for each vehicle type and commodity were then summed to produce the *total annual operating costs* in the identified sectors and markets.

87. Similarly, the total annual cost of moving goods by domestic intermodal rail freight was produced.

Traffic Forecasts and Mode Choice: baseline

88. The next stage in the assessment was the production of traffic forecasts for both road freight and domestic intermodal rail freight in the identified markets and sectors on the basis that longer semi-trailer equipment is not introduced (Do Nothing Option). Two forecasting tools were utilised:

- The MDS Transmodal GB Freight Model version 5 (GBFMv5); and
- The GB intermodal forecasting module.

89. *GBFMv5* is an established analysis and forecasting tool for freight traffic. It has been audited by the ITEA division of DfT and it has been adopted by the DfT as part of the National Transport Model. The GBFM Version 5.0 Report, submitted to DfT in March 2008 (available to download from dft.gov.uk), fully documents latest version of GBFM. The *GB intermodal forecasting module* is an add-on tool to the GBFMv5. This forecasting tool was utilised to produce national rail freight forecasts for the DfT in Autumn 2009.

90. DfT required that the rail forecasting methodology and assumptions for this project should ideally be consistent with the national rail freight forecasts. As a result, the domestic intermodal elements of these forecasts were reproduced for this project (in tonnes-lifted and tonne-kilometres). *GBFMv5* was utilised to establish the growth rates (scaling factors) for total domestic unit load traffic in 2019 for the identified markets (road and domestic intermodal rail combined), for both tonnes-lifted and tonne-kilometres. These scaling factors were then applied to the current total domestic unit load traffic to forecast tonnes-lifted and tonne-kilometres in 2019. Forecast years 2015, 2020 and 2025 were then interpolated and extrapolated from the 2019 forecasts.

91. The forecasts assumed that by 2019 significantly more intermodal rail traffic will be to/from terminals with warehousing on-site (i.e. no need for expensive local road hauls), thereby eliminating any need for grant funding.

92. Although the national rail freight forecasts did not use WebTAG assumptions, they were broadly consistent with the main WebTAG principles. However, as a sensitivity test, the forecasts were re-run based directly on WebTAG assumptions for future changes in fuel costs and driver wage rates. The results were approximately the same, albeit the WebTAG compliant forecasts produced a marginally higher tonnes-lifted output.

93. By subtracting rail tonnes-lifted from total tonnes-lifted, the amount of cargo moved by road transport was calculated (and similarly for tonne-kilometres). It was assumed that the proportion of cargo conveyed in the different HGV types (including 4.9m tall semi-trailers) would remain constant.

94. The process was undertaken on the basis that transport costs form a small proportion of the overall total cost of goods. As a result, total cargo demand is constant with respect to changes in modal transport costs, i.e. it was assumed that there would be no traffic generation effect. For example, as

road transport becomes more expensive relative to rail, there is mode switch away from road freight to the intermodal sector, though the total amount of cargo lifted will remain constant.

95. The principal output produced was a forecast of domestic unit load road freight activity in 2015, 2020 and 2025 in the identified market/sectors, on the assumption that longer semi-trailers are not introduced, as follows:

Road freight traffic:

- Annual tonnes lifted;
- Annual tonne-km;
- Annual vehicle-km;
- Annual vehicle trips;
- Vehicle type;
- Commodity and cargo type; and
- Volume or weight constrained or neither.

Domestic intermodal rail freight:

- Annual tonnes lifted;
- Annual tonne-km

Total domestic unit load freight:

- Annual tonnes lifted;
- Annual tonne-km

96. A revision to rail forecast growth developed by Network Rail had the effect of reducing the rail sector growth by 25%.

Traffic Forecasts for 2015, 2020 and 2025: baseline

97. Under the Base Case option, the in-scope market grows by 32.4 million tonnes or +7.5% between 2009 and 2025. Domestic intermodal rail freight is estimated to grow by 732% to 14.3 million tonnes-lifted by 2025 (from 2.0 million tonnes in 2009), with road freight to grow by 4% increasing from 430.8 million tonnes-lifted (in 2009) to 450.9 million tonnes lifted by 2025. 99.5% of in-scope freight is road based in 2009 and 96.9% is road based in 2025. The volume of growth is illustrated in Figure 1.

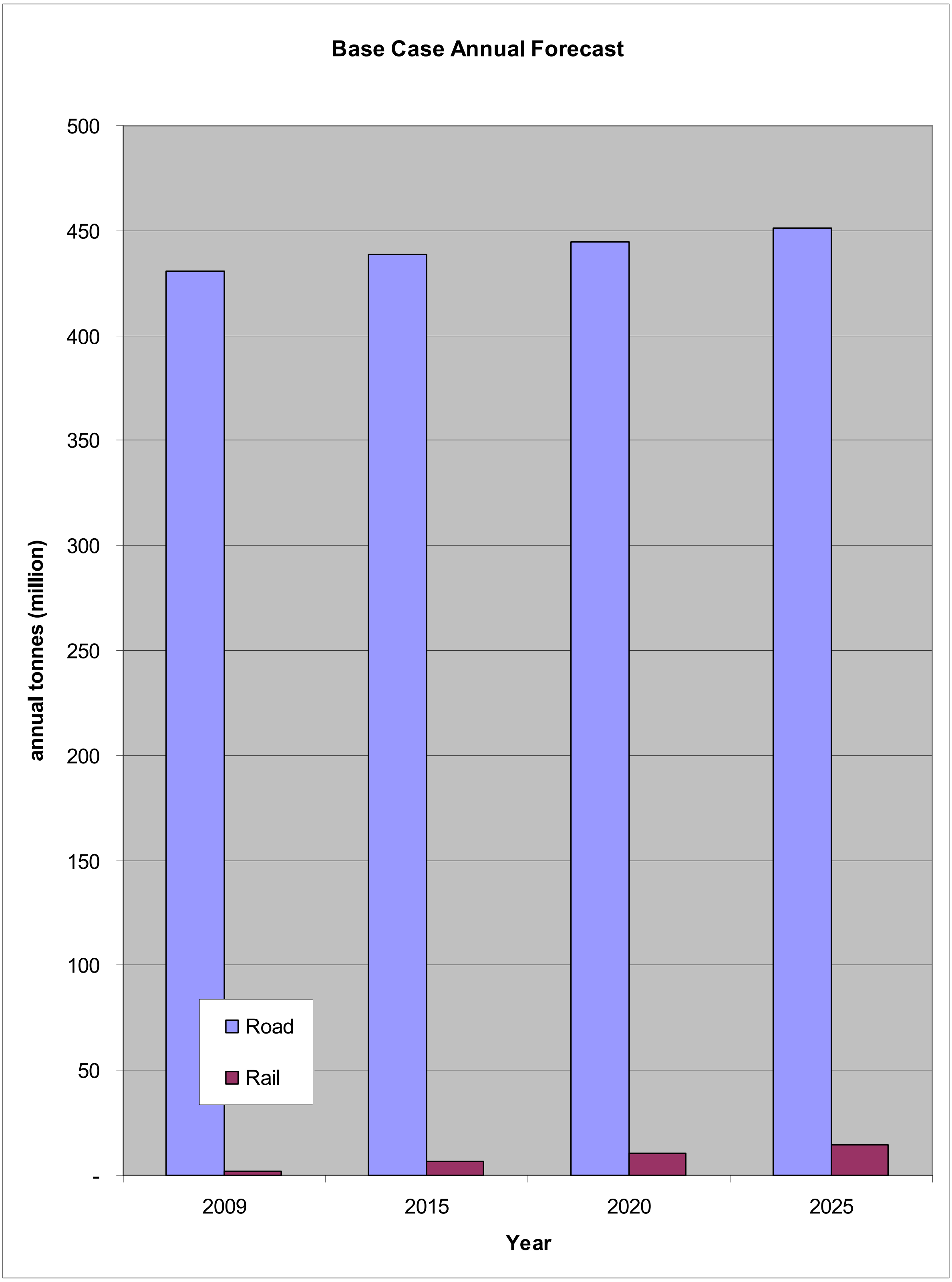


Figure 1: Base Case Annual Forecast of In-scope Freight (Million Tonnes pa)

98. The large growth in domestic intermodal rail freight forecast under the Base Case option by 2025 is primarily due to the assumed development of distribution centre floorspace at rail-linked sites. Developing distribution centres at rail-served sites reduces the rail-road transfer costs, and the consequent network effect of these developments results in rail freight gaining additional traffics (at the expense of the road haulage market), particularly over medium-distance flows. As noted above, the intermodal forecasts are consistent with these recently undertaken for DfT-Rail.

99. The next stage in the assessment was the production of traffic forecasts in the identified markets and sectors on the basis that longer semi-trailer equipment is introduced. This has taken into account the following:

- The differing types of longer semi-trailer equipment which may be introduced i.e. 14.6m or 15.65m, self-steer, active-steer etc;
- The use of existing length intermodal units on domestic intermodal flows i.e. 13.6m/45ft; and
- The potential introduction of longer intermodal units on domestic intermodal flows i.e. 14.6m or 15.6m (results in Annex 6).

100. The traffic forecasts undertaken for the Best Estimate scenario were on the basis that the rail freight sector continues up to 2025 to utilise existing length intermodal units (i.e. 13.6m or 45ft). In this case, the road haulage market would benefit from the greater payload capacity (and therefore efficiency savings) offered by the introduction of longer semi-trailers, but the rail freight sector would not. This exercise will therefore help identify any modal switch impact as a result of introducing longer semi-trailer equipment, but with rail not taking advantage of the additional length opportunities.

101. The model run was then repeated but with longer intermodal units being operated by the rail freight sector (in this case all operators utilising longer units i.e. 100% take-up). In brief, both modes would benefit from the greater payload capacity offered by the introduction of longer semi-trailers.

Longer Semi-Trailer Take Up: policy options

102. A 100% take-up of longer semi-trailer equipment in the identified road freight markets is unrealistic. The Impact Assessment "Summary: Analysis & Evidence" page requires a *Best Estimate (central case)* to be presented for each Option, together with a Low-High range for NPV. The take-up rate of LSTs is clearly crucial to the economic impact. Therefore, the Best Estimate, Low and High forecasts were based on the assumed level of LST take up.

103. To understand the likely take-up of LSTs, discussions were held with a wide range of business organisations and of operators, via the Freight Trade Association and the Road Haulage Association. This gathered valuable evidence, discussed below, that quantified using real case studies supplied by individual firms, the types of markets in which LSTs would compete and their likely take-up.

104. In order to estimate the level of take up, it is important to appreciate that in the sectors and markets identified, goods are generally lifted two or three times along the supply chain before being purchased by end users (consumers), as follows:

- NDC to RDC, then RDC to retail outlet;
- Producer to NDC, then NDC to RDC, then RDC to retail outlet; and
- Producer to RDC, then RDC to retail outlet.

105. Inter-depot trunking movements (i.e. not deliveries to retail outlets) are generally over medium to long distances, being from production sites nationwide or from Midlands based NDCs to depots in other regions. Also, such flows tend to be multiple full-load movements undertaken on existing maximum length goods vehicles, principally 13.6m semi-trailers, both standard height and, increasingly, double-deck equipment (between facilities which can accommodate such vehicles). For example, some food producers can often despatch 10-15 full-length semi-trailers per day into a single supermarket RDC.

106. Conversely, flows from RDCs to retail outlets are generally over much shorter distances. RDCs are located close to the main conurbations of Britain in order to minimise re-distribution transport costs and provide timely stock replenishment. In addition, store deliveries can be undertaken in a range of goods vehicle sizes, depending on volumes delivered and access restrictions.

107. A broad conclusion that can be drawn from the above, therefore, is that goods being moved on inter-depot trunking operations are highly likely to transfer to longer semi-trailers, while utilisation on retail store deliveries is likely to be more varied. This conclusion is supported through views and data collected during evidence gathering. Traffic data supplied by shippers suggests that most inter-depot trunking operations are multiple full-load movements and will therefore benefit greatly from the introduction of longer semi-trailers, principally through a reduction in total HGV trips. A switch to LSTs is likely to be widespread. In addition, some retail outlets have a high throughput of trade and could physically accommodate a larger vehicle, for example a hypermarket store in an out-of-town

retail park. Again, views and evidence supplied to date suggests that such flows will benefit greatly from the introduction of longer semi-trailers and that a switch to longer equipment will occur.

108. However, many town centre retail outlets and smaller metro or express store formats either cannot accommodate existing maximum length HGVs, or their trade volumes do not warrant the use of a large vehicle. Shorter single-axle articulated or rigid vehicles therefore serve such stores. In such cases, the use of LSTs is less likely.

109. The CSRGT was used to quantify the identified markets in which LSTs could compete. It only records goods each time they are lifted by road transport. It is therefore not possible to identify directly at which stage in the supply chain goods are lifted. However, the CSRGT does allow the following to be identified:

- Distance of flows;
- Loads which are volume constrained i.e. reach cube capacity before gvw;
- Loads which are weight constrained i.e. reach gvw before cube capacity; and
- Loads that are neither weight nor volume constrained.

110. The CSRGT data (current flows by road transport) was interrogated and all goods vehicle flows in the identified markets and sectors were further divided into six categories. Table 5 summarises the assumptions made and applied to all Options. The percentage of conventional HGV-km in each category in 2009 is indicated, showing that Category 1 and Category 3 are the most significant.

Table 5: Summary of LST Take Up Input Assumptions for each Scenario

Scenario			Conventional HGV-km in 2009	Low	Best Estimate	High
				Distance threshold		
			%	150km	120km	100km
Category	1	Volume-constrained but not weight-constrained travelling distances greater than threshold	34.1%	50%	90%	100%
	2	Volume-constrained but not weight-constrained travelling distances less than threshold	8.4%	0%	45%	75%
	3	Not volume or weight constrained travelling distances greater than threshold	34.3%	50%	90%	100%
	4	Not volume or weight constrained travelling distances less than threshold	12.3%	0%	45%	75%
	5	Weight constrained travelling distances greater than threshold	8.9%	0%	20%	25%
	6	Weight constrained travelling distances less than threshold	2.0%	0%	5%	10%

111. As before, outputs were in tonnes-lifted, tonne-km, vehicle-km and vehicle trips, etc. The 120km threshold was based on the average distance between Midlands NDCs and the nearest RDCs in the adjacent South East region (the nearest region to the Midlands).

112. Categories 1, 3 and 5 can be considered as generally representing inter-depot trunking operations, whereas Categories 2, 4 and 6 are shorter final delivery to store type flows. The estimated percentage switch to longer semi-trailers in each category was then estimated principally based on data collected during the evidence gathering exercise.

113. Traffic data supplied by shippers suggests that the vast majority of loads in Categories 1 and 3 would switch to longer semi-trailer equipment, as significant benefits can be achieved. Consequently, *90% of all loads* in Categories 1 and 3 are assumed to switch to longer semi-trailer equipment. This would reflect the anticipated widespread switch but acknowledge that some shippers would continue to use existing equipment and that sub-contracted hauliers may continue to use 13.6m semi-trailers due to their lower tare-weight (i.e. vehicle weight when unloaded).

114. Longer semi-trailers will have a heavier tare-weight. Given that there is going to be no associated increase in the gvw restrictions (i.e. no 'payload neutral' option was considered), loads which are weight constrained are likely to continue being moved in existing length equipment given their greater weight payload, particularly where shippers utilise dedicated semi-trailer equipment. However, some of these loads may transfer to longer semi-trailers given that sub-contracted hauliers may have switched to operating fleets of longer equipment. As a result, *20% of all loads* in Category 5 were assumed to switch to longer semi-trailer equipment and 80% continue to move on existing type semi-trailers.

115. Rates of switch in Categories 2 and 4 were informed by data supplied by major retailers that suggested 40-50% of all loads in these Categories could potentially switch to longer semi-trailers. As a result, 45% of all loads in Categories 2 and 4 were assumed to switch to longer semi-trailers.

116. For Category 6 a nominal *5%* of traffic was assumed to switch to longer semi-trailers.

117. The reason for having these different Categories is to acknowledge that some in-scope operations are more prone to switching than others and that a uniform percentage switch across all traffic affected would be too simplistic. It could further be argued that a uniform percentage switch for the loads **within** each of the six categories is still a simplification. However, on balance, it was believed that this approach was sufficiently robust and reasonable, and that further complexity would have decreased clarity for little gain. Effectively, a percentage of vehicles within each category would switch to longer semi-trailers and therefore the remaining vehicles would retain the same characteristics they had before - e.g. average payload, distance band proportions, commodity proportions etc.

118. The overall differentiation into these categories was applied uniformly to all Options.

119. When converting loads to longer semi-trailers, the existing tonnes per vehicle ratio was scaled up (or down) accordingly:

- For volume-constrained but not mass-constrained HGVs, we assumed 90% of the potential improvement, e.g. for a standard HGV going from 26 to 30 pallets, we've assumed +13.8% payload (i.e. 90% of 15.4%);
- For neither volume nor weight constrained HGVs, we assumed 50% of the potential improvement, e.g. for a standard HGV going from 26 to 30 pallets, we've assumed +7.7% payload (i.e. 50% of 15.4%) equivalent to 28 pallets;
- For weight constrained HGVs, we assumed a worsening of cargo per HGV, equal to the % loss of payload.

120. Sensitivity tests were carried out with respect to the rate of take-up (see Table 5); these are reported in Annex 4. For Low take up, the threshold distance was increased (from 120 to 150 kilometres) with the effect that the most likely take up categories will reduce in size, and the proportions switching in all Categories 1 to 6 were reduced. In the High scenario, the distance threshold was reduced (from 120 to 100 kilometres) and the proportions of take up in all Categories 1 to 6 were increased.

121. Each Option uses the same take up assumptions but will have a different result reflecting the relative attractiveness of the vehicle characteristics of that Option.

Total Costs with Longer Semi-trailers

122. The next stage in the analysis was to estimate the total annual operating costs of road freight activity for the forecast years in the identified sectors and markets on the basis that longer semi-trailer equipment is introduced as described above (Best Estimate, Low, High and Single-deck scenarios). The total annual cost of moving goods by domestic intermodal rail freight in the forecast years was also calculated. Essentially the combined figures will represent the forecast total direct cost to industry of moving goods in the identified sectors. They can then be compared with the future do-nothing scenario, enabling the change in transport costs over the medium/long term to be established given longer semi-trailers being introduced. Lower transport costs for the longer semi-trailer scenarios would therefore represent a direct cost benefit to industry, while higher costs would generate a cost penalty to industry.

123. One of the underlining rationales for longer semi-trailer equipment is that their additional cargo capacity will result in an overall reduction in the number of HGV trips and HGV kilometres nationally.

Given this outcome, we should expect the introduction of longer semi-trailer equipment to generate direct cost benefits to industry, when compared with a 'do-nothing' scenario.

124. Calculating the total annual operating costs of road freight activity in the forecast years 2015, 2020 and 2025 used the traffic forecasts described above along with the appropriate longer semi-trailer vehicle cost models (and appropriate existing length operating costs for traffic which does not switch).

Changes in externalities as a result of longer semi-trailers

125. In addition to internal freight industry costs, changes in road and rail operations through introduction of LSTs could impose external costs and benefits on society and the environment.

126. The Department for Transport has provided a methodology and cost values for marginal changes in both HGV-kilometres and train-kilometres (described in Annex 2).

127. The effect of congestion is an important component. DfT examined the results of a National Transport Model (NTM) to see how much the congestion values might have reduced due to the recession, and this yielded congestion value adjustments of:

- 2010: 83%;
- 2015: 80%,
- 2025: 83%.

128. Therefore, these adjusted values were applied to estimate congestion externalities.

129. The net road effect is a combination of changing volumes of HGV-km and LST-km, and the costs attached to each. The external costs and benefits from the introduction of LSTs were calculated for the following components:

- The change in HGV-km for conventional vehicles (the 'average articulated lorry' vehicle type used in the Department's external cost calculations);
- The change in LST-km;
- The change in train-km.

130. This assessment uses the GBFM based future year forecasts of the change of vehicle kilometres for each of the 66 road type combinations defined by:

- Region / nation [11 categories];
- Urban / rural [2 categories];
- Motorway / A-roads / Other roads [3 categories].

131. These calculations were made for the two road vehicle types (LSTs and Conventional HGVs), together with the change in rail usage in the case with and without the introduction of LSTs. The appropriate cost component value was applied to each change in vehicle kilometres and then the result summed across vehicle types / modes in order to calculate the external costs or benefits.

132. When carrying out these calculations there are some further aspects to be considered. The values have been calculated on a marginal basis and are hence only directly applicable to relatively small changes in HGV traffic levels. If the change is significant (non-marginal) then using the marginal external costs would over or under-estimate the congestion component of external cost values (for a decrease or increase in miles respectively). For a fall in lorry miles this arises because the congestion benefit will decline on removing each successive mile, and hence the average benefit of removing all the lorry miles will not be as large as the benefit of removing the first lorry. However, following sensitivity tests it is likely that the scale of this under or overestimation is insignificant for this proposal. For a 3-4% increase in traffic levels on relatively congested roads, it was found that the under-estimation would be between 5-7%. The impact of this issue will be largest on congested roads as the marginal costs of congestion rise steeply at higher levels of congestion. Hence the average impact is likely to be lower than this. In the later Table13, for all Options, except Option 1 with a 40t gvw restriction, there is an estimated reduction in road traffic in all years as a result of the introduction of longer semi-trailers. This reduction is estimated in 2020 to be around 1% for the 1m increase Options 2 and 3 and to be around 2.5% for the full 2.05m increase. The capture of traffic

by road from rail is more than offset by the reduction in road vehicles enabled by more efficient loading per longer semi-trailer.

133. For each external cost component, it was necessary to determine the appropriate value for the LST cost where this differs from that of the representative articulated vehicle. The approach adjusted the existing cost component to take account of the characteristics of the specific LST vehicle design under consideration. In some components, the LSTs were assumed to impose greater external costs than their conventional HGV counterpart (such as congestion), while in other components there was no change assumed (such as noise).

134. Table 6 summarises the cost component adjustments for LSTs.

Table 6: LST Externalities Adjustment Factors Compared to Conventional HGV

External Cost Component		Factor for +1.0m LST	Factor for +2.05m LST	Rationale
1	Congestion	1.020	1.041	Contribution to congestion increases in proportion to one-third of additional length above standard 16.5m articulated HGV.
2	Accidents	1.000	1.000	No significant difference estimated by TRL
3	Noise	1.000	1.000	No difference assumed
4	Local Air Pollution	Approx 1.028, varies between Options	Approx 1.028, varies between Options	Increase in emissions in proportion to increased fuel consumption (TRL research showed small increase owing to additional unladen weight and aerodynamic drag).
5	Climate Change	Approx 1.028, varies between Options	Approx 1.028, varies between Options	Increase in emissions in proportion to increased fuel consumption (TRL research showed small increase owing to additional unladen weight and aerodynamic drag).
6	Infrastructure	1.000	1.000	No difference assumed as gvw not changed.

135. There is no available body of empirical evidence on the impacts on congestion of the length increase of the LSTs, so it has been considered by assembling indirect evidence on how the impact would differ from a standard artic.

- Experience from the LST tests in Germany and Italy suggested that many of the public did not notice the increase in length of the test vehicles so LSTs are unlikely to have a disproportionately large impact on congestion.
- As is the case for standard large artics, the LSTs are likely to be relatively uncommon in dense urban areas. It is particularly in these types of areas that the length of tailbacks at junctions would be directly influenced by the length of the vehicle.
- In mixed traffic that is starting and stopping, as experienced in highly congested conditions, it will be the rate of acceleration and deceleration of the HGV relative to a light vehicle that matters - this rate is likely to be similar for LSTs and standard artics so little difference in impacts would be expected.
- In mixed fairly heavy traffic that is still running smoothly there should be a substantial gap between each moving vehicle for reasons of safety. The proportionate increase in total lane length required per LST, relative to that per standard artic, is likely to be quite small in comparison to the proportionate difference in their lengths; accordingly, the difference in their congestion impacts will be relatively small.

136. Drawing these strands together suggests that most of their driving time under reasonably congested conditions would be in circumstances in which the difference in impacts would be relatively small. Accordingly, a rough estimate of an increased impact of one-third the percentage increase in total vehicle length seems appropriate. (For Options 1, 2 and 3 the +1m length increase

implies a factor 1+(1.0/16.5)/3 = 1.020; Options 4, 5, 6 and 7 the +2.05m increase implies 1+(2.05/16.5)/3 = 1.041).

137. Sensitivity analysis on these factors was also conducted and reported in Annex 3.

Implementation costs

138. A relaxation of the existing Construction and Use Regulations to permit the operation of semi-trailers longer than those allowed today carries a requirement to notify the European Commission. Hence implementation would be by a two–stage approach; introducing a trial operating under the Vehicle Special Order (VSO) regime while the necessary clearances are sought and the legislative changes to the Regulations introduced.

139. In the interim period where longer vehicles would be subject to VSOs the Department would determine the terms and conditions that would apply to any vehicle operating under the VSO. The VCA would then draft a template VSO and agree this with the Department. The terms and conditions would be made freely available and Operators would then be able to apply for a VSO, which would require evidence to be provided that the appropriate requirements are met and a means of identifying the vehicle(s) - such as the registration / chassis number. The VCA would then verify the information provided by the applicant and if appropriate, issue a VSO to the operator specifying the vehicles so authorised for a period of time determined by policy leads.

140. The Department does not know the speed at which manufacturers could develop longer semi-trailers for operational use and therefore the number of VSOs likely to be applied for. Hence it is currently not possible to estimate the costs of this implementation period. The consultation document asks for information from consultees on the number of VSOs they would expect to apply for so that this element can be costed. This is the only option to allow immediate use whilst the work to change the regulations is undertaken, and is deregulatory in the same manner as the relaxation of the regulations would be. Not following this route would have the affect of delaying the impacts discussed. Following the consultation the Department will be able to assess whether the benefits of allowing early use outweigh the administration costs.

4 Summary of Costs and Benefits

Introduction

141. This section summarises the estimated annual costs and benefits and calculates their present values for the Best Estimate (central case) scenario. First, the change to total industry costs is presented for each option. Secondly, external social and environmental costs are presented for each component. These are presented as either Present Value Costs (PVC) or Present Value Benefits (PVB) in the "Summary: Analysis & Evidence" pages depending on whether they result in a cost or a benefit to society respectively. These are brought together for the calculation of Present Value (NPV) for each scenario.

142. This section describes the Best Estimate (central case) forecast using the Base Case forecast and LST take up assumptions described above. The results of sensitivity tests with respect to underlying assumptions are presented in Annex 3. Results for alternative Low and High take up scenarios are included in Annex 4. An alternative regulatory possibility is that LSTs are restricted to single-deck HGVs (nominally 4m height). This alternative scenario is presented in Annex 5, while Annex 6 presents the results from a scenario in which longer intermodal units are adopted by the rail freight sector.

Best Estimate Traffic Forecast

143. Table 7 presents a summary of the forecast tonnes lifted for the Base Case (Do Nothing) and for the longer semi-trailer Options 1 to 7 which reflect the use of existing length intermodal units on domestic intermodal flows.

Table 7: Best Estimate Summary Traffic Forecasts

	Domestic Intermodal Rail	**000s tonnes**				**+/- v Base Case**		
		2009	2015	2020	2025	2015	2020	2025
Option								
	Base Case	1,955	6,586	10,444	14,303			
1	14.6m Fixed Axles		4,636	6,871	9,105	-1,949	-3,574	-5,198
2	14.6m Single Self-steer Axle		4,636	6,871	9,105	-1,949	-3,574	-5,198
3	14.6m Active Steering		4,636	6,871	9,105	-1,949	-3,574	-5,198
4	15.65m 2 x Self-steer Axles		3,139	4,126	5,113	-3,447	-6,319	-9,191
5	15.65m 1 x Command-steer Axle		3,139	4,126	5,113	-3,447	-6,319	-9,191
6	15.65m 2 x Command-steer Axles		3,139	4,126	5,113	-3,447	-6,319	-9,191
7	15.65m Active Steering		3,139	4,126	5,113	-3,447	-6,319	-9,191
	Road Haulage	**000s tonnes**				**+/- v Base Case**		
		2009	2015	2020	2025	2015	2020	2025
Option								
	Base Case	430,834	438,361	444,633	450,906			
1	14.6m Fixed Axles		440,310	448,207	456,104	1,949	3,574	5,198
2	14.6m Single Self-steer Axle		440,310	448,207	456,104	1,949	3,574	5,198
3	14.6m Active Steering		440,310	448,207	456,104	1,949	3,574	5,198
4	15.65m 2 x Self-steer Axles		441,808	450,952	460,096	3,447	6,319	9,191
5	15.65m 1 x Command-steer Axle		441,808	450,952	460,096	3,447	6,319	9,191
6	15.65m 2 x Command-steer Axles		441,808	450,952	460,096	3,447	6,319	9,191
7	15.65m Active Steering		441,808	450,952	460,096	3,447	6,319	9,191
	Total Domestic Unit Load	**000s tonnes**				**+/- v Base Case**		
		2009	2015	2020	2025	2015	2020	2025
	All Options	432,789	444,947	455,078	465,209	0	0	0

Source: Longer Semi-trailers Feasibility Study and Impact Assessment Technical Report D5: Economic Assessment

144. The introduction of longer semi-trailers in the road haulage sector but with domestic intermodal continuing to use existing length units would result in a switch from rail to road freight transport. For

14.6m semi-trailers, domestic intermodal rail freight would be around 5 million tonnes-lifted lower in 2025 compared with the Base Case option (-36%). For 15.65m semi-trailers, domestic intermodal rail freight would be around 9 million tonnes-lifted lower in 2025 compared with the Base Case option (-64%).

145. It is concluded that, under these future operating conditions, the road haulage market would gain efficiency savings associated with the greater payload capacity offered by the introduction of longer semi-trailers, and the rail freight sector would not benefit from any efficiency savings. As a result, the road haulage sector is able to win traffic from domestic intermodal.

146. This Best Estimate scenario can be viewed as a worst case growth scenario for the rail industry. An alternative scenario is presented in Annex 6, in which the rail industry capitalises on the opportunity to use longer intermodal units in order to generate efficiency savings on rail similar to those achieved on road. In this alternative scenario the major reduction in domestic intermodal tonnage growth shown above for the Best Estimate scenario is entirely cancelled out, leading instead to a modest further growth in domestic intermodal relative to the major growth already within the base case. This alternative longer intermodal unit scenario can be viewed as a best case for domestic intermodal.

Estimated Total Transport Costs 2015, 2020 and 2025

147. Table 8 presents the estimated net annual operating costs (not discounted) in the identified (in scope) sectors in the forecast years 2015, 2020 and 2025 for the Base Case and Options 1-7 for the combined intermodal rail and road sectors. It then shows the change this represents for each option from the Base Case, showing the benefit derived from more efficient movement of freight. The costs in Table 8 represent the total cost to industry of moving goods by road and rail.

Table 8: Total Rail and Road Annual Operating Costs (£m)

Option	2015	2020	2025	Change 2015	Change 2020	Change 2025	% Change 2015	% Change 2020	% Change 2025
Base Case	£8,836	£9,322	£9,789						
1	£8,770	£9,272	£9,757	-£66	-£51	-£32	-1%	-1%	0%
2	£8,663	£9,159	£9,638	-£173	-£163	-£151	-2%	-2%	-2%
3	£8,706	£9,202	£9,682	-£130	-£120	-£107	-1%	-1%	-1%
4	£8,457	£8,958	£9,445	-£379	-£364	-£344	-4%	-4%	-4%
5	£8,452	£8,953	£9,440	-£384	-£369	-£349	-4%	-4%	-4%
6	£8,480	£8,981	£9,469	-£356	-£341	-£320	-4%	-4%	-3%
7	£8,512	£9,014	£9,502	-£324	-£308	-£287	-4%	-3%	-3%

Source: Longer Semi-trailers Feasibility Study and Impact Assessment Technical Report D5: Economic Assessment

148. The net change in costs to industry is the result of three combined effects. Firstly, a loss of rail mode share, compared to the Base Case, as shown in Table 7. The change in the volume of the rail market is shown in Table 9, together with the change in annual costs. However, it is noted that, despite loss of traffic, the rail sector remains significantly larger than in 2009 owing to the underlying large increase in the Base Case forecast described above.

Table 9: Change in Rail Mode Share and Annual Costs Compared to Base Case

	Domestic Intermodal Rail	**Mode Share tonnes (% Change)**			**Change in Annual Costs (£m)**		
		2015	2020	2025	2015	2020	2025
Option							
1	14.6m Fixed Axles	-30%	-34%	-36%	-£57	-£106	-£158
2	14.6m Single Self-steer Axle	-30%	-34%	-36%	-£57	-£106	-£158
3	14.6m Active Steering	-30%	-34%	-36%	-£57	-£106	-£158
4	15.65m 2 x Self-steer Axles	-52%	-60%	-64%	-£102	-£191	-£284
5	15.65m 1 x Command-steer Axle	-52%	-60%	-64%	-£102	-£191	-£284
6	15.65m 2 x Command-steer Axles	-52%	-60%	-64%	-£102	-£191	-£284
7	15.65m Active Steering	-52%	-60%	-64%	-£102	-£191	-£284

Source: Longer Semi-trailers Feasibility Study and Impact Assessment Technical Report D5: Economic Assessment

149. The second effect is the increase in overall costs to the road sector owing to increased market share and volume. Table 10 shows that, compared to rail, this is a small relative change. However, as a third effect, the LST part of the in-scope market will have lower costs (efficiencies) with the result that average costs for the road sector reduce. Table 11 shows how the average cost for road haulage changes due to the inclusion of each LST Option.

Table 10: Change in Road Mode Share and Annual Costs Compared to Base Case

	Road Haulage		**Mode Share tonnes (% Change)**			**Change in Annual Costs (£m)**		
			2015	2020	2025	2015	2020	2025
Option								
1	14.6m Fixed Axles		0%	1%	1%	-£9	£56	£126
2	14.6m Single Self-steer Axle		0%	1%	1%	-£116	-£57	£7
3	14.6m Active Steering		0%	1%	1%	-£73	-£14	£51
4	15.65m 2 x Self-steer Axles		1%	1%	2%	-£277	-£173	-£60
5	15.65m 1 x Command-steer Axle		1%	1%	2%	-£282	-£178	-£65
6	15.65m 2 x Command-steer Axles		1%	1%	2%	-£254	-£150	-£36
7	15.65m Active Steering		1%	1%	2%	-£222	-£117	-£3

Source: Longer Semi-trailers Feasibility Study and Impact Assessment Technical Report D5: Economic Assessment

Table 11: Change in Road Average Costs (pence) Compared to Base Case

	Road Haulage		**Cost per tonne**			**Cost per tonne-km**		
			2015	2020	2025	2015	2020	2025
Option								
1	14.6m Fixed Axles		-10.87	-3.70	3.96	-0.19	-0.24	-0.30
2	14.6m Single Self-steer Axle		-35.07	-28.85	-22.03	-0.36	-0.43	-0.49
3	14.6m Active Steering		-25.40	-19.23	-12.45	-0.29	-0.36	-0.42
4	15.65m 2 x Self-steer Axles		-78.17	-66.81	-54.42	-0.77	-0.89	-1.01
5	15.65m 1 x Command-steer Axle		-79.24	-67.86	-55.45	-0.78	-0.90	-1.02
6	15.65m 2 x Command-steer Axles		-72.95	-61.59	-49.20	-0.73	-0.85	-0.97
7	15.65m Active Steering		-65.67	-54.38	-42.07	-0.68	-0.80	-0.92

Source: Longer Semi-trailers Feasibility Study and Impact Assessment Technical Report D5: Economic Assessment

150. This highlights the large range of outcomes for road and rail sectors, representing changes varying by Option arising from mode switch and efficiencies. However, Table 8 shows that for all Options the net effect is a net benefit to industry. Therefore, these cost changes are recorded as benefits (PVB) in the "Summary: Analysis & Evidence" pages.

151. Table 12 shows the Average Annual benefit and PVB for direct internal costs to industry (net of indirect taxation and subsidy) for the Best Estimate scenario.

Table 12: Best Estimate Average Annual Benefit and Present Value Benefits of Net Direct Costs to Industry (£m)

Option	Average Annual Benefit (£m)	Present Value of Benefit (£m)
1	£45	£520
2	£142	£1,592
3	£105	£1,177
4	£317	£3,541
5	£321	£3,587

6	£296	£3,315
7	£268	£3,002

Source: Summary of information I Longer Semi-trailers Feasibility Study and Impact Assessment Technical Report D5: Economic Assessment

Externalities

152. Changes in HGV and train kilometres drive the external costs. Tables 13 and 14 show the change in LST-kms, Conventional HGV-kms and Train-kms for each Option 1-7. As noted above, the externalities are calculated for marginal changes in kilometres and each category has a different set of costs per kilometre. The change in the total kilometres of HGVs and the split between LSTs and conventional HGVs is important to understanding the impacts on externalities: Figure 3 shows the changes graphically for each Option for each modelled year.

153. With the exception of Option 1, both the total HGV-km and total train-km reduce in all forecast years and for all Options. In Option 1 (Fixed Axles), switching to LSTs is restricted to HGVs with gvw less than 40 tonnes, i.e. potentially understating the benefits, because no traffic currently in 44t HGVs benefits from LSTs. In all Options, except Option 1, LSTs take up approximately two-thirds of the in-scope market. However, in Option 1, this pattern reverses, with only approximately one-third switching to LSTs.

Table 13: Summary of Change in Annual Road Kilometres (Millions) Compared to Base Case

Option	LST			Conventional HGV			All HGV		
	2015	2020	2025	2015	2020	2025	2015	2020	2025
1	2271	2274	2278	-2302	-2235	-2168	-31	39	110
2	4590	4596	4603	-4744	-4680	-4617	-154	-84	-14
3	4594	4600	4607	-4744	-4680	-4617	-150	-80	-10
4	4425	4472	4519	-4724	-4644	-4564	-299	-172	-45
5	4426	4473	4520	-4724	-4644	-4564	-298	-171	-44
6	4428	4475	4522	-4724	-4644	-4564	-296	-169	-43
7	4428	4475	4522	-4724	-4644	-4564	-296	-169	-42

Source: Longer Semi-trailers Feasibility Study and Impact Assessment Technical Report D5: Economic Assessment

Table 14: Summary of Change in Annual Train Kilometres (Millions) Compared to Base Case

Option	Train		
	2015	2020	2025
1	-3	-5	-8
2	-3	-5	-8
3	-3	-5	-8
4	-5	-10	-14
5	-5	-10	-14
6	-5	-10	-14
7	-5	-10	-14

Source: Longer Semi-trailers Feasibility Study and Impact Assessment Technical Report D5: Economic Assessment

154. Table 15 and Table 16 present by mode the value of the change in the average annual externalities for the Best Estimate scenario in the period 2011-2025 (£m, not discounted). A positive change in externalities denotes a benefit for that Option relative to the Base Case.

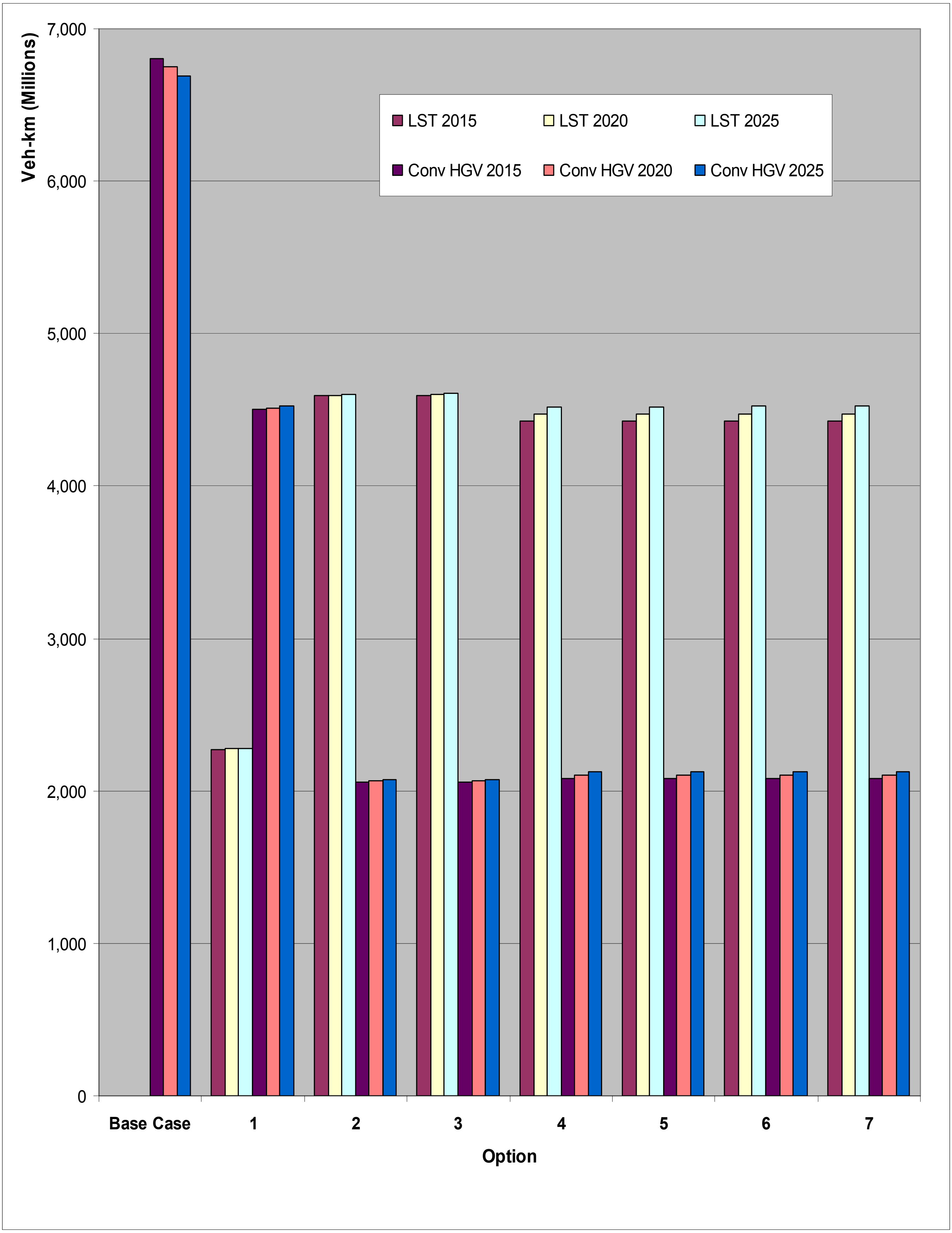


Figure 3: Best Estimate HGV Kilometres (Millions)

Table 15: HGV Annual Average Externalities Best Estimate 2011-2025 (£m) Compared to Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
1	-£22	£0	-£1	-£0	-£3	£1	-£25
2	£5	£2	£5	£1	£7	£11	£30
3	£3	£2	£5	£1	£6	£10	£27
4	£11	£3	£10	£1	£7	£21	£54
5	£11	£3	£10	£1	£4	£21	£50
6	£10	£3	£10	£1	£4	£21	£49
7	£10	£3	£10	£1	£4	£21	£49

Source: Calculations described in text

Table 16: Train Annual Average Externalities Best Estimate 2011-2025 (£m) Compared to Base Case

Option	Train Noise	Train Pollution	Train Climate Change	TOTAL
1	£4	£3	£3	£10
2	£4	£3	£3	£10
3	£4	£3	£3	£10
4	£7	£6	£6	£18
5	£7	£6	£6	£18
6	£7	£6	£6	£18
7	£7	£6	£6	£18

Source: Calculations described in text

155. The "Summary: Analysis & Evidence" tables express the externalities separately, depending on whether there are increases in costs imposed on society (PVC) or decreases in costs imposed on society (PVB). The results are summarised for each component for all Options in Tables 17 and 18 for the two contributing modes, and graphically in Figure 4 for the Best Estimate.

Table 17: HGV Externalities Best Estimate (Present Value, £m) Compared to Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
1	-£219	£2	-£5	-£4	-£31	£17	-£240
2	£72	£18	£57	£14	£76	£123	£361
3	£57	£18	£55	£14	£74	£119	£337
4	£161	£37	£116	£17	£84	£243	£657
5	£156	£37	£115	£11	£47	£242	£607
6	£149	£37	£114	£11	£51	£240	£602
7	£147	£37	£114	£11	£49	£240	£597

Source: Calculations described in text

Table 18: Train Externalities Best Estimate (Present Value, £m) Compared to Base Case

Option	Train Noise	Train Pollution	Train Climate Change	TOTAL
1	£38	£32	£32	£102
2	£38	£32	£32	£102
3	£38	£32	£32	£102
4	£70	£60	£60	£189
5	£70	£60	£60	£189
6	£70	£60	£60	£189
7	£70	£60	£60	£189

Source: Calculations described in text

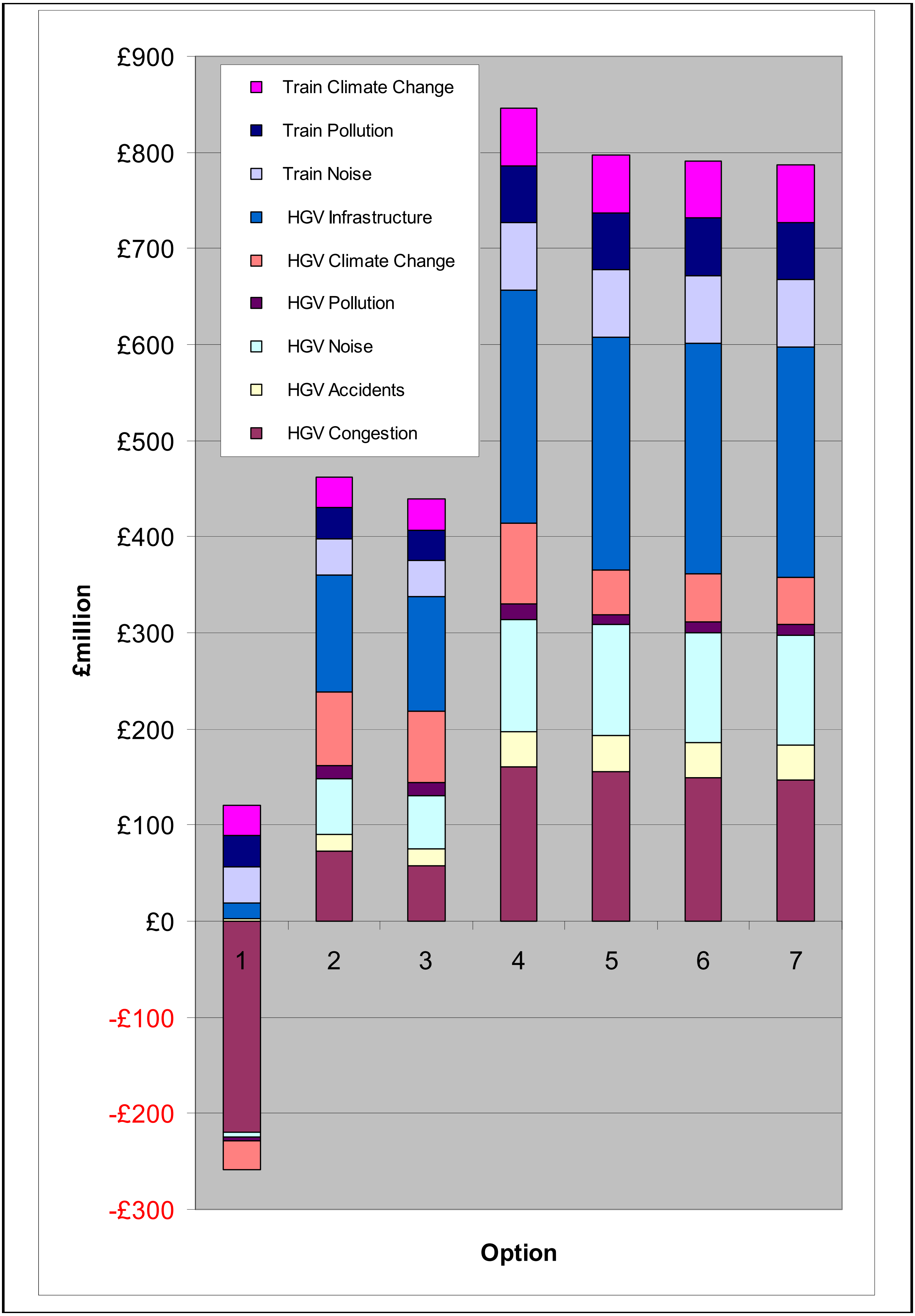


Figure 4: Summary of Change in Externalities (£m, discounted) Compared to Base Case

Summary Costs, Benefits and NPV

156. Table 19 shows the change from the Base Case in the average annual internal industry costs (net of indirect taxation and subsidy) and externalities for the Options under the Best Estimate assumptions. Table 20 brings together the PVC, PVB and NPV for all Options. These results appear in the "Summary: Analysis & Evidence" tables. Table 20 shows that all Options 1-7 yield a positive NPV. Industry benefits arise in all Options considered and only Option 1 imposes net external costs due mainly to increased congestion and carbon emissions.

Table 19: Summary of Change in Average Annual 2011-2025 Values (£m) Compared to Base Case

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	£0	£45	-£15	£0	-£15	£45
2	£0	£142	£0	£39	£0	£181
3	£0	£105	£0	£37	£0	£142
4	£0	£317	£0	£72	£0	£389
5	£0	£321	£0	£67	£0	£388
6	£0	£296	£0	£67	£0	£363
7	£0	£268	£0	£67	£0	£335

Table 20: Summary of Present Values (£m, discounted) Compared to Base Case

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	£0	£520	-£138	£0	-£138	£520	£381
2	£0	£1,592	£0	£462	£0	£2,055	£2,055
3	£0	£1,177	£0	£439	£0	£1,616	£1,616
4	£0	£3,541	£0	£846	£0	£4,387	£4,387
5	£0	£3,587	£0	£797	£0	£4,384	£4,384
6	£0	£3,315	£0	£791	£0	£4,106	£4,106
7	£0	£3,002	£0	£787	£0	£3,789	£3,789

Sensitivity Tests on Best Estimate Scenario

157. Sensitivity tests were conducted on some key assumptions used in the Best Estimate (central case):

- Test 1: Traffic generation arising from changes in transport costs;
- Test 2: LST congestion factor, and
- Test 3: Improvement to rail productivity through increased train length.

158. The results of these sensitivity tests are reported in Annex 3. In summary, for the best performing Options 4 to 7 the overall changes in NPV were less than 20% for all tests and the overall net benefit of the proposition remains strongly positive for options 2 to 7.

Low and High Alternative Scenarios

159. There are uncertainties around the assumptions used which is the nature of forecasting impacts; hence low and high alternative scenarios have been developed by altering those variables which are most uncertain and significant. The primary factor affecting the impact of LSTs will be the assumed rate of take up of the new permitted trailer type. Section 3 above described the development of a 'Low' and 'High' range of take up in addition to the 'Best Estimate'. The assumptions were summarised in Table 5 on page 40. The Low case assumes a reduced level of take up for each of the identified sub-categories of traffic, together with a higher threshold for definition of trip length distance. The High case assumes a higher level of take up in each sub-category and a lower threshold distance.

160. The Low and High case assumptions affect both the internal industry costs and the externalities imposed on society and the environment. The results of the alternative Low and High take up scenario results are described in full in Annex 4.

161. Note that the effect of these take up scenarios is to redistribute traffic between LSTs and conventional HGVs; for simplicity, **no change is assumed to rail mode share or costs** compared to the Best Estimate.

162. As expected, the High take-up Scenario increases the benefits for industry and the environment due a greater proportion of the goods on road being carried in more efficient, longer vehicles. The Low scenario is the reverse of this, with reductions in benefits for industry and the environment. However, even in the Low scenario the NPV of total economic benefits is positive for all except Option 1.

Single-deck LST Alternative Scenario

163. The Best Estimate analysis has assumed that mode switch would apply to all in-scope traffic. An alternative regulatory possibility is that LSTs would be restricted to single-deck (assumed 4 metre high) trailers. This would reduce the level of switch and render LSTs less competitive compared to rail, particularly for longer distance hauls. Therefore, this alternative scenario considers the impact of restricting the mode shift effect to a sub-set of the market currently employing single-deck HGVs.

164. The alternative Single-deck LST scenario results are described in full in Annex 5. An apparent anomaly can be noted in these economic results; that industry benefits are slightly greater when a restriction is introduced to only allow single-deck longer semi trailers, as compared to also allowing longer double-deck semi trailers. This appears to be counter-intuitive; it is natural to assume that a restriction would *increase* industry costs.

165. The economic benefit results have been calculated using the road and rail cost models developed for the project. These are intended to replicate market rates incurred by the logistics industry i.e. *pure financial cost*. The traffic forecasts and modal split analysis use *generalised costs*, which account for the quality of service and flexibility characteristics of a particular mode in addition to the actual transport operating costs. For example, between a particular origin and destination intermodal rail freight may offer marginally lower transport rates than road haulage in pure financial terms, however it may have a higher generalised cost due to road haulage's in-built flexibility and convenience. Consequently, the cargo will move by road haulage. As a general rule of thumb, the following currently applies:

- Over long distances, intermodal rail has both lower operating costs and generalised costs;
- Over short distances, road haulage has both lower operating costs and generalised costs; and
- Over medium distances, intermodal rail has marginally lower operating costs but marginally higher generalised costs.

166. In this particular case, the difference in the scenarios is largely within the medium and long distance market that chooses between double-deck semi-trailers and rail. If a restriction is introduced such that longer double-deck semi-trailers are not allowed, there is a mode-switch to rail which has lower operating costs over these medium/long distances, and therefore overall operating costs decrease. Without the restriction, this traffic goes by road (on a longer double-deck semi-trailer). Road is more expensive than rail in pure financial terms but was the chosen mode because its generalised costs were lower i.e. quality of service and flexibility characteristics encouraged the use of road even though the financial (operating) costs were higher.

167. This scenario yields greater net benefits for both industry and the environment than the Best Estimate scenario. For Options 2-7, the increase in the NPV lies in the range +6% to +11%.

Longer Intermodal Units Alternative Scenario

168. The ability to operate longer semi-trailers potentially allows the complementary introduction of longer intermodal units on domestic rail freight flows. The Megafret intermodal platform wagon, used for most domestic intermodal flows, has a 15.6m loading deck and is capable of accommodating units of such a length, so new rolling-stock equipment would not have to be developed. A train hauling a rake of Megafret wagons essentially costs the same, regardless of the length of the intermodal units being conveyed on those wagons. A longer intermodal unit could therefore be conveyed for the same cost as a train conveying existing length (13.6m) intermodal units, thereby generating efficiencies. A 15.6m unit would allow an additional four pallets to be conveyed, compared with an existing maximum length box, generating cost savings in the form of lower per pallet costs.

169. Therefore, as an alternative scenario, the Best Estimate assumptions were also applied assuming that longer intermodal units were employed in the rail sector. The results are described in full in Annex 6.

170. For all Options, this scenario yields significantly greater net benefits for both industry and the environment than the Best Estimate scenario. This improvement in benefits due to the adoption by rail of longer intermodal units persists for all Options across all of the sensitivity tests and across the High, Low and Single-deck variant scenarios. In all cases, the highest overall NPV of total economic benefits arises for Option 12, which has the full 2.05m trailer length increase and a single command steer axle, though it is only a little higher than Option 11, which instead has 2 self steer axles. The NPV for each of Options 8-10, which only have a 1m length increase, is substantially lower than that for any of Options 11-14, which have the full 2.05m increase.

Safer Aerodynamic Fronts Additional Option

171. In addition to the options to extend the allowed length of the articulated vehicle, recent reports have found that it would be possible to re-design the frontal shape of trucks to make them safer and more aerodynamic. This would reduce fuel consumption and the numbers of pedestrian, truck occupant, car occupant and other casualties. This would require increases in allowed length of current overall vehicle combinations (but no change to loading length). The Department commissioned research to consider what benefits there could be from considering extensions of this sort. The report determined that viable options range from a 0.2m increase to a 1m increase. A full description of the analysis is given in Annex 10 and the report will be published alongside this IA as "Safer aerodynamic frontal structures for trucks: final report". The analysis has been extended to ensure full coverage of the impacts.

172. In summary the following results were found:

Table 21: Cost implications of safer aerodynamic fronts

Description	Purchase price (£)	Fuel consumption (g/km)	Total costs per km (£)	Indexed costs/km
Baseline 44 tonne 16.5m artic	£63,000	230.328	£0.961	1.000
Safer front 0.2m	£63,166	229.073	£0.960	0.999
Safer front 0.5m	£63,415	227.528	£0.959	0.998
Safer front 1.0m standard aerodynamics	£63,830	231.725	£0.964	1.003
Safer front 1.0m optimised aerodynamics	£64,330	228.422	£0.961	1.001

Source: Safer aerodynamic frontal structures for trucks: final report: TRL (to be published alongside)

Table 22: Estimated fatality reduction with all articulated vehicles using safer aerodynamic fronts

	Predicted annual average fatality reduction					
Description	Car occupants	Truck occupants	Vulnerable road users	Total	Fatality rate	Index fatality rate
Baseline 44 tonne 16.5m artic	0.00	0.00	0.00	0.00	13.174	1.000
Safer front 0.2m	0.70	0.25	4.00	4.95	12.828	0.974
Safer front 0.5m	1.50	0.30	7.50	9.30	12.523	0.951
Safer front 1.0m standard aerodynamics	2.00	0.50	12.00	14.50	12.158	0.923
Safer front 1.0m optimised aerodynamics	2.00	0.50	12.00	14.50	12.158	0.923

Source: Safer aerodynamic frontal structures for trucks: final report: TRL (to be published alongside)

Table 23: Overall estimated impact of all articulated vehicles using safer aerodynamic fronts

	Annual averages					
	Magnitude of changes with respect to baseline					
Description	Discounted cost change before congestion and noise impacts (£)	Cost (%)	HGV traffic (BVKM)	HGV traffic (%)	Discounted cost of congestion and noise	Discounted net present value
Baseline 44 tonne 16.5m artic	£0	0.00%	0.00	0.00%	£0	£0
Safer front 0.2m	-£18,924,685	-0.11%	0.01	0.04%	£4,048,598	-£14,876,087
Safer front 0.5m	-£25,701,440	-0.17%	0.03	0.09%	£10,480,203	-£15,221,237
Safer front 1.0m standard aerodynamics	£54,551,400	0.31%	0.05	0.18%	£20,902,561	£75,453,962
Safer front 1.0m optimised aerodynamics	£36,403,758	0.25%	0.08	0.28%	£31,864,962	£68,268,721

Source: Calculations as described in Annex 10

173. The analysis concludes that there are likely to be social benefits to allowing additional length of either 0.2m or 0.5m for the purposes of constructing safer aerodynamic fronts to HGVs.

174. In general safety performance improves strongly with an increase in frontal length of up to 1m, with the biggest casualty savings for pedestrians. However, there is some trade off with the extra unladen mass reducing payload and thereby generating some additional HGV traffic. An increase in nosecone length of around 0.2m and 0.5m have both been found to give a similar monetised net benefit of between £0m and £15m per year, dependent on take up, with a best estimate of the mid-point £7.5m per year. Uptake of the opportunity to develop these fronts is uncertain, and the Department would like to engage vehicle manufacturers to discuss the issues described in the TRL analysis and gather evidence on the incentives operators and manufacturers would face.

175. Allowing an increase of 0.5m would allow vehicles longer than the current length of the maximum allowed rigid truck/drawbar combination. This could result in issues with parking these vehicles. Given that the net benefit is estimated to be similar for 0.2m or 0.5m and the shorter distance would remain within known vehicle lengths, it is likely that 0.2m could provide the greatest social benefit. Furthermore, with a 0.2m extension it would be possible to gain 0.4m for the frontal design by fitting the trailer with a close coupling arrangement (a design reducing the space needed between cab and trailer) whilst still remaining within the current length of maximum combinations on the road today of 18.75m. Hence manufacturers would still have the option of designing close to the longer design.

5 Results of Specific Impact Tests

Introduction

176. The following Specific Impact Tests: Checklist identifies those considered applicable to this impact assessment. The most important are the Competition Assessment (described in Annex 7), Small firms Impact Test (Annex 8), and the Carbon Assessment (Annex 9).

177. The remaining tests, not considered further, are briefly noted below.

Sustainable Development

178. There are potential impacts on environment and sustainable economy. Reductions in the number of vehicles and vehicle-km improve sustainability, but this has not been quantified or monetised.

Carbon Assessment

179. The external cost of climate change is included in the impact assessment. The annual cost (saving) in 2020 is included in the "Summary: Analysis & Evidence" pages based on the unit costs specified in Annex 2.

180. The forecasts suggest that there would be increases in CO2 equivalent emissions (Tonnes) for the +1.0 metre LST Option 1 and perhaps very small increases also for Options 2 and 3. However, for the longer, +2.05 metre LST Options 4, 5, 6 and 7 there are predicted to be reductions in CO2 emissions.

181. Further details are included in Annex 9.

Other Environment

182. The external cost of local air pollution is included in the impact assessment. The annual cost (saving) in 2020 is included based on the unit costs specified in Annex 2.

Health Impact Assessment

183. The external cost of road accidents is included in the impact assessment. The annual cost (saving) in 2020 is included based on the unit costs specified in Annex 2.

Race, Disability and Gender Equality

184. An Equalities Impact Assessment proforma has been completed. No impacts are expected.

6 Main Conclusions

185. It is clear from the analysis above that **introducing longer semi-trailers has the potential to generate substantial industry benefits and external/ environmental benefits**. However, the level of these benefits and the impacts on various sectors of industry and society are influenced by the exact characteristics of the vehicles that would be permitted and by any complementary measures that might be considered to mitigate unintended consequences.

186. In general, the benefits from permitting the full 15.65m semi-trailers are substantially greater than those for the shorter 14.6m alternative. Accordingly, there does not appear to be a strong case for restricting to the 1m extension instead of adopting the full 2.05m length increase, though in practice users may of course adopt intermediate lengths to cater for specific niche markets. **The full 2.05m semi-trailer length increase appears most beneficial**.

187. An identical ranking of benefits across the set of all seven vehicle options arises in most scenarios and sensitivity tests. The ranking of direct industry benefits by vehicle option tends to be broadly similar to that of external benefits, so that **there is not a major conflict across options between internal industry and external cost savings.**

188. **Within the set of 15.65m trailer options, the 2 self-steer axle, Option 4, produces the highest overall economic benefits** in NPV, though there is little difference in NPV from the single command-steer axle, Option 5. The expected benefits of Option 6 (two command-steer axles) are some 6% lower than for the other two. The performance of all these options would **comply with all existing vehicle regulations (Regulatory possibility ii).** Their high-speed performance assumes that like all existing systems the steer axles are locked at speed. New regulation may be required to enforce this condition.

189. The above three vehicle options generate tail swing in the legislative turning manoeuvres that is greater than that for current vehicles. However, this could be limited by introducing a specific test for an articulated combination with an appropriate tail swing limit (either 0.6 for a drive in test, comparable to buses, or 0.8 in a steady state test comparable to rigid trucks) and to prescribe the test speed. Also, the analyses suggest that there are no vehicle options where the performance is reduced in all metrics at the same time – there is a trade-off such that the measures that are adversely affected are always accompanied by other measures where there is an improvement. This means that overall there can be net performance improvements relative to existing vehicles. Any increase in the casualty risk per vehicle km would be likely to be so small as to be immeasurable in casualty data after implementation. Introducing a limit that reduced the height of the tallest vehicles to around 4.6m would be one potential means to eliminate this increase in risk.

190. **If it is further required that longer vehicles should match or exceed the actual performance of existing vehicles (Regulatory possibility iii), the active steering axle option 7 is the only full-length candidate.** Due to its higher tare-weight and cost, it has a lower NPV than the other full-length options (around 10-15% below that of Option 5, depending on the scenario or sensitivity test). Any reduction in the casualty risk per vehicle km is again likely to be so small as to be immeasurable.

191. The Best Estimate scenario has assumed that mode switch would apply to all in-scope traffic. An alternative regulatory possibility is that length increases would be restricted to single-deck (assumed 4 metre high) trailers. This would leave the competition between double-deck semi-trailers and rail unchanged from the Base Case, so it would reduce the level of switch particularly for longer distance hauls. This height restriction would also provide some small improvements in accident rates. **The LST single-deck only scenario yields similar net benefits for industry but to greater benefits for the environment than the Best Estimate scenario.** This is because the forecast loss of rail share to LSTs is significantly reduced in all future years, compared to the Best Estimate scenario.

192. In the Best Estimate forecast scenario the introduction of longer vehicles leads to a major diversion of the growth in domestic intermodal traffic from rail to road, though nevertheless this rail traffic market still would grow strongly over time. This scenario is based on the assumption that the rail industry continues to use existing length intermodal units rather than purchasing longer units that would cater more cost-effectively for the growth in domestic intermodal traffic. Although there may be some complications for rail in adopting longer intermodal units, these may not be insurmountable and we intend to consult on the feasibility of this response from the rail industry. In all tests for all

future years, **Scenarios that assume the widespread adoption by rail of longer intermodal units generate much larger benefits than the Best Estimate scenario.** They indicate that at worst the impact of longer semi-trailers would be neutral on the domestic intermodal sector, and that there may actually be some marginal benefits to the rail industry. There are improved benefits both to industry and to the environment.

193. This longer intermodal unit scenario effectively estimates an upper bound for the benefits to rail from the introduction of LSTs, whereas the Best Estimate scenario provides a corresponding lower bound to the rail industry from their introduction. The widespread adoption of longer intermodal units would amplify substantially the added benefits to the economy overall, as well as to the environment and the rail industry in particular, from introducing LSTs. It highlights the importance of encouraging their usage in tandem with the introduction of LSTs.

194. The overall impacts on competition from the introduction of LSTs are expected to be minor, with potentially some small negative impacts in the short term as fleets adjust.

195. Despite the significant benefits to the freight industry overall, the evidence suggested that **smaller haulage firms might lose out from the introduction of longer semi-trailers**. They may incur extra capital costs due to being forced by large clients to switch promptly to purchase LSTs, leading to premature write-off of their existing trailer capacity, but have no scope to recover these costs through the rates charged to clients.

196. **All the LST options, except the 40 tonne gvw Option 1, are forecast to lead to overall reductions in CO2 emissions in all years,** relative to those for the corresponding scenario without LSTs.

Annexes

Annex 1 should be used to set out the Post Implementation Review Plan as detailed below. Further annexes may be added where the Specific Impact Tests yield information relevant to an overall understanding of policy options.

Annex 1: Post Implementation Review (PIR) Plan

A PIR should be undertaken, usually three to five years after implementation of the policy, but exceptionally a longer period may be more appropriate. A PIR should examine the extent to which the implemented regulations have achieved their objectives, assess their costs and benefits and identify whether they are having any unintended consequences. Please set out the PIR Plan as detailed below. If there is no plan to do a PIR please provide reasons below.

Basis of the review: [The basis of the review could be statutory (forming part of the legislation), it could be to review existing policy or there could be a political commitment to review];

Statutory review three years after implementation

Review objective: [Is it intended as a proportionate check that regulation is operating as expected to tackle the problem of concern?; or as a wider exploration of the policy approach taken?; or as a link from policy objective to outcome?]

It would be intended as a proportionate check that the legislation is operating as expected, namely that longer semi-trailers are being used to transport higher volumes of lighter weight goods and that the impacts on the freight markets for road and rail are as anticipated in the research.

Review approach and rationale: [e.g. describe here the review approach (in-depth evaluation, scope review of monitoring data, scan of stakeholder views, etc.) and the rationale that made choosing such an approach]

In depth evaluation, including a review of statistical data and a survey of stakeholders in order to assess: how many longer semi trailers are on the market; the purposes they are used for; and their impact on the domestic rail and road haulage markets. An indepth evaluation is required because neither statistical data or a stakeholder survey would be sufficient on their own to get a reliable assessment of the impact of implementation.

Baseline: [The current (baseline) position against which the change introduced by the legislation can be measured]

The baseline in this report will be used to measure the impact of implementation although account will have to be taken of other external factors which might have affected the baseline (e.g. rail linked warehousing, GDP growth, industry cost differentials).

Success criteria: [Criteria showing achievement of the policy objectives as set out in the final impact assessment; criteria for modifying or replacing the policy if it does not achieve its objectives]

That longer semi-trailers are being used primarily to transport higher volumes of lighter weight goods and are being used to their full capacity. Whether the impact on freight carried by rail is consistent with the conclusions of the research. That accident data shows no marked rise in injuries or fatalities specifically as a result of the introduction of longer semi-trailers.

Monitoring information arrangements: [Provide further details of the planned/existing arrangements in place that will allow a systematic collection systematic collection of monitoring information for future policy review]

There are a number of sources of data including: DfT statistics on freight carried by rail and road; trailer manufacturing data; vehicle licensing data; road safety and accident statistics held by VOSA;

Reasons for not planning a PIR: [If there is no plan to do a PIR please provide reasons here]

N/A

Annex 2: Marginal cost values used in estimating externalities (Annex supplied by DfT)

Articulated HGV externality values summary

197. These values were produced using the methods developed in producing the Mode-Shift Benefit values for use in grant schemes[8]. Three forecast years are presented; estimates for intervening years can be obtained by linear interpolation. The values are in market prices (as consistent with NATA appraisal methods) and do not include "Other costs" as these should be treated as non-monetised elements in all appraisals and impact assessments carried out using these values.

198. The values reflect an estimate using the best available sources of the marginal externalities of the current fleet of articulated HGVs. They have been rounded to the nearest penny in the table below (further accuracy is spurious given the range of uncertainty around them) but a spreadsheet is available so that the exact outputs can be used. They can be interpreted as either the cost of adding an extra lorry mile to the network or the benefit of removing one.

199. Note that the taxation impact calculated for the mode-shift benefit values is not shown. Within an impact assessment, this will be a transfer between business and government and should have no net impact.[9]

2010 values, cost per additional lorry mile (pence, 2010 market prices)

	London and Conurbations			Other Urban		Rural		
	M'way	A-roads	Other roads	A-roads	Other roads	M'way	A-roads	Other roads
Congestion	35	364	213	112	88	26	17	20
Accidents	0.4	4	4	4	4	0.4	5	5
Noise	19	20	20	17	17	4	4	4
Local air pollution	3	7	7	4	4	1	2	2
Climate Change	7	11	11	9	9	7	8	8
Infrastructure	8	24	128	23	128	8	20	128

2015 values, cost per additional lorry mile (pence, 2010 market prices)

	London and Conurbations			Other Urban		Rural		
	M'way	A-roads	Other roads	A-roads	Other roads	M'way	A-roads	Other roads
Congestion	53	469	265	146	107	41	22	29
Accidents	0.4	4	4	4	4	0.4	5	5
Noise	22	23	23	19	19	4	4	5
Local air pollution	2	5	5	3	3	1	1	1
Climate Change	7	12	11	10	10	7	8	8
Infrastructure	7	21	113	20	113	7	18	113

2025 values, cost per additional lorry mile (pence, 2010 market prices)

	London and Conurbations			Other Urban		Rural		
	M'way	A-roads	Other roads	A-roads	Other roads	M'way	A-roads	Other roads
Congestion	102	692	393	217	139	84	42	48
Accidents	0.4	4	4	4	4	0.4	5	5
Noise	27	28	28	23	24	5	5	6
Local air pollution	1	5	5	3	3	1	1	1
Climate Change	8	14	13	11	11	8	9	9
Infrastructure	5	16	86	15	86	5	14	86

[8] http://www.dft.gov.uk/pgr/freight/railfreight/modeshiftben/
[9] Taxation is netted off from mode-shift benefits because the corresponding business impact is accounted for in the way that the financial need for grant is calculated

200. As explained previously, the forecast future congestion costs tabulated above were scaled down to take account of the reductions required in future traffic forecasts to take account of the impacts of the recent recession. They were scaled down to 83%, 80% and 83% respectively for the years 2015, 2020 and 2025. All costs were further converted to be in £ / HGV kilometre at 2009 prices.

201. Rail externality values were calculated for the mode-shift benefit work but no evidence on how they varied by location was available. They are shown below as 'per train' as the evidence gave similar values for any type of freight train. If differences between train types appear important to the impact assessment then these values may need to be investigated further. Also note that in the mode-shift benefit work the total externalities of rail and water were assumed to be roughly equal based on limited evidence available, however the component parts are unlikely to be equal. If externalities due to fewer vessels travelling are identified these should be considered directly.

202. Again both taxation impacts and "other costs" are not shown here, for the reasons given above.

2010 values, externalities of freight trains (pence per train mile, 2010 market prices)	
	Average freight train
Noise	110
Local air pollution	90
Climate Change	103

2015 values, externalities of freight trains (pence per train mile, 2010 market prices)	
	Average freight train
Noise	125
Local air pollution	109
Climate Change	110

2025 values, externalities of freight trains (pence per train mile, 2010 market prices)	
	Average freight train
Noise	152
Local air pollution	128
Climate Change	127

Source:
Freight Economics - DfT

Annex 3: Sensitivity Tests

Introduction

1. In order to test the robustness of the assessment, some of the key assumptions were subject to sensitivity analysis. All these tests were based on the 'central case' of the Best Estimate Scenario.

2. In the Impact Assessment, it was assumed that the total volume of goods transported would remain constant and that the only change was potential mode switch between rail and road. However, Sensitivity Test 1 examines the circumstances where the change in costs of transport could cause a traffic generation effect. An increase in traffic might erode the benefits of LSTs identified in the impact assessment.

3. Secondly, external congestion impacts caused by LSTs made a significant contribution to costs and benefits. Sensitivity Test 2 examines the significance on the impact assessment of varying this assumed contribution of LSTs to additional congestion.

4. Thirdly, the effect of increased train productivity was tested by increasing the assumed number of wagons per train.

Sensitivity Test 1: Traffic Generation

5. The Best Estimate scenario assumed fixed total traffic demand. An effect of changes (reductions) in transport costs could be generation of additional traffic that might erode the benefits reported.

6. It was assumed that the impact would be to the total distances hauled rather than the absolute total of goods. To estimate the impact of this possible effect, an elasticity of -0.1 for overall tonne-km with respect to overall transport financial costs (including taxes) was applied. Therefore, a 1% reduction in transport costs would result in an additional 0.1% tonne-km. This has the effect of increasing kilometres and increasing externalities.

7. Table A3.1 shows the changes in industry costs compared to the corresponding Option in the Best Estimate Scenario.

Table A3.1: Sensitivity Test 1: Traffic Generation. Total Rail and Road Annual Operating Costs (£m) compared to Option in Best Estimate

Option	Change Compared with Best Estimate 2015	Change Compared with Best Estimate 2020	Change Compared with Best Estimate 2025	% Change Compared with Best Estimate 2015	% Change Compared with Best Estimate 2020	% Change Compared with Best Estimate 2025
1	£2	£0	-£2	0.0%	0.0%	0.0%
2	£7	£6	£4	0.1%	0.1%	0.0%
3	£5	£4	£2	0.1%	0.0%	0.0%
4	£17	£15	£13	0.2%	0.2%	0.1%
5	£17	£15	£13	0.2%	0.2%	0.1%
6	£16	£14	£12	0.2%	0.2%	0.1%
7	£15	£13	£10	0.2%	0.1%	0.1%

8. The summary of costs and benefits is included in Table A3.2 and A3.3 (comparable with Tables 19 and 20).

Table A3.2: Sensitivity Test 1: Traffic Generation. Summary of Change in Average Annual 2011-2025 Values (£m) Compared to Base Case

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	£0	£45	-£16	£0	-£16	£45
2	£0	£137	£0	£35	£0	£172
3	£0	£102	£0	£34	£0	£136
4	£0	£303	£0	£60	£0	£364
5	£0	£307	£0	£56	£0	£363
6	£0	£284	£0	£56	£0	£340
7	£0	£257	£0	£57	£0	£314

Table A3.3: Sensitivity Test 1: Traffic Generation. Summary of Present Values (£m, discounted) Compared to Base Case

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	£0	£514	-£141	£0	-£141	£514	£373
2	£0	£1,535	£0	£414	£0	£1,949	£1,949
3	£0	£1,139	£0	£407	£0	£1,546	£1,546
4	£0	£3,390	£0	£718	£0	£4,108	£4,108
5	£0	£3,434	£0	£667	£0	£4,101	£4,101
6	£0	£3,174	£0	£672	£0	£3,846	£3,846
7	£0	£2,874	£0	£679	£0	£3,554	£3,554

9. Table A.3.4 summarises the change in discounted costs and benefits between the Best Estimate scenario and Sensitivity Test 1. Table A.3.5 summarises the change in percentage terms.

Table A3.4: Sensitivity Test 1: Traffic Generation. Summary of Change in Present Values Compared to Option in Best Estimate (£m, discounted)

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	£0	-£5	-£3	£0	-£3	-£5	-£9
2	£0	-£57	£0	-£48	£0	-£105	-£105
3	£0	-£38	£0	-£32	£0	-£70	-£70
4	£0	-£151	£0	-£128	£0	-£279	-£279
5	£0	-£152	£0	-£130	£0	-£283	-£283
6	£0	-£141	£0	-£120	£0	-£260	-£260
7	£0	-£128	£0	-£108	£0	-£236	-£236

Table A3.5: Sensitivity Test 1: Traffic Generation. Summary of Change in Present Values Compared to Option in Best Estimate (%)

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	0%	-1%	2%	0%	2%	-1%	-2%
2	0%	-4%	0%	-10%	0%	-5%	-5%
3	0%	-3%	0%	-7%	0%	-4%	-4%
4	0%	-4%	0%	-15%	0%	-6%	-6%
5	0%	-4%	0%	-16%	0%	-6%	-6%
6	0%	-4%	0%	-15%	0%	-6%	-6%
7	0%	-4%	0%	-14%	0%	-6%	-6%

10. Therefore, as expected, the introduction of traffic generation had the effect of reducing the benefits of the proposition, affecting both internal industry and externalities. Nevertheless, Table A3.3 shows that the overall net benefit of the proposition remains strongly positive for all Options and would remain so even if a larger elasticity of response had been adopted.

Sensitivity Test 2: LST Congestion Effect

11. In the Best Estimate scenario, congestion imposed by LSTs accounted for a significant proportion of estimated external costs. No relevant research evidence was found to provide an estimate of the impact on congestion of a relatively short increase in HGV length. In the Best Estimate scenario, it was assumed that the impact on congestion was in proportion to one-third of the additional length.
12. Additional tests were conducted to test the sensitivity of this assumption. Table A3.6 summarises the results for a zero effect and a doubled effect (a factor of two-thirds of the additional length).
13. The results show that if no additional congestion costs are associated with LSTs, then the impact is an increase in external benefits. However, if the effect were doubled to two-thirds of the additional length, then significant external costs are created for all Options. However, Table A3.7 shows that the NPV remains positive for all Options.

Table A3.6: Sensitivity Test 2: LST Congestion Effect. Summary of HGV Congestion Costs Compared to Base Case

Option	Annual Average HGV Congestion Cost £m			Present Value HGV Congestion Cost £m		
	Zero	Best Estimate (one-third)	Double (two-thirds)	Zero	Best Estimate (one-third)	Double (two-thirds)
1	-£6	-£22	-£39	-£43	-£219	-£396
2	£38	£5	-£28	£429	£72	-£284
3	£36	£3	-£30	£414	£57	-£300
4	£77	£11	-£54	£870	£161	-£548
5	£76	£11	-£55	£865	£156	-£553
6	£76	£10	-£55	£858	£149	-£560
7	£75	£10	-£56	£857	£147	-£562

Table A3.7: Sensitivity Test 2: LST Congestion Effect. Summary of NPV Compared to Base Case

Option	NPV				
	Zero		Best Estimate (one-third)	Double (two-thirds)	
1	£546	48%	£369	£192	-48%
2	£2,307	18%	£1,950	£1,593	-18%
3	£1,868	24%	£1,511	£1,154	-24%
4	£5,044	16%	£4,335	£3,626	-16%
5	£5,083	16%	£4,374	£3,665	-16%
6	£4,801	17%	£4,091	£3,382	-17%
7	£4,486	19%	£3,776	£3,067	-19%

Sensitivity Test 3: Improved Intermodal Train Productivity

14. Increased intermodal train productivity was represented by longer trains: the average number of wagons increasing from 14 to 17, without any other detrimental effects.

15. Table A3.8 summarises the results for the Base Case (Do Nothing) and Options 1 to 7 with the revised assumption compared with the Best Estimate scenario. The rail sector is significantly larger than in the Best Estimate in equivalent years but, in percentage terms, the effect on the road sector is small.

Table A3.8a: Sensitivity Test 3: Improved Intermodal Train Productivity. Rail Traffic Forecasts (thousand tonnes)

Option	17 Wagon Trains			Change From Best Estimate			% Change From Best Estimate		
	2015	2020	2025	2015	2020	2025	2015	2020	2025
Base	9,187	15,214	21,241	2,601	4,770	6,938	39%	46%	49%
1	6,364	10,038	13,712	1,728	3,167	4,607	37%	46%	51%
2	6,364	10,038	13,712	1,728	3,167	4,607	37%	46%	51%
3	6,364	10,038	13,712	1,728	3,167	4,607	37%	46%	51%
4	4,196	6,063	7,930	1,057	1,937	2,817	34%	47%	55%
5	4,196	6,063	7,930	1,057	1,937	2,817	34%	47%	55%
6	4,196	6,063	7,930	1,057	1,937	2,817	34%	47%	55%
7	4,196	6,063	7,930	1,057	1,937	2,817	34%	47%	55%

Table A3.8b: Sensitivity Test 3: Improved Intermodal Train Productivity. Road Traffic Forecasts (thousand tonnes)

Option	17 Wagon Trains			Change From Best Estimate			% Change From Best Estimate		
	2015	2020	2025	2015	2020	2025	2015	2020	2025
Base	435,760	439,864	443,968	-2,601	-4,769	-6,938	-1%	-1%	-2%
1	438,583	445,040	451,497	-1,727	-3,167	-4,607	0%	-1%	-1%
2	438,583	445,040	451,497	-1,727	-3,167	-4,607	0%	-1%	-1%
3	438,583	445,040	451,497	-1,727	-3,167	-4,607	0%	-1%	-1%
4	440,751	449,015	457,279	-1,057	-1,937	-2,817	0%	0%	-1%
5	440,751	449,015	457,279	-1,057	-1,937	-2,817	0%	0%	-1%
6	440,751	449,015	457,279	-1,057	-1,937	-2,817	0%	0%	-1%
7	440,751	449,015	457,279	-1,057	-1,937	-2,817	0%	0%	-1%

16. Table A3.9 presents the estimated net annual operating costs (not discounted) in the identified (in scope) sectors in the forecast years 2015, 2020 and 2025 and the change compared with the Best Estimate for the Base Case and Options 1-7.

Table A3.9: Sensitivity Test 3: Improved Intermodal Train Productivity. Total Rail and Road Annual Operating Costs (£m)

	17 Wagon Trains			Change From Best Estimate			% Change From Best Estimate		
Option	2015	2020	2025	2015	2020	2025	2015	2020	2025
Base	£8,812	£9,274	£9,715	-£24	-£48	-£74	0%	-1%	-1%
1	£8,751	£9,236	£9,701	-£19	-£36	-£56	0%	0%	-1%
2	£8,646	£9,125	£9,585	-£17	-£34	-£53	0%	0%	-1%
3	£8,688	£9,167	£9,628	-£18	-£35	-£54	0%	0%	-1%
4	£8,445	£8,935	£9,410	-£12	-£23	-£35	0%	0%	0%
5	£8,441	£8,931	£9,406	-£11	-£22	-£34	0%	0%	0%
6	£8,468	£8,959	£9,434	-£12	-£22	-£35	0%	0%	0%
7	£8,500	£8,991	£9,466	-£12	-£23	-£36	0%	0%	0%

17. The summary of costs and benefits is included in Table A3.10 and A3.11.

Table A3.10: Sensitivity Test 3: Improved Intermodal Train Productivity. Summary of Change in Average Annual 2011-2025 Values (£m) Compared to Base Case

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	£0	£36	-£41	£0	-£41	£36
2	£0	£131	£0	£12	£0	£144
3	£0	£94	£0	£10	£0	£105
4	£0	£296	£0	£23	£0	£320
5	£0	£300	£0	£19	£0	£319
6	£0	£276	£0	£19	£0	£294
7	£0	£248	£0	£18	£0	£266

Table A3.11: Sensitivity Test 3: Improved Intermodal Train Productivity. Summary of Present Values (£m, discounted) Compared to Base Case

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	£0	£419	-£406	£0	-£406	£419	£12
2	£0	£1,477	£0	£183	£0	£1,660	£1,660
3	£0	£1,067	£0	£160	£0	£1,227	£1,227
4	£0	£3,323	£0	£339	£0	£3,661	£3,661
5	£0	£3,368	£0	£290	£0	£3,658	£3,658
6	£0	£3,098	£0	£285	£0	£3,383	£3,383
7	£0	£2,790	£0	£280	£0	£3,070	£3,070

18. Table A3.12 summarises the change in discounted costs and benefits between the Best Estimate scenario (Table 20) and Sensitivity Test 1. Table A3.13 summarises the change in percentage terms.

Table A3.12: Sensitivity Test 3: Improved Intermodal Train Productivity. Summary of Change in Present Values Compared to Option in Best Estimate (£m, discounted)

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	£0	-£101	-£268	£0	-£268	-£101	-£369
2	£0	-£115	£0	-£280	£0	-£395	-£395
3	£0	-£110	£0	-£279	£0	-£389	-£389
4	£0	-£219	£0	-£507	£0	-£726	-£726
5	£0	-£219	£0	-£507	£0	-£726	-£726
6	£0	-£217	£0	-£507	£0	-£723	-£723
7	£0	-£213	£0	-£507	£0	-£719	-£719

Table A3.13: Sensitivity Test 3: Improved Intermodal Train Productivity. Summary of Change in Present Values Compared to Option in Best Estimate (%)

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	0%	-19%	178%	0%	178%	-19%	-100%
2	0%	-7%	0%	-78%	0%	-20%	-20%
3	0%	-9%	0%	-83%	0%	-26%	-26%
4	0%	-6%	0%	-64%	0%	-17%	-17%
5	0%	-6%	0%	-64%	0%	-17%	-17%
6	0%	-7%	0%	-65%	0%	-18%	-18%
7	0%	-7%	0%	-65%	0%	-19%	-19%

19. Therefore, as expected, the introduction of longer trains compared to the Best Estimate assumption reduces overall industry costs and increases rail mode share. However, the Base Case in these tests also is more efficient and consequently the benefits and NPV of introducing longer semi-trailer Options are diminished compared with the Best Estimate. Nevertheless, Table A3.11 shows that the overall net benefit of the proposition remains strongly positive for Options 2 to 7.

Annex 4: Results for Low and High Case Scenarios

Introduction

1. The Impact Assessment requires a range of forecast results to reflect the main uncertainties in the assessment. Accordingly, scenarios for both a 'Low' and a 'High' range of take up were developed in addition to the 'Best Estimate'. The take up assumptions for the Low and High alternative scenarios are summarised in Table 5.
2. The Low case assumes a reduced level of take up for each of the identified sub-categories of traffic, together with a higher threshold for definition of trip length distance. The High case assumes a higher level of take up in each sub-category and a lower threshold distance. All other assumptions are as for the Best Estimate.
3. The Low and High case assumptions affect both the internal industry costs for the overall road mode and the externalities imposed on society.
4. Note that the effect of these take up scenarios is to redistribute traffic between LSTs and conventional HGVs; for simplicity, **no change is assumed to rail mode share or costs** compared to the Best Estimate. Therefore, the forecasts of traffic on road and rail are those in Table 7 and the rail operating cost changes by Option from the Base Case are those in Table 9.

Estimated Total Transport Costs 2015, 2020 and 2025

5. Tables A4.1 and A4.2 presents the estimated net annual operating costs (not discounted) in the identified (in scope) sectors in the forecast years 2015, 2020 and 2025 for the Base Case and Options 1-7 for the combined intermodal rail and road sectors for the Low and High scenarios.

Table A4.1: Low Case Total Rail and Road Annual Operating Costs (£m)

Option	2015	2020	2025	Change 2015	Change 2020	Change 2025	Change 2015	Change 2020	Change 2025
Base Case	£8,836	£9,322	£9,789						
1	£8,828	£9,334	£9,823	-£8	£12	£34	0%	0%	0%
2	£8,785	£9,289	£9,776	-£51	-£33	-£14	-1%	0%	0%
3	£8,798	£9,302	£9,789	-£38	-£20	-£0	0%	0%	0%
4	£8,722	£9,240	£9,744	-£114	-£82	-£45	-1%	-1%	0%
5	£8,720	£9,238	£9,742	-£116	-£84	-£47	-1%	-1%	0%
6	£8,728	£9,247	£9,751	-£107	-£75	-£38	-1%	-1%	0%
7	£8,742	£9,261	£9,765	-£94	-£62	-£25	-1%	-1%	0%

Table A4.2: High Case Total Rail and Road Annual Operating Costs (£m)

Option	2015	2020	2025	Change 2015	Change 2020	Change 2025	Change 2015	Change 2020	Change 2025
Base Case	£8,836	£9,322	£9,789						
1	£8,744	£9,244	£9,728	-£92	-£78	-£61	-1%	-1%	-1%
2	£8,614	£9,106	£9,582	-£222	-£216	-£207	-3%	-2%	-2%
3	£8,668	£9,162	£9,639	-£168	-£161	-£151	-2%	-2%	-2%
4	£8,350	£8,844	£9,324	-£486	-£479	-£465	-6%	-5%	-5%
5	£8,344	£8,838	£9,318	-£492	-£485	-£471	-6%	-5%	-5%
6	£8,379	£8,874	£9,355	-£457	-£448	-£434	-5%	-5%	-4%
7	£8,417	£8,913	£9,394	-£418	-£410	-£395	-5%	-4%	-4%

6. Tables A4.3 and A4.4 show that, compared to rail, this is a relatively small change in road mode share. However, the LST part of the in-scope market will have lower costs (efficiencies) than the Base Case with the result that average unit costs for the road sector reduce overall. Tables A4.5 and A4.6 show how the average cost for road haulage changes for each Option with the inclusion of LSTs.

Table A4.3: Low Case Change in Road Mode Share and Annual Costs compared to Base Case

	Road Haulage	**Mode Share tonnes (% Change)**			**Change in Annual Costs (£m)**		
		2015	2020	2025	2015	2020	2025
Option							
1	14.6m Fixed Axles	0%	1%	1%	£49	£118	£192
2	14.6m Single Self-steer Axle	0%	1%	1%	£6	£73	£144
3	14.6m Active Steering	0%	1%	1%	£19	£86	£158
4	15.65m 2 x Self-steer Axles	1%	1%	2%	-£12	£109	£238
5	15.65m 1 x Command-steer Axle	1%	1%	2%	-£14	£107	£236
6	15.65m 2 x Command-steer Axles	1%	1%	2%	-£6	£116	£245
7	15.65m Active Steering	1%	1%	2%	£8	£129	£259

Table A4.4: High Case Change in Road Mode Share and Annual Costs compared to Base Case

	Road Haulage	**Mode Share tonnes (% Change)**			**Change in Annual Costs (£m)**		
		2015	2020	2025	2015	2020	2025
Option							
1	14.6m Fixed Axles	0%	1%	1%	-£35	£28	£97
2	14.6m Single Self-steer Axle	0%	1%	1%	-£166	-£110	-£49
3	14.6m Active Steering	0%	1%	1%	-£111	-£54	£7
4	15.65m 2 x Self-steer Axles	1%	1%	2%	-£385	-£288	-£181
5	15.65m 1 x Command-steer Axle	1%	1%	2%	-£390	-£294	-£187
6	15.65m 2 x Command-steer Axles	1%	1%	2%	-£355	-£257	-£150
7	15.65m Active Steering	1%	1%	2%	-£317	-£219	-£111

Table A4.5: Low Case Change in Road Average Costs (pence) compared to Base Case

	Road Haulage	**Cost per tonne**			**Cost per tonne-km**		
		2015	2020	2025	2015	2020	2025
Option							
1	14.6m Fixed Axles	2.40	10.22	18.47	-0.09	-0.14	-0.19
2	14.6m Single Self-steer Axle	-7.33	0.14	8.09	-0.16	-0.21	-0.27
3	14.6m Active Steering	-4.38	3.06	10.98	-0.14	-0.19	-0.25
4	15.65m 2 x Self-steer Axles	-18.18	-4.22	10.52	-0.34	-0.44	-0.54
5	15.65m 1 x Command-steer Axle	-18.63	-4.68	10.07	-0.34	-0.44	-0.54
6	15.65m 2 x Command-steer Axles	-16.66	-2.71	12.03	-0.33	-0.42	-0.53
7	15.65m Active Steering	-13.59	0.33	15.04	-0.31	-0.40	-0.51

Table A4.6: High Case Change in Road Average Costs (pence) compared to Base Case

	Road Haulage		Cost per tonne			Cost per tonne-km		
			2015	2020	2025	2015	2020	2025
Option								
1	14.6m Fixed Axles		-16.65	-9.77	-2.37	-0.23	-0.29	-0.35
2	14.6m Single Self-steer Axle		-46.33	-40.65	-34.31	-0.44	-0.51	-0.58
3	14.6m Active Steering		-33.90	-28.27	-21.98	-0.35	-0.42	-0.49
4	15.65m 2 x Self-steer Axles		-102.41	-92.14	-80.73	-0.94	-1.07	-1.20
5	15.65m 1 x Command-steer Axle		-103.74	-93.44	-82.02	-0.95	-1.08	-1.21
6	15.65m 2 x Command-steer Axles		-95.68	-85.40	-73.99	-0.90	-1.02	-1.15
7	15.65m Active Steering		-87.04	-76.85	-65.53	-0.83	-0.96	-1.09

7. Table A4.7 summarises the Annual Average and Present Values of industry benefits for the Low and High cases. Table A4.6 shows that for all Options, except Option 1 in the Low case, the net effect is a net benefit to industry.

Table A4.7: Annual Average and Present Value of Industry Benefits (£m) compared to Base Case

Option	LOW		HIGH	
	Average Annual Benefit (£m)	Present Value of Benefit (£m)	Average Annual Benefit (£m)	Present Value of Benefit (£m)
1	-£8	-£73	£69	£778
2	£31	£357	£188	£2,094
3	£19	£231	£140	£1,561
4	£75	£859	£415	£4,626
5	£76	£879	£420	£4,683
6	£69	£793	£388	£4,334
7	£57	£662	£355	£3,963

Externalities

8. Table A4.8 and A4.9 show the change in LST-kms and Conventional HGV-kms for each Option 1-7 compared to the Base Case. As noted above, the externalities are calculated for marginal changes in kilometres and each category has a different set of costs per kilometre.

9. The results show that there are generally increases in total HGV-km in the Low Case and decreases in the High Case. Note it has been assumed for simplicity in these scenarios that there is no difference in train-km from those in the Best Estimate Options so that the train externalities by Option adopted are those presented previously in Tables 16 and 18.

10. Tables A4.10 and A4.11 present the annual average value of externalities based on the changes in LST-km and HGV-km from the Base Case for the Low and High scenarios.

Table A4.8: Low Case Summary of Change in Annual Road (Millions) compared to Base Case

Option	LST			Conventional HGV			All HGV		
	2015	**2020**	**2025**	**2015**	**2020**	**2025**	**2015**	**2020**	**2025**
1	891	893	894	-854	-784	-715	38	108	179

2	1868	1870	1873	-1885	-1817	-1750	-17	53	123
3	1868	1870	1873	-1885	-1817	-1750	-17	53	123
4	1796	1815	1834	-1834	-1723	-1613	-37	92	222
5	1796	1815	1834	-1834	-1723	-1613	-37	92	222
6	1796	1815	1834	-1834	-1723	-1613	-37	92	222
7	1796	1815	1834	-1834	-1723	-1613	-37	92	222

Table A4.9: High Case Summary of Change in Annual Road (Millions) compared to Base Case

Option	LST			Conventional HGV			All HGV		
	2015	2020	2025	2015	2020	2025	2015	2020	2025
1	2774	2778	2782	-2830	-2764	-2698	-56	14	84
2	5535	5543	5551	-5736	-5674	-5612	-201	-131	-61
3	5540	5548	5556	-5736	-5674	-5612	-196	-126	-56
4	5338	5395	5451	-5727	-5658	-5589	-390	-264	-138
5	5339	5396	5453	-5727	-5658	-5589	-388	-262	-136
6	5342	5398	5455	-5727	-5658	-5589	-386	-260	-134
7	5342	5399	5456	-5727	-5658	-5589	-385	-259	-133

Table A4.10: Low Case HGV Annual Average Externalities 2011-2025 (£m) compared to Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
1	-£37	-£1	-£4	-£1	-£5	-£4	-£51
2	-£24	-£0	-£1	£0	-£1	£0	-£26
3	-£24	-£0	-£1	£0	-£1	£0	-£26
4	-£43	£0	-£2	-£0	-£4	£1	-£48
5	-£43	£0	-£2	-£1	-£5	£1	-£50
6	-£43	£0	-£2	-£0	-£5	£1	-£50
7	-£43	£0	-£2	-£1	-£5	£1	-£50

Table A4.11: High Case HGV Annual Average Externalities 2011-2025 (£m) compared to Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
1	-£17	£0	£0	-£0	-£2	£3	-£16
2	£15	£2	£7	£2	£9	£14	£49
3	£13	£2	£7	£2	£9	£14	£46
4	£30	£4	£14	£2	£11	£28	£89
5	£29	£4	£14	£1	£7	£28	£84
6	£29	£4	£14	£1	£7	£28	£83
7	£28	£4	£14	£1	£7	£28	£83

11. The "Summary: Analysis & Evidence" tables express the externalities separately depending on whether there are increases in costs imposed on society (PVC) or decreases in costs imposed on society (PVB). Tables A4.12 and A4.13 present the Present Values of externalities for HGVs for both Low and High scenarios, while Figures A4.1 and A4.2 present these graphically and also include the train externalities.

Table A4.12: Low Case HGV Present Value Externalities 2011-2025 (£m) compared to Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
1	-£377	-£7	-£40	-£7	-£51	-£43	-£525
2	-£241	£0	-£12	£1	-£6	£5	-£253
3	-£241	£0	-£12	£1	-£6	£5	-£253
4	-£430	£2	-£18	-£3	-£34	£17	-£466
5	-£430	£2	-£18	-£5	-£49	£17	-£483
6	-£430	£2	-£18	-£5	-£47	£17	-£481
7	-£430	£2	-£18	-£5	-£48	£17	-£482

Table A4.13: High Case HGV Present Value Externalities 2011-2025 (£m) compared to Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
1	-£162	£5	£8	-£2	-£23	£38	-£136
2	£180	£25	£81	£18	£104	£163	£572
3	£160	£24	£79	£18	£102	£159	£542
4	£364	£49	£162	£23	£125	£321	£1,044
5	£358	£49	£161	£16	£80	£319	£984
6	£349	£48	£160	£17	£84	£317	£976
7	£346	£48	£160	£16	£82	£317	£970

12. The summary of costs and benefits for the Low and High scenarios is included in Table A4.14 to A4.17.

Table A4.14: Low Case Summary of Change in Average Annual 2011-2025 Values (£m) compared to Base Case

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	-£8	£0	-£41	£0	-£50	£0
2	£0	£31	-£17	£0	-£17	£31
3	£0	£19	-£17	£0	-£17	£19
4	£0	£75	-£30	£0	-£30	£75
5	£0	£76	-£32	£0	-£32	£76
6	£0	£69	-£32	£0	-£32	£69
7	£0	£57	-£32	£0	-£32	£57

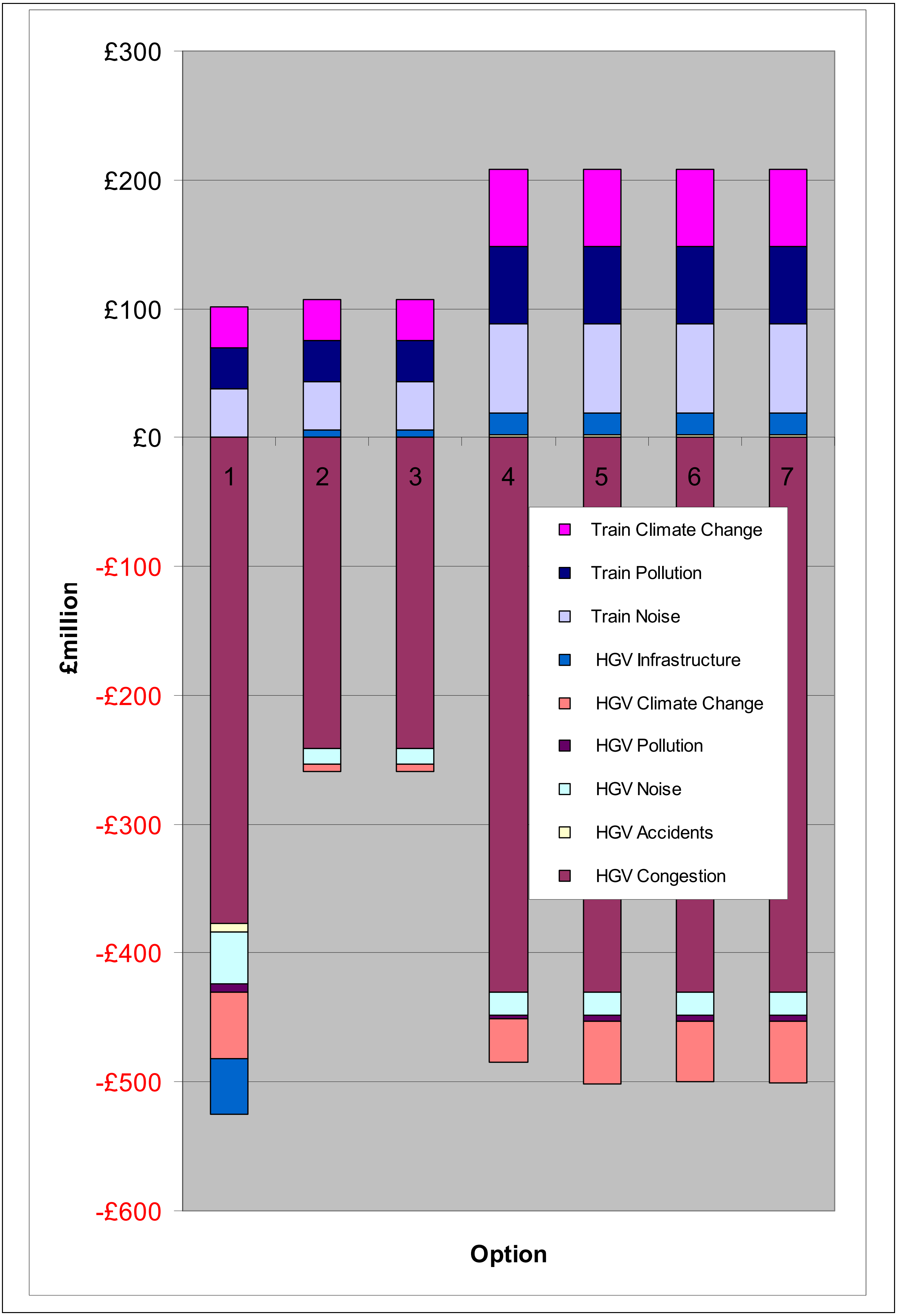


Figure A4.1: Low Case Summary of Externalities (£m, discounted) Compared to Base Case

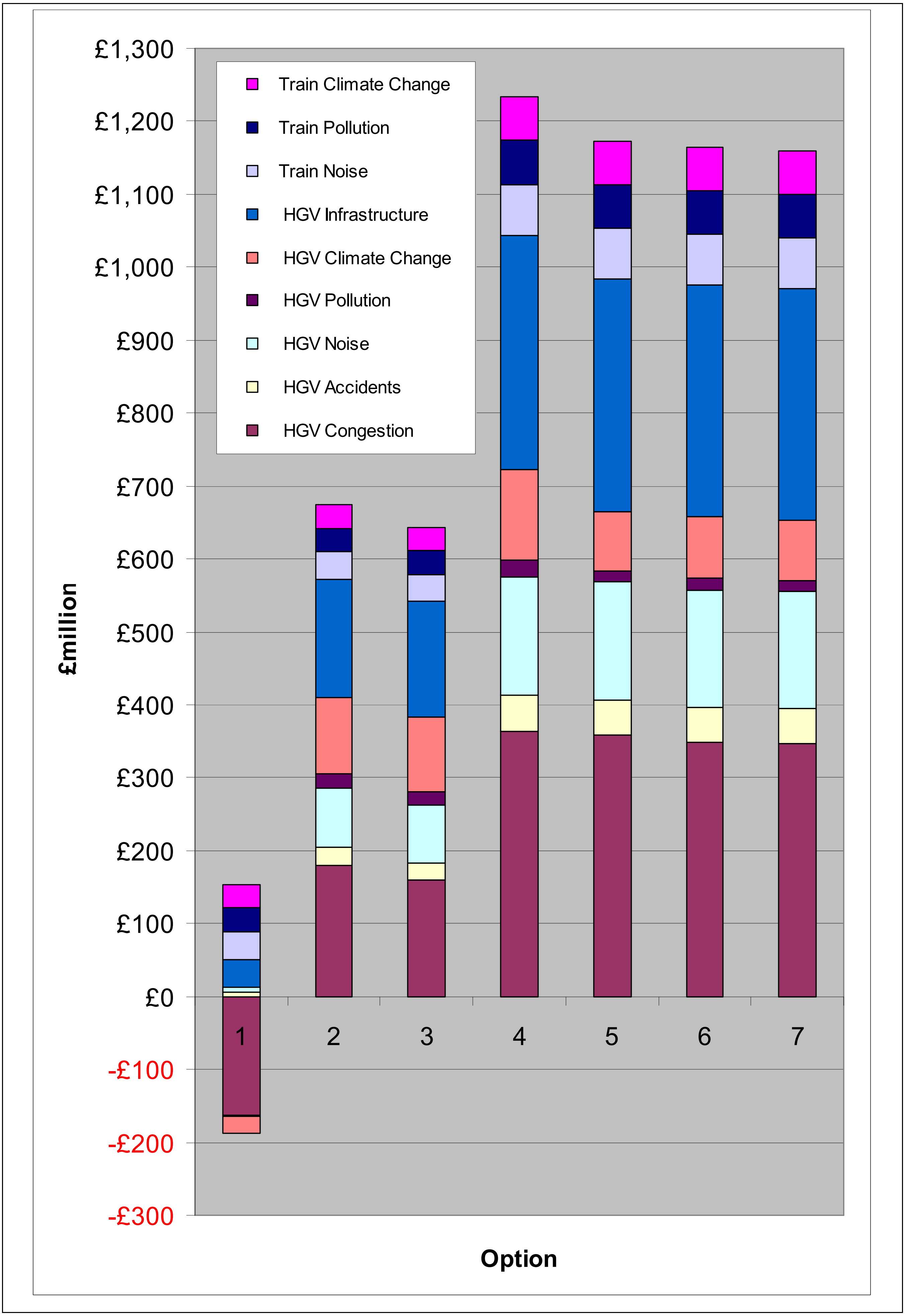


Figure A4.2: High Case Summary of Externalities (£m, discounted) Compared to Base Case

Table A4.15: High Case Summary of Change in Average Annual Values (£m) Compared to Base Case

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	£0	£69	-£6	£0	-£6	£69
2	£0	£188	£0	£58	£0	£246
3	£0	£140	£0	£56	£0	£195
4	£0	£415	£0	£107	£0	£522
5	£0	£420	£0	£102	£0	£522
6	£0	£388	£0	£101	£0	£489
7	£0	£355	£0	£101	£0	£456

Table A4.16: Low Case Summary of Present Values (£m, discounted) compared to Base Case

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	-£73	£0	-£423	£0	-£496	£0	-£496
2	£0	£357	-£152	£0	-£152	£357	£206
3	£0	£231	-£151	£0	-£151	£231	£80
4	£0	£859	-£277	£0	-£277	£859	£582
5	£0	£879	-£294	£0	-£294	£879	£585
6	£0	£793	-£292	£0	-£292	£793	£502
7	£0	£662	-£293	£0	-£293	£662	£369

Table A4.17: High Case Summary of Present Values (£m, discounted) Compared to Base Case

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	£0	£778	-£34	£0	-£34	£778	£743
2	£0	£2,094	£0	£674	£0	£2,768	£2,768
3	£0	£1,561	£0	£643	£0	£2,204	£2,204
4	£0	£4,626	£0	£1,233	£0	£5,859	£5,859
5	£0	£4,683	£0	£1,173	£0	£5,856	£5,856
6	£0	£4,334	£0	£1,165	£0	£5,499	£5,499
7	£0	£3,963	£0	£1,160	£0	£5,123	£5,123

13. Table A4.18 summarises the NPV range for the Low, Best Estimate and High cases. These results appear in the "Summary: Analysis & Evidence" page for each Option. For Options 2-7, the range of NPV is approximately -90% to +35% of the Best Estimate and they each yield a positive NPV in the Low case.

14. Option 1 has a larger percentage range. Only Option 1 shows a negative NPV in the Low case.

Table A4.18: Summary of Range of Net Present Values (£m, discounted) Compared to Base Case

Option	Low	Best Estimate	High
1	-£496	£381	£743
2	£206	£2,055	£2,768
3	£80	£1,616	£2,204
4	£582	£4,387	£5,859
5	£585	£4,384	£5,856
6	£502	£4,106	£5,499
7	£369	£3,789	£5,123

Annex 5: Single-deck LST Scenario

Introduction

1. The Best Estimate analysis has assumed that mode switch would apply to all in-scope traffic. An alternative regulatory possibility is that LSTs would be restricted to single-deck (assumed 4 metre high) trailers. This would reduce the level of switch and render LSTs less competitive compared to rail, particularly for longer distance hauls. Therefore, this alternative scenario considers the impact of restricting the mode shift effect to a sub-set of the market currently employing single-deck HGVs. All other assumptions remain as for the Best Estimate (central case) scenario.
2. Analysis of CSRGT suggests 30% of the rail market to be in competition with double-deck HGVs. In this alternative scenario, this market segment was assumed immune to the introduction of LSTs.
3. The Single-deck LST scenario results in more rail traffic for each Option than the Best Estimate because now no traffic is assumed to switch from rail to double-deck HGVs. The internal industry costs only change marginally as a result of the restriction to single-deck only but it does lead to a significant improvement in external costs due to the congestion and carbon savings resulting from a greater proportion of goods being on rail.

Traffic Forecasts

4. Table A5.1 summarises the results for the Base Case (Do Nothing) and for Options 1 to 7 for the Single-deck scenario. Despite loss of traffic in each year relative to the Base Case without LSTs, the rail sector remains significantly higher than in 2009 owing to the underlying large increase for rail in the Base Case forecast described above.

Table A5.1: Single-deck LST: Summary Traffic Forecasts – Options 1-7

	Domestic Intermodal Rail	000s tonnes				+/- v Base Case		
		2009	2015	2020	2025	2015	2020	2025
Option								
	Base Case	1,955	6,586	10,444	14,303			
1	14.6m Fixed Axles		5,221	7,943	10,665	-1,365	-2,502	-3,639
2	14.6m Single Self-steer Axle		5,221	7,943	10,665	-1,365	-2,502	-3,639
3	14.6m Active Steering		5,221	7,943	10,665	-1,365	-2,502	-3,639
4	15.65m 2 x Self-steer Axles		4,173	6,021	7,870	-2,413	-4,423	-6,434
5	15.65m 1 x Command-steer Axle		4,173	6,021	7,870	-2,413	-4,423	-6,434
6	15.65m 2 x Command-steer Axles		4,173	6,021	7,870	-2,413	-4,423	-6,434
7	15.65m Active Steering		4,173	6,021	7,870	-2,413	-4,423	-6,434
	Road Haulage	000s tonnes				+/- v Base Case		
		2009	2015	2020	2025	2015	2020	2025
Option								
	Base Case	430,834	438,361	444,633	450,906			
1	14.6m Fixed Axles		439,726	447,135	454,544	1,365	2,502	3,639
2	14.6m Single Self-steer Axle		439,726	447,135	454,544	1,365	2,502	3,639
3	14.6m Active Steering		439,726	447,135	454,544	1,365	2,502	3,639
4	15.65m 2 x Self-steer Axles		440,774	449,056	457,339	2,413	4,423	6,434
5	15.65m 1 x Command-steer Axle		440,774	449,056	457,339	2,413	4,423	6,434
6	15.65m 2 x Command-steer Axles		440,774	449,056	457,339	2,413	4,423	6,434
7	15.65m Active Steering		440,774	449,056	457,339	2,413	4,423	6,434
	Total Domestic Unit Load	000s tonnes				+/- v Base Case		
		2009	2015	2020	2025	2015	2020	2025
	All Options	432,789	444,947	455,078	465,209	0	0	0

Estimated Total Transport Costs 2015, 2020 and 2025 for Single-deck LST Scenario

5. Table A5.2 presents the estimated net annual operating costs (not discounted) in the identified (in scope) sectors in the forecast years 2015, 2020 and 2025 for the Base Case and Options 1-7 for the combined intermodal rail and road sectors.

Table A5.2: Single-deck LST: Total Rail and Road Annual Operating Costs (£m)

Option	2015	2020	2025	Change 2015	Change 2020	Change 2025	Change 2015	Change 2020	Change 2025
Base Case	£8,836	£9,322	£9,789						
1	£8,770	£9,267	£9,747	-£65	-£55	-£42	-1%	-1%	0%
2	£8,668	£9,159	£9,633	-£168	-£163	-£156	-2%	-2%	-2%
3	£8,709	£9,200	£9,675	-£127	-£122	-£114	-1%	-1%	-1%
4	£8,467	£8,959	£9,436	-£369	-£363	-£353	-4%	-4%	-4%
5	£8,463	£8,955	£9,432	-£373	-£367	-£357	-4%	-4%	-4%
6	£8,489	£8,982	£9,459	-£347	-£340	-£330	-4%	-4%	-3%
7	£8,522	£9,015	£9,493	-£314	-£307	-£296	-4%	-3%	-3%

6. Table A5.3 shows the change in rail mode share, compared to the Base Case, together with the change in annual costs. As expected, the rail loss of mode share and reduction in rail transport expenditure for each individual Option is less than in the Best Estimate (Table 9).

Table A5.3: Single-deck LST: Change in Rail Mode Share and Annual Costs Compared to the Base Case

	Domestic Intermodal Rail		**Mode Share tonnes (% Change)**			**Change in Annual Costs (£m)**		
			2015	2020	2025	2015	2020	2025
Option 1	14.6m Fixed Axles		-21%	-24%	-25%	-£40	-£74	-£111
2	14.6m Single Self-steer Axle		-21%	-24%	-25%	-£40	-£74	-£111
3	14.6m Active Steering		-21%	-24%	-25%	-£40	-£74	-£111
4	15.65m 2 x Self-steer Axles		-37%	-42%	-45%	-£71	-£134	-£199
5	15.65m 1 x Command-steer Axle		-37%	-42%	-45%	-£71	-£134	-£199
6	15.65m 2 x Command-steer Axles		-37%	-42%	-45%	-£71	-£134	-£199
7	15.65m Active Steering		-37%	-42%	-45%	-£71	-£134	-£199

7. The second effect is the increase in costs to the road sector owing to increased market share and volume relative to the Base Case. Table A5.4 shows that, compared to rail, this is a relatively small percentage change. However, as a third effect, the LST part of the in-scope market will have lower costs (efficiencies) with the result that average unit costs for the overall road sector reduce. Table A5.5 shows the average cost for road haulage changes from the Base Case for each Option with the restriction to exclude double-deck LSTs.

Table A5.4: Single-deck LST: Change in Road Mode Share and Annual Costs Compared to the Base Case

	Road Haulage		**Mode Share tonnes (% Change)**			**Change in Annual Costs (£m)**		
			2015	2020	2025	2015	2020	2025
Option 1	14.6m Fixed Axles		0%	1%	1%	-£26	£20	£68
2	14.6m Single Self-steer Axle		0%	1%	1%	-£128	-£89	-£46

3	14.6m Active Steering		0%	1%	1%	-£88	-£48	-£4
4	15.65m 2 x Self-steer Axles		1%	1%	1%	-£298	-£229	-£154
5	15.65m 1 x Command-steer Axle		1%	1%	1%	-£302	-£234	-£159
6	15.65m 2 x Command-steer Axles		1%	1%	1%	-£275	-£207	-£131
7	15.65m Active Steering		1%	1%	1%	-£242	-£173	-£97

Table A5.5: Single-deck LST: Change in Road Average Costs (pence) Compared to the Base Case

	Road Haulage		Cost per tonne			Cost per tonne-km		
			2015	2020	2025	2015	2020	2025
Option								
1	14.6m Fixed Axles		-11.98	-6.94	-1.49	-0.16	-0.20	-0.24
2	14.6m Single Self-steer Axle		-35.30	-31.19	-26.58	-0.33	-0.38	-0.43
3	14.6m Active Steering		-26.04	-21.97	-17.39	-0.27	-0.31	-0.36
4	15.65m 2 x Self-steer Axles		-78.29	-70.98	-62.79	-0.71	-0.80	-0.90
5	15.65m 1 x Command-steer Axle		-79.30	-71.98	-63.78	-0.72	-0.81	-0.91
6	15.65m 2 x Command-steer Axles		-73.28	-65.96	-57.77	-0.68	-0.77	-0.86
7	15.65m Active Steering		-65.77	-58.51	-50.38	-0.62	-0.71	-0.81

8. Table A5.6 shows that the net effect relative to the Base Case for all Options is a net benefit to industry. Therefore, these cost changes are reported as benefits (PVB). However, the magnitude of these benefits is marginally reduced for Option 2-7 compared with the Best Estimate, reflecting the potentially less efficient specification of LSTs. In Option 1, the industry benefits slightly increase.

Table A5.6: Single-deck LST: Average Annual and Present Value of Industry Benefits (£m)

Option	Average Annual Benefit (£m)	Present Value of Benefit (£m)
1	£49	£550
2	£142	£1,582
3	£106	£1,185
4	£314	£3,508
5	£318	£3,551
6	£295	£3,292
7	£266	£2,970

Externalities

9. Changes in HGV and train kilometres drive the external costs. Table A5.7 and A5.8 show the change in LST-kms, Conventional HGV-kms and Train-kms for each Option 1-7. As noted above, the externalities are calculated for marginal changes in kilometres and each category has a different set of costs per kilometre.

10. The reduction in HGV-km compared to the Best Estimate increases the external HGV benefits and this outweighs the reduction in rail external benefits giving rise to overall increases in the value of external benefits in the Single-deck LST scenario.

Table A5.7: Single-deck LST: Summary of Change in Annual Road Kilometres (Millions) Compared to the Base Case

Option	LST			Conventional HGV			All HGV		
	2015	2020	2025	2015	2020	2025	2015	2020	2025
1	2135	2138	2141	-2183	-2135	-2087	-48	3	54
2	4367	4373	4380	-4532	-4488	-4444	-165	-115	-64
3	4371	4377	4384	-4532	-4488	-4444	-161	-111	-60
4	4210	4255	4300	-4530	-4484	-4438	-320	-229	-138
5	4212	4256	4301	-4530	-4484	-4438	-319	-228	-137
6	4213	4258	4303	-4530	-4484	-4438	-317	-226	-136
7	4214	4258	4303	-4530	-4484	-4438	-317	-226	-135

Table A5.8: Single-deck LST: Summary of Change in Annual Train Kilometres (Millions) Compared to the Base Case

Option	2015	2020	2025
1	-2	-4	-5
2	-2	-4	-5
3	-2	-4	-5
4	-4	-7	-10
5	-4	-7	-10
6	-4	-7	-10
7	-4	-7	-10

11. Tables A5.9 and A5.10 present the annual average value of externalities for HGVs and rail.

Table A5.9: Single-deck LST: HGV Annual Average Externalities 2011-2025 (£m) Compared to the Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
1	-£8	£1	£1	-£0	-£1	£4	-£5
2	£17	£2	£6	£1	£8	£13	£47
3	£16	£2	£6	£1	£8	£12	£45
4	£35	£4	£13	£2	£9	£25	£87
5	£34	£4	£12	£1	£6	£25	£83
6	£34	£4	£12	£1	£7	£25	£82
7	£34	£4	£12	£1	£6	£25	£82

Table A5.10: Single-deck LST: Train Annual Average Externalities 2011-2025 (£m) Compared to the Base Case

Option	Train Noise	Train Pollution	Train Climate Change	TOTAL
1	£2	£2	£2	£7
2	£2	£2	£2	£7
3	£2	£2	£2	£7
4	£5	£4	£4	£13
5	£5	£4	£4	£13
6	£5	£4	£4	£13
7	£5	£4	£4	£13

12. The "Summary: Analysis & Evidence" tables express the externalities separately depending on whether there are increases in costs imposed on society (PVC) or decreases in costs imposed on society (PVB). Tables A5.11 and A5.12 present the Present Values of externalities for HGVs and rail, and Figure A5.1 presents these graphically.

Table A5.11: Single-deck LST: HGV Present Value Externalities 2011-2025 (£m) Compared to the Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
1	-£76	£6	£11	-£1	-£14	£43	-£31
2	£203	£22	£71	£16	£88	£144	£544
3	£188	£21	£69	£15	£86	£141	£522
4	£403	£43	£141	£20	£109	£282	£999
5	£399	£43	£141	£15	£74	£281	£952
6	£392	£43	£140	£15	£77	£280	£947
7	£390	£43	£140	£15	£75	£279	£943

Table A5.12: Single-deck LST: Train Present Value Externalities 2011-2025 (£m) Compared to the Base Case

Option	Train Noise	Train Pollution	Train Climate Change	TOTAL
1	£26	£22	£22	£71
2	£26	£22	£22	£71
3	£26	£22	£22	£71
4	£49	£42	£42	£133
5	£49	£42	£42	£133
6	£49	£42	£42	£133
7	£49	£42	£42	£133

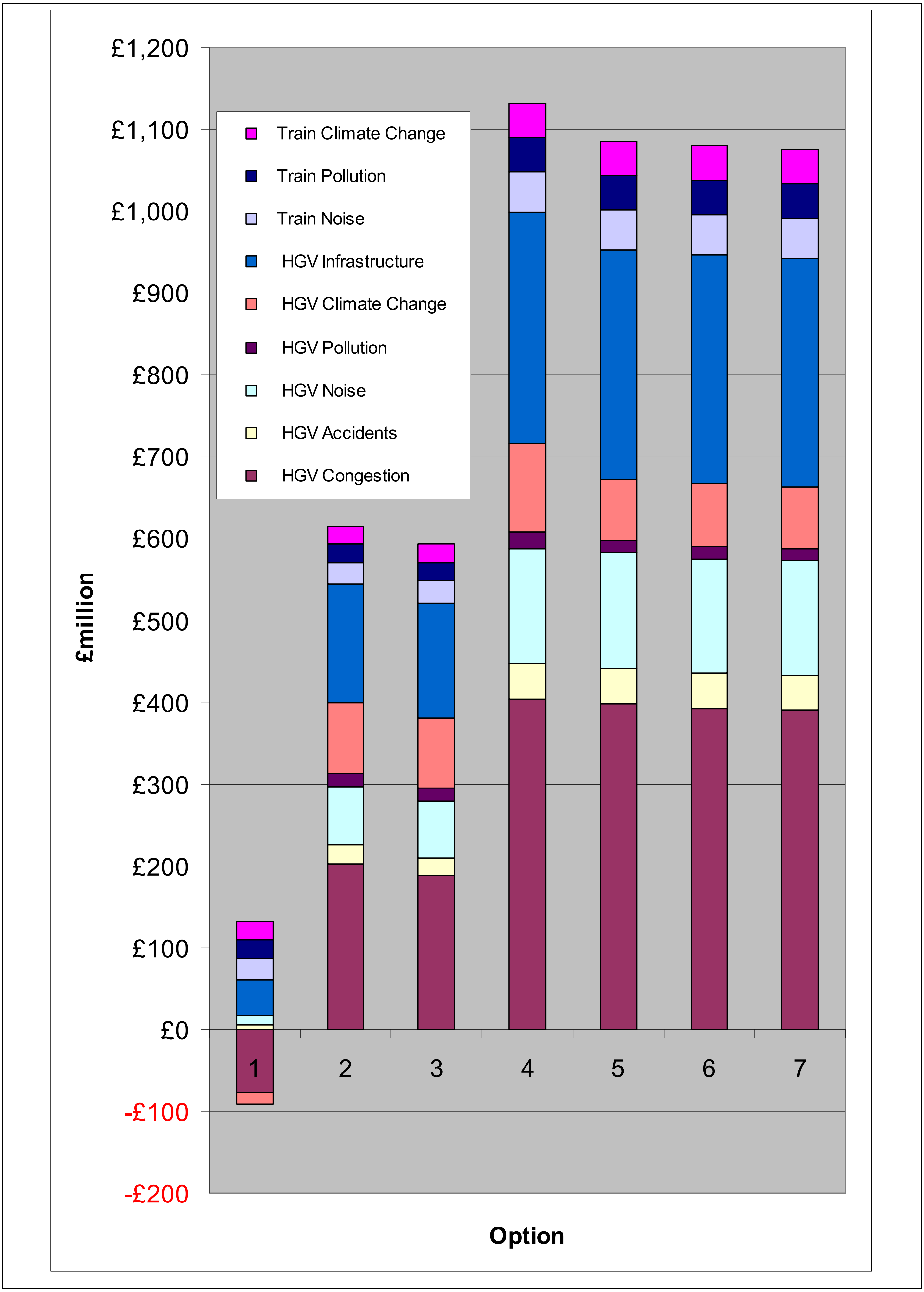


Figure A5.1: Single-deck LST: Summary of Externalities (£m, discounted) Compared to Base Case

13. The summary of average annual costs and benefits is included in Table A5.13 and their Present Values in Table A5.14.

Table A5.13: Single-deck LST: Summary of Average Annual Values (£m) Compared to the Base Case

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1	£0	£49	£0	£2	£0	£50
2	£0	£142	£0	£54	£0	£196
3	£0	£106	£0	£52	£0	£158
4	£0	£314	£0	£100	£0	£414
5	£0	£318	£0	£95	£0	£414
6	£0	£295	£0	£95	£0	£390
7	£0	£266	£0	£95	£0	£361

Table A5.14: Single-deck LST: Summary of Present Values (£m, discounted) Compared to the Base Case

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	£0	£550	£0	£40	£0	£590	£590
2	£0	£1,582	£0	£615	£0	£2,197	£2,197
3	£0	£1,185	£0	£593	£0	£1,778	£1,778
4	£0	£3,508	£0	£1,132	£0	£4,640	£4,640
5	£0	£3,551	£0	£1,085	£0	£4,636	£4,636
6	£0	£3,292	£0	£1,080	£0	£4,371	£4,371
7	£0	£2,970	£0	£1,075	£0	£4,045	£4,045

14. The restriction to single-deck for LSTs leads in Table A5.15 to a minimal increase in overall internal industry costs compared to the Best Estimate assumption, while it significantly increases rail mode share. This greater use of rail in place of road leads to greater overall external benefits (relative to the Best Estimate scenario) for every Option. This is due to reductions in road congestion, noise and carbon emissions as well as to improvements in safety. Table A5.16 shows that the Single-deck LST scenario yields greater overall net benefits than the Best Estimate due primarily to these reductions in external costs. For Options 2-7, the increase in the NPV lies in the range +6% to +10%. For Option 1, the increase in the NPV is +55%, though this is from a much smaller initial value than for other Options, noting that Option 1 remains the poorest performing of all of the Options in each of the scenarios that has been tested. However, there is an important caveat to this analysis. The economic benefit results have been calculated using the *road and rail cost models* developed for the project. These models are intended to replicate market rates incurred by the logistics industry i.e. pure financial cost. The traffic forecasts and modal split analysis use *generalised costs*, which account for the quality of service and flexibility characteristics of a particular mode in addition to the actual transport operating costs. For a number of movements road is more expensive than rail in pure *financial* terms but was the chosen mode because its *generalised*

costs were lower i.e. quality of service and flexibility characteristics encouraged the use of road even though the financial (operating) costs were higher. In this scenario the traffic which has switched (back) to rail due to the restriction to single-deck may incur ***lower*** financial cost but ***higher*** generalised cost; but only the financial impact is monetised.

Table A5.15: Single-deck LST: Summary of Change in Present Values Compared to Option in Best Estimate (£m, discounted)

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	£0	£31	£138	£40	£138	£71	£209
2	£0	-£10	£0	£153	£0	£143	£143
3	£0	£8	£0	£154	£0	£162	£162
4	£0	-£33	£0	£286	£0	£252	£252
5	£0	-£35	£0	£288	£0	£253	£253
6	£0	-£23	£0	£288	£0	£265	£265
7	£0	-£33	£0	£288	£0	£256	£256

Table A5.16: Single-deck LST: Summary of Change in Present Values Compared to Option in Best Estimate (%)

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1	0%	6%	-100%	n/a	-100%	14%	55%
2	0%	-1%	0%	33%	0%	7%	7%
3	0%	1%	0%	35%	0%	10%	10%
4	0%	-1%	0%	34%	0%	6%	6%
5	0%	-1%	0%	36%	0%	6%	6%
6	0%	-1%	0%	36%	0%	6%	6%
7	0%	-1%	0%	37%	0%	7%	7%

Annex 6: Assessment of Impact of Rail Sector Response with Longer Intermodal Units

1. The ability to operate longer semi-trailers potentially allows the complementary introduction of longer intermodal units on domestic rail freight flows.

2. The Megafret intermodal platform wagon, used for most domestic intermodal flows, has a 15.6m loading deck and is capable of accommodating units of such a length, so new rolling-stock equipment would not have to be developed. A train hauling a rake of Megafret wagons essentially costs the same, regardless of the length of the intermodal units being conveyed on those wagons. A longer intermodal unit could therefore be conveyed for the same cost as a train conveying existing length (13.6m) intermodal units, thereby generating efficiencies. A 15.6m unit would allow an additional four single-stacked pallets to be conveyed compared with an existing 13.6m maximum length box, generating cost savings in the form of lower per pallet costs. Therefore, as an alternative scenario, the Best Estimate assumptions were also applied assuming that longer intermodal units were employed in the rail sector.

Issues Potentially Affecting Introduction of Longer Intermodal Units

3. There are a number of issues (which have been raised by industry during the evidence gathering exercise) which may prevent their introduction, in the short/medium term. These are summarised below.

4. *Construction and strength*. In order to be compatible with existing lifting equipment, a longer intermodal unit will need to be fitted with the 'lifting points' in the same position as a standard 40/45ft maritime shipping container. It has been suggested that it may not be possible to construct such a unit with the required 'rigid strength'. However, we understand that Wincanton have commissioned a design for a 15.6m intermodal unit which is compatible with existing lifting equipment and has sufficient in-built rigid strength.

5. *Compatibility with skeletal trailers*. Longer skeletal semi-trailers (to convey longer intermodal units by road) will need to be 'flexible' and compatible with existing standard 40/45ft maritime shipping containers. Otherwise, industry will be required to operate two types of skeletal trailers (which will add to industry costs). We understand that Wincanton have commissioned a design for a 15.6m skeletal semi-trailer which is universal and is able to convey 40/45ft maritime shipping containers, 13.6m swap-bodies and their design for the longer intermodal unit.

6. *Dispose of existing length units*. Operators would be forced to dispose of existing length intermodal units before the end of their economic/operational life i.e. before they had been fully depreciated. The second-hand market would consequently be 'flooded' with partially depreciated 13.6m/45ft units that would be difficult/impossible to sell. Such units may ultimately have to be scrapped. Operators would be forced to partially write-off recent capital investments. However, the road haulage industry is in the same position, with road haulage operators potentially needing to write-off existing trailer equipment early to benefit from longer semi-trailers.

7. *Investment in new equipment*. Similar to the above argument, the rail industry would need to invest in a new fleet of longer intermodal units in order to achieve the forecast benefits. Again, this is a realistic argument and operators would need to invest in new equipment. However, the road haulage industry is in the same position, with road haulage operators potentially needing to invest in new semi-trailers to benefit from any efficiency savings.

8. *Cranes*. Equipment at some intermodal terminals might not be suitable for longer intermodal units. In particular, they might not longitudinally 'fit through' the gap between rail-mounted gantry crane 'legs'. Discussions with Freightliner appear to suggest that their cranes are able to 'twist' container units when being lifted so that they 'fit through' the gap between rail-mounted gantry crane 'legs' lengthways. In any case, this problem would be overcome by using reach-stacker lifting equipment.

9. As outlined in Figure 1, major future growth is forecast in rail domestic intermodal, which will imply a substantial increase from the existing fleet of intermodal units, so much of the new rail investment would arise in any scenario.

Traffic Forecasts

10. Table A6.1 summarises the results for the Base Case (Do Nothing) and for Options 8 to 14 for this Longer Intermodal Unit scenario. Each Option 8-14 matches to the corresponding original Option 1-7 that was based instead on the use only of existing shorter 13.6m intermodal units. Unlike any other scenario considered, the modelled forecasts show that the introduction of Longer Intermodal Units increase the rail market (tonnes-lifted) by +7% by 2025, over and above the large increase in

market shown in the Base Case between 2009 and 2025. There is a corresponding reduction in HGV tonnes-lifted for LST Options 8-14. The overall mode switch is approximately 0.2% in 2025 compared with the Base Case.

Table A6.1: Longer Intermodal Units: Summary Traffic Forecasts – Options 8-14

	Domestic Intermodal Rail	**000s tonnes**				**+/- v Base Case**		
		2009	2015	2020	2025	2015	2020	2025
Option								
	Base Case	1,955	6,586	10,444	14,303			
8	14.6m Fixed Axles		6,942	11,097	15,253	356	653	949
9	14.6m Single Self-steer Axle		6,942	11,097	15,253	356	653	949
10	14.6m Active Steering		6,942	11,097	15,253	356	653	949
11	15.65m 2 x Self-steer Axles		6,974	11,156	15,338	388	711	1,035
12	15.65m 1 x Command-steer Axle		6,974	11,156	15,338	388	711	1,035
13	15.65m 2 x Command-steer Axles		6,974	11,156	15,338	388	711	1,035
14	15.65m Active Steering		6,974	11,156	15,338	388	711	1,035
	Road Haulage	**000s tonnes**				**+/- v Base Case**		
		2009	2015	2020	2025	2015	2020	2025
Option								
	Base Case	430,834	438,361	444,633	450,906			
8	14.6m Fixed Axles		438,005	443,981	449,956	-356	-653	-949
9	14.6m Single Self-steer Axle		438,005	443,981	449,956	-356	-653	-949
10	14.6m Active Steering		438,005	443,981	449,956	-356	-653	-949
11	15.65m 2 x Self-steer Axles		437,973	443,922	449,871	-388	-711	-1,035
12	15.65m 1 x Command-steer Axle		437,973	443,922	449,871	-388	-711	-1,035
13	15.65m 2 x Command-steer Axles		437,973	443,922	449,871	-388	-711	-1,035
14	15.65m Active Steering		437,973	443,922	449,871	-388	-711	-1,035
	Total Domestic Unit Load	**000s tonnes**				**+/- v Base Case**		
		2009	2015	2020	2025	2015	2020	2025
	All Options	432,789	444,947	455,078	465,209	0	0	0

Estimated Total Transport Costs 2015, 2020 and 2025

11. Table A6.2 presents the estimated net annual operating costs (not discounted) in the identified (in scope) sectors in the forecast years 2015, 2020 and 2025 for the Base Case and Options 8-14 for the combined intermodal rail and road sectors.

Table A6.2: Longer Intermodal Units: Total Rail and Road Annual Operating Costs (£m) Compared to Base Case

Option	2015	2020	2025	Change 2015	Change 2020	Change 2025	Change 2015	Change 2020	Change 2025
Base Case	£8,836	£9,322	£9,789						
8	£8,736	£9,208	£9,660	-£100	-£114	-£129	-1%	-1%	-1%
9	£8,631	£9,098	£9,545	-£205	-£225	-£244	-2%	-2%	-2%
10	£8,673	£9,140	£9,588	-£163	-£182	-£201	-2%	-2%	-2%
11	£8,401	£8,853	£9,286	-£435	-£470	-£503	-5%	-5%	-5%
12	£8,396	£8,848	£9,281	-£440	-£474	-£508	-5%	-5%	-5%
13	£8,423	£8,876	£9,309	-£412	-£447	-£480	-5%	-5%	-5%
14	£8,455	£8,907	£9,340	-£381	-£416	-£450	-4%	-4%	-5%

12. Table A6.3 shows the change in rail mode share, compared to the Base Case, together with the change in annual costs.

Table A6.3: Longer Intermodal Units: Change in Rail Mode Share and Annual Costs Compared to Base Case

	Domestic Intermodal Rail		**Mode Share tonnes (% Change)**			**Change in Annual Costs (£m)**		
			2015	2020	2025	2015	2020	2025
Option								
8	14.6m Fixed Axles		5%	6%	7%	£1	£3	£6
9	14.6m Single Self-steer Axle		5%	6%	7%	£1	£4	£6
10	14.6m Active Steering		5%	6%	7%	£1	£4	£7
11	15.65m 2 x Self-steer Axles		6%	7%	7%	-£7	-£9	-£11
12	15.65m 1 x Command-steer Axle		6%	7%	7%	-£7	-£9	-£11
13	15.65m 2 x Command-steer Axles		6%	7%	7%	-£7	-£9	-£11
14	15.65m Active Steering		6%	7%	7%	-£7	-£9	-£11

13. Table A6.4 shows the change in expenditure by the road sector owing to reduced market volume (decreasing by 0.2%). However, the LST part of the in-scope market will have lower costs (efficiencies) with the result that average costs for the overall road sector reduce compared to the Base Case. Table A6.5 shows the average cost per tonne and per tonne-km for road haulage reduces for each Option with the inclusion of LSTs.

Table A6.4: Longer Intermodal Units: Change in Road Mode Share and Annual Costs Compared to Base Case

	Road Haulage		**Mode Share tonnes (% Change)**			**Change in Annual Costs (£m)**		
			2015	2020	2025	2015	2020	2025
Option								
8	14.6m Fixed Axles		0%	0%	0%	-£100	-£118	-£135
9	14.6m Single Self-steer Axle		0%	0%	0%	-£206	-£228	-£250
10	14.6m Active Steering		0%	0%	0%	-£164	-£186	-£208
11	15.65m 2 x Self-steer Axles		0%	0%	0%	-£428	-£461	-£492
12	15.65m 1 x Command-steer Axle		0%	0%	0%	-£433	-£465	-£497
13	15.65m 2 x Command-steer Axles		0%	0%	0%	-£406	-£438	-£469
14	15.65m Active Steering		0%	0%	0%	-£374	-£407	-£439

Table A6.5: Longer Intermodal Units: Change in Road Average Costs (pence) Compared to Base Case

	Road Haulage	Cost per tonne			Cost per tonne-km		
		2015	2020	2025	2015	2020	2025
Option							
8	14.6m Fixed Axles	-21.34	-23.52	-25.66	-0.14	-0.14	-0.14
9	14.6m Single Self-steer Axle	-45.40	-48.40	-51.26	-0.31	-0.33	-0.34
10	14.6m Active Steering	-35.78	-38.87	-41.81	-0.24	-0.26	-0.27
11	15.65m 2 x Self-steer Axles	-96.06	-100.52	-104.64	-0.68	-0.71	-0.74
12	15.65m 1 x Command-steer Axle	-97.12	-101.55	-105.65	-0.69	-0.72	-0.75
13	15.65m 2 x Command-steer Axles	-90.88	-95.39	-99.55	-0.64	-0.68	-0.70
14	15.65m Active Steering	-83.75	-88.44	-92.78	-0.59	-0.62	-0.65

14. Table A6.6 shows that, the net effect for each Option is a net benefit to industry. Therefore, these cost changes are recorded as benefits (PVB).

Table A6.6: Longer Intermodal Units: Annual Average and Present Value of Industry Benefits (£m) Compared to Base Case

Option	Average Annual Benefit (£m)	Present Value of Benefit (£m)
8	£97	£1,069
9	£192	£2,121
10	£155	£1,711
11	£402	£4,449
12	£406	£4,493
13	£382	£4,228
14	£356	£3,929

Externalities

15. Changes in HGV and train kilometres drive the external costs. Table A6.7 and A6.8 show the change in LST-kms, Conventional HGV-kms and Train-kms for each Option 8-14 compared to the Base Case. The efficiency savings derived from the use of longer intermodal units lessens both rail and overall road vehicle kilometres. As noted above, the externalities are calculated for marginal changes in kilometres and each category has a different set of costs per kilometre.

Table A6.7: Longer Intermodal Units: Summary of Change in Annual Road and Train Kilometres (Millions) Compared to Base Case

Option	LST			Conventional HGV			All HGV		
	2015	2020	2025	2015	2020	2025	2015	2020	2025
8	2247	2230	2214	-2376	-2370	-2364	-129	-140	-150
9	4531	4488	4446	-4780	-4747	-4715	-250	-259	-269
10	4535	4492	4450	-4780	-4747	-4715	-246	-255	-265
11	4319	4279	4238	-4781	-4748	-4715	-461	-469	-477
12	4320	4280	4239	-4781	-4748	-4715	-460	-468	-476
13	4322	4281	4241	-4781	-4748	-4715	-458	-466	-474
14	4323	4282	4241	-4781	-4748	-4715	-458	-466	-474

Table A6.8: Longer Intermodal Units: Summary of Change in Annual Train Kilometres (Millions) Compared to Base Case

Option	2015	2020	2025
8	0	0	0
9	0	0	0
10	0	0	0
11	-1	-1	-1
12	-1	-1	-1
13	-1	-1	-1
14	-1	-1	-1

16. Tables A6.9 and A6.10 present the change compared to the Base Case annual average value of externalities for HGVs and rail. They illustrate that the reduction in overall road vehicle and rail kilometres leads to benefits due to reductions in all external cost components.

Table A6.9: Longer Intermodal Units: HGV Annual Average Externalities 2011-2025 (£m) Compared to Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
8	£32	£2	£6	£1	£4	£10	£55
9	£59	£3	£12	£2	£14	£19	£109
10	£57	£3	£12	£2	£13	£19	£106
11	£103	£6	£22	£3	£19	£36	£187
12	£102	£6	£21	£3	£16	£36	£183
13	£102	£6	£21	£3	£16	£35	£183
14	£101	£6	£21	£3	£16	£35	£182

Table A6.10: Longer Intermodal Units: Train Annual Average Externalities 2011-2025 (£m) Compared to Base Case

Option	Train Noise	Train Pollution	Train Climate Change	TOTAL
8	£0	£0	£0	£0
9	£0	£0	£0	£0
10	£0	£0	£0	£0
11	£1	£0	£0	£2
12	£1	£0	£0	£2
13	£1	£0	£0	£2
14	£1	£0	£0	£2

17. Tables A6.11 and A6.12 present the Present Values of externalities for HGVs and rail, and Figure A6.1 presents these graphically. The results show that the complementary introduction of Longer Intermodal Units yields large increases in the external benefits (PVB) of reduced HGV-km.

Table A6.11: Longer Intermodal Units: HGV Present Value Externalities 2011-2025 (£m) Compared to Base Case

Option	HGV Congestion	HGV Accidents	HGV Noise	HGV Pollution	HGV Climate Change	HGV Infrastructure	TOTAL
8	£346	£17	£69	£7	£46	£113	£599
9	£632	£33	£130	£24	£150	£217	£1,186
10	£617	£33	£128	£24	£148	£214	£1,163
11	£1,109	£62	£237	£34	£210	£400	£2,052
12	£1,104	£61	£236	£28	£175	£399	£2,004
13	£1,098	£61	£236	£29	£178	£397	£1,999
14	£1,096	£61	£235	£29	£177	£397	£1,995

Table A6.12: Longer Intermodal Units: Train Present Value Externalities 2011-2025 (£m) Compared to Base Case

Option	Train Noise	Train Pollution	Train Climate Change	TOTAL
8	£0	£0	£0	£1
9	£0	£0	£0	£1
10	£0	£0	£0	£1
11	£6	£5	£5	£17
12	£6	£5	£5	£17
13	£6	£5	£5	£16
14	£6	£5	£5	£16

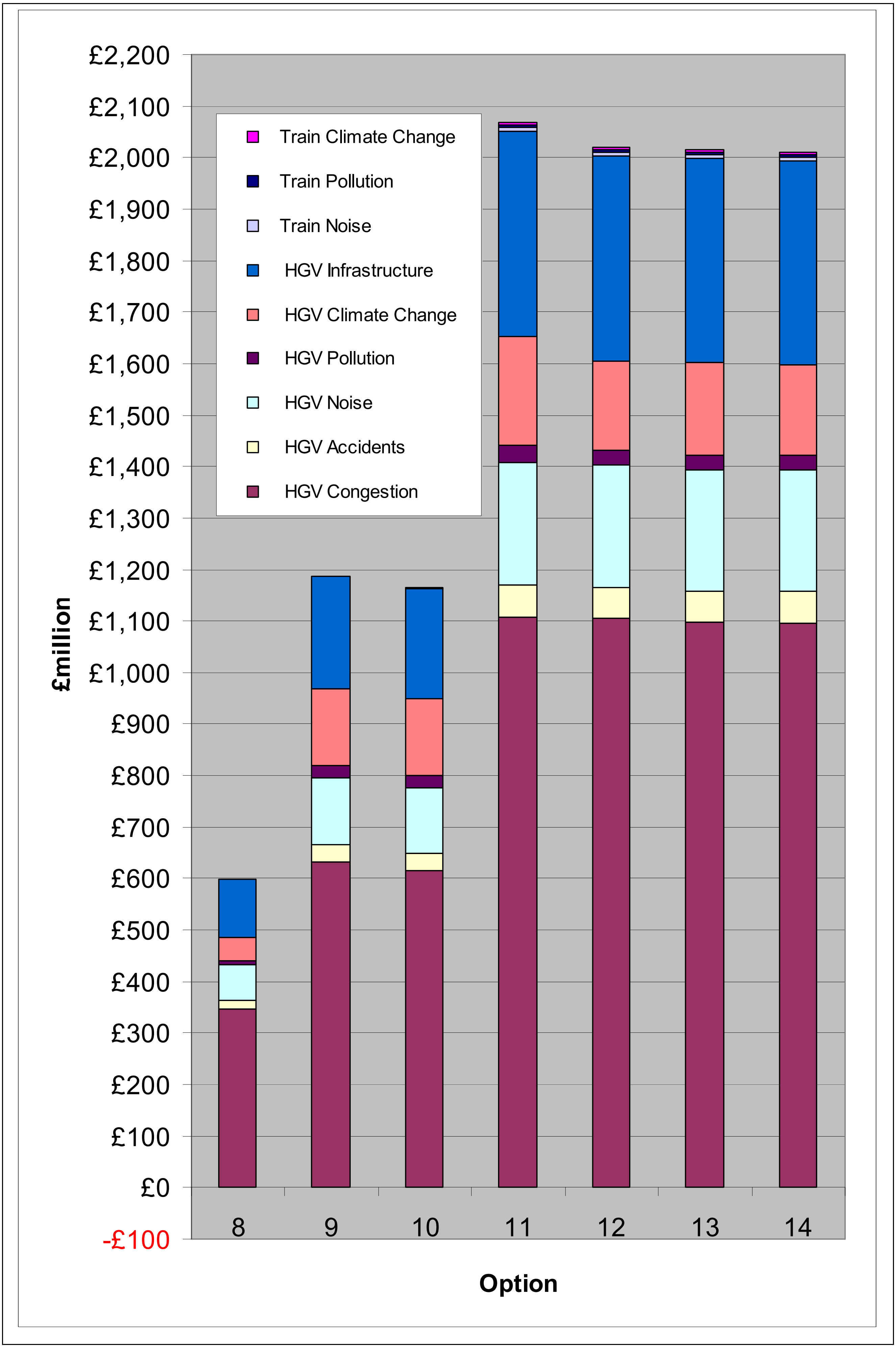


Figure A6.1: Longer Intermodal Units: Summary of Externalities (£m, discounted) Compared to the Base Case

18. The summary of costs and benefits for the Longer Intermodal Units scenario is included in Table A6.13 and A6.14. These show increased benefits (for both internal industry and externalities).

Table A6.13: Longer Intermodal Units: Summary of Average Annual Values (£m) Compared to Base Case

Option	Internal Industry		Externalities		Total	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
8	£0	£97	£0	£55	£0	£152
9	£0	£192	£0	£109	£0	£301
10	£0	£155	£0	£106	£0	£262
11	£0	£402	£0	£189	£0	£591
12	£0	£406	£0	£185	£0	£591
13	£0	£382	£0	£184	£0	£566
14	£0	£356	£0	£184	£0	£539

Table A6.14: Longer Intermodal Units: Summary of Present Values (£m, discounted) Compared to Base Case

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
8	£0	£1,069	£0	£600	£0	£1,668	£1,668
9	£0	£2,121	£0	£1,187	£0	£3,309	£3,309
10	£0	£1,711	£0	£1,164	£0	£2,875	£2,875
11	£0	£4,449	£0	£2,068	£0	£6,517	£6,517
12	£0	£4,493	£0	£2,021	£0	£6,514	£6,514
13	£0	£4,228	£0	£2,015	£0	£6,243	£6,243
14	£0	£3,929	£0	£2,011	£0	£5,940	£5,940

19. The extensive take-up by rail of longer intermodal units leads in Table A6.15 to a major reduction both in overall internal industry costs and in external costs compared to the Best Estimate assumption, while it significantly increases rail mode share. Table A6.16 shows that the Longer Intermodal Units scenario yields overall net benefits that typically are around 50% greater than those in the Best Estimate scenario due particularly to reductions in external costs.

20. This scenario effectively estimates an upper bound for the benefits to rail from the introduction of LSTs, whereas the Best Estimate scenario provides a corresponding lower bound to the rail industry from their introduction. The widespread adoption of longer intermodal units would amplify substantially the added benefits to the economy overall, as well as to the environment and the rail industry in particular, from introducing LSTs. It highlights the importance of encouraging their usage in tandem with the introduction of LSTs.

Table A6.15: Longer Intermodal Units: Summary of Change in Present Values Compared to Option in Best Estimate (£m, discounted)

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1/8	£0	£549	£138	£600	£138	£1,149	£1,287
2/9	£0	£529	£0	£725	£0	£1,254	£1,254
3/10	£0	£534	£0	£725	£0	£1,259	£1,259
4/11	£0	£908	£0	£1,222	£0	£2,130	£2,130
5/12	£0	£906	£0	£1,224	£0	£2,130	£2,130
6/13	£0	£913	£0	£1,224	£0	£2,137	£2,137
7/14	£0	£926	£0	£1,224	£0	£2,151	£2,151

Table A6.16: Longer Intermodal Units: Summary of Change in Present Values Compared to Option in Best Estimate (%)

Option	Internal Industry		Externalities		Total		
	PVC	PVB	PVC	PVB	PVC	PVB	NPV
1/8	0%	106%	-100%	n/a	-100%	221%	337%
2/9	0%	33%	0%	157%	0%	61%	61%
3/10	0%	45%	0%	165%	0%	78%	78%
4/11	0%	26%	0%	144%	0%	49%	49%
5/12	0%	25%	0%	154%	0%	49%	49%
6/13	0%	28%	0%	155%	0%	52%	52%
7/14	0%	31%	0%	156%	0%	57%	57%

Annex 7: Competition Assessment

1. The purpose of the competition assessment is to identify whether the impact of a proposal is pro- or anti- competitive in relation to affected markets, and to assess whether this impact on competition is significant.
2. There are four filter questions, and the answers are listed below. Would the regulatory proposal:

- ***Directly limit the number or range of suppliers?*** NO.
  - i) The threat of entry of new competitors will not substantially change with the revised regulations and is not believe to be a constraint on existing suppliers of haulage services. The proposed regulations do not grant exclusive rights to supply the services of LSTs to customers in the haulage market.
  - ii) The proposed regulations are unlikely to lead to a single supplier situation.
  - iii) It is not envisaged that the proposed regulation will impose additional licensing constraints or a special licensing regime to operate in the market and therefore no constraint on supply is expected (although some overseas trial experience suggests that operation of albeit much longer vehicles was restricted to experienced drivers).
  - iv) It is not expected that the proposed regulation will seek to impose a fixed limit on the number of suppliers and new entrants.
- ***Indirectly limit the number or range of suppliers?*** YES. There may be indirect effects because the proposed LST is more expensive to acquire and operate, and those hauliers that are not in a suitable position to change their fleet may be disadvantaged. It is possible that some customers may come to regard the LST as the de facto standard vehicle type, and it is possible that rates charged by hauliers may not increase in line with increased productivity. This view was voiced by some hauliers, notably smaller firms, but it was not possible to quantify or monetise this possible impact. In general, policies raising the costs of entry will deter entry and thereby have detrimental impact on potential competition and efficiency.
- ***Limit the ability of suppliers to compete?*** YES. As above. However, by permitting a wider range of possible services and niches, i.e. by operating a range of vehicle types best suited to the task in hand, the ability to compete may increase. However, the general view from the evidence gathering was that, particularly for small firms, the change in the de facto standard vehicle might cause some inefficiency by deployment of the unnecessarily long vehicles for some tasks, and thereby indirectly limit the ability of those suppliers to compete with the larger fleets of the bigger firms and the prices charged. However, it is not anticipated that the proposed regulation would affect the likelihood of the creation of price floors or ceilings that might lead to a distortion of competition. The proposed regulation is unlikely to restrict innovation by suppliers. In theory, the proposed regulation could cause a restriction on the geographic scope where suppliers may operate and thus reduce competition. For example, physical access restrictions in town centres may prohibit the use of LSTs, and in theory reduce competition, although the use of existing maximum length vehicles is already probably very small for that particular type of operation. There are unlikely to be significant effects caused by changes in ability to advertise services or organisation of firms.
- ***Reduce suppliers' incentives to compete vigorously?*** NO. The road haulage sector is very competitive and, overall, it is believed that the introduction and use of a new vehicle option will tend to be a part of that competitive market. However, there may be particular sensitivity in the small firms sector, discussed below. There are also predicted impacts on the rail sector that is assumed to grow rapidly in this sector, with or without this change in HGV regulations. In Options 1-7, there is a loss of traffic to road, although the total rail sector grows substantially in the Do Minimum case compared to the existing market. This could be converted to a gain for rail if the rail industry is able to take advantage of the use of longer intermodal units (see Annex 5). The high fixed cost base in the rail industry means that any loss of business could result in higher costs for the remaining rail users and exacerbate the problem further. The proposed regulations do not require exemptions from general competition law, are unlikely to affect the intellectual property regime, do not require publication of price information, or increase the cost to customers of switching between suppliers.

Annex 8: Small Firms Impact Test

1. The structure of sector and businesses likely to be affected is an important consideration in the Impact Assessment.
2. Most businesses in the road haulage sector are small businesses. The Small Firms Impact Test regards all businesses having fewer than 250 full-time equivalent employees as being a small business (SME). 99.3% of firms employ fewer than 20. There are only 5,920 firms in the UK larger than this (2007) constituting 0.1% of all enterprises. The SIC 602 (Other land transport, i.e. not rail or pipelines) shows that, of 26,170 firms in 2008, 79.9% are micro (9 or fewer employees), 17.1% are small (10-49 employees), 2.5% are medium 50-249 employees), and 0.5% are large (greater than 250 employees) (source: http://stats.berr.gov.uk/ed/sme/).
3. The principal sector affected by the proposal is the road haulage sector, and this may be expected to follow a similar pattern to industry in general. Although no statistics are available by vehicle type, activity or commodity, the DfT Road Freight Statistics 2008 provides a breakdown of operator fleet size (Table 4.9). If fleet size serves as a proxy for firm size, 97% of operators have fewer than 20 goods vehicles and 94% have fewer than 10 goods vehicles. However, it should be noted that this total number of operators includes 13,200 operators who do not own vehicles (counted as zero fleet size), for example if vehicles are only required for short periods and are therefore hired in. Similarly, 60% of goods vehicles are in fleets of less than 20 and 47% are in fleets of less than 10.
4. The rail freight sector will also be affected by this proposal; however, there is a limited number of firms in this sector. These are all medium or large firms relative to the road haulage sector due to the need for a large fixed asset base to operate rail freight. The impact on rail freight is discussed elsewhere in this document; therefore the rest of this Small Firms Impact Test focuses on road haulage firms.
5. Although the distribution of Operator Licences serves to illustrate that the structure of the industry is skewed towards small firms, Table 4.10 of the DfT Road Freight Statistics 2008 publication shows that there are only 33,800 enterprises in the road haulage sector, or approximately only one-third of the number of licences. Table 4.10 suggests that average annual turnover is £780,000 and on average less than nine employees per enterprise.
6. Therefore, it is expected that the impacts of this regulation will fall disproportionately on smaller firms.
7. Feedback from industry suggests that there is a significant likelihood that these firms will feel competitive and client pressure to adopt LSTs.
8. The small firms in the road haulage sector are represented by a trade association, the Road Haulage Association (RHA). Contact was made with the Policy Director of RHA and an evidence gathering presentation and seminar was held on 14 October 2009 with a sample of ten firms with RHA membership (invited by RHA). (A similar event was also held with the Freight Transport Association that is representative of larger firms). Full details of the evidence gathering through the RHA event are contained in the Evidence Gathering Report, including feedback on the likely effects of the proposal. In general, the representative firms believed that the proposal would have important implications for their businesses. The firms work in a highly competitive environment and are generally ‘price takers’: there was also a feeling that the customers are unlikely to reward operators with higher rates in return for higher productivity (the same rate per load will apply regardless of the additional volume carried).
9. Whereas large firms with large fleets can retain specialist equipment, the small operators will need an all-purpose workhorse vehicle. There was a strong belief that the proposed longer semi-trailer would become the de facto standard vehicle and would be demanded by customers. Therefore, the additional costs of switching to a longer semi-trailer will be imposed on small firms. Not only may smaller firms feel compelled to purchase higher cost equipment but they might need to purchase higher cost equipment sooner – with additional finance cost, depreciation, and write off costs. Smaller firms will have to make the greatest changes with regard to their operations and will bear the greatest impact. However, this is normal in all industries where small firms are less able to take advantages of economies of scale.
10. The issue of the premature write-off of existing trailer capacity has wider implications for the assessment – beyond its impact on the intermodal market. Road hauliers have had difficulty to factor into their rate structures a proper measure of the depreciation of assets, particularly vehicles. Competitive pressures to upgrade to the new LST trailers may force hauliers to dump perfectly good

trailers well before their normal 'retirement' age. Finding the money to invest in the new trailers will be difficult for many hauliers, given current trading conditions, and may put additional strain on already fragile balance sheets. This would be less of a problem if hauliers could expect to gain sufficient extra revenue from the use of the longer trailers to pay-off the new investment. Regrettably, as past experience suggests and the consultation with the RHA has confirmed, this may not happen. The shippers may then obtain most of the benefit whereas the financial position of the haulage industry may worsen. The second-hand market in the 13.6m trailers will also be over-supplied, driving down prices and reducing the capital required for new entrants into the haulage industry. This may cause some market distortion. 13.6m trailers surplus to requirement at different levels of LST take-up might affect the second hand trailer market. Environmental concerns might be raised about the replacement of good kit with newly manufactured units if the longer semi-trailer is to become the new workhorse of the industry.

11. There does not seem to be a viable means of allowing exemptions for small firms from this regulation, since the adoption of LSTs would be entirely voluntary and existing types would remain in use.

12. However, the maximum saturation rate of LST take up eventually reached would be expected to:

- be higher for small operators with fleets of 10 articulated vehicles or less who may have little option but to opt for flexibility by choosing the LST option;
- be somewhat lower for large operators who tend already to operate fleets of mixed sizes, since they will tend to have a mixture of requirements that can then provide regular scope to match smaller vehicles to some smaller consignments, thus saving capital and fuel costs.

Quantifying the impact by size of road haulage firm

13. As the above discussion explains, it is unclear to what extent smaller firms will be able to pass through higher costs of capital equipment to haulage rates. It is feasible that smaller firms would need to invest if they wanted to continue with the same types of business, even though they might not receive the benefits from the greater efficiency (with the benefits being taken as either profit by shippers, or in the case of competitive industries by reductions in price to final consumers of goods).

14. Hence two approaches are taken to estimating the monetised impacts per road firm. The first assumes that all operators are able to take the financial gains from greater efficiency, effectively assuming that operators are paid per pallet rather than per load. The second assumes that only medium and large organisations have the negotiating power necessary to increase rates on the basis that each load delivers more pallets, but that micro and small organisations continue to receive the same revenue per load. This makes the implicit assumption that businesses choose to incur the greater cost rather than other plausible responses such as changing business models or trading sectors.

15. Both methods are based on the number of firms in each fleet size category and the numbers of vehicles in that category (based on Table 4.9 and Table 4.10 Road Freight Statistics, 2008 described above). Using the number of vehicles as the proxy for estimating the distribution of firm size in the road haulage sector, the Micro Firms have 47% of the fleet, Small Firms with 29%, Medium Firms 15% and Large Firms 9% of the fleet.

16. For the first method, assuming all operators see an increase in revenue in line with the extra freight delivered, these proportions were simply applied to the annual average total road sector cost change shown in column two of Table A8.1. Dividing the total costs in each size group by the number of firms (overall total to be 33,800) yields the average change in cost per firm in each size group in Table A8.1. For Option 1 there is an increase in annual operating costs, but for most a decrease resulting from productivity efficiencies. The larger firms have more costs or savings reflecting their fleet sizes. This assumes that the propensity to take up LSTs is equal for all firms regardless of size.

Table A8.1: Estimated Additional Annual Average Costs (Savings) per road haulage organisation

Option	Total change in road haulage costs	Micro	Small	Medium	Large
	£m	£	£	£	£
1	£41	£600	£6,599	£26,256	£68,265
2	-£56	-£834	-£9,166	-£36,469	-£94,820
3	-£19	-£281	-£3,088	-£12,286	-£31,943

4	-£162	-£2,405	-£26,445	-£105,218	-£273,567
5	-£166	-£2,466	-£27,112	-£107,871	-£280,466
6	-£142	-£2,104	-£23,131	-£92,031	-£239,281
7	-£114	-£1,687	-£18,554	-£73,822	-£191,937

17. The distribution of additional overall road costs between the different groups of size of firm under this method is presented in Table A8.2.

Table A8.2: Estimated Additional Annual Average Costs Grouped by Size of Firm (road haulage)

Option	Total change in road haulage costs	Micro	Small	Medium	Large
	£m	£m	£m	£m	£m
1	£41	£19	£12	£6	£4
2	-£56	-£26	-£16	-£8	-£5
3	-£19	-£9	-£5	-£3	-£2
4	-£162	-£76	-£47	-£24	-£15
5	-£166	-£78	-£48	-£25	-£15
6	-£142	-£67	-£41	-£21	-£13
7	-£114	-£54	-£33	-£17	-£10

18. Alternatively the assumption is that micro and small firms incur the costs of purchasing larger trailers but continue to receive the same rates per load. Using table 4.9 in Road Freight Statistics, an average number of vehicles per organisation has been calculated and shown below. The increase in capital costs for a new trailer under each option is shown, using the increased cost estimates explained in the cost section of the Impact Assessment, and hence the average cost by size of organisation which operates semi-trailers.

19. This table shows the average cost for an organisation falling into one of the categories to replace all semi-trailers with longer semi-trailers (hence the cost will be less if an organisation operates a mix of vehicles and doesn't therefore have to replace all its vehicles). This table also assumes all trailers are single-deck; costs per trailer would be increased by £76 per metre if trailers are double-deck (full costs are shown in Table 4a)

Table A8.3: Estimated Average Costs per road haulage firm

Option		Micro	Small	Medium	Large
	Average vehicles per organisation	2.4	20	84	216
	Cost per trailer (£)	£	£	£	£
1	£514	£1,200	£10,300	£43,200	£111,000
2	£2,814	£6,800	£56,300	£236,400	£607,800
3	£6,514	£15,600	£130,300	£547,200	£1,407,000
4	£5,654	£13,600	£113,100	£474,900	£1,221,300
5	£5,054	£12,100	£101,100	£424,500	£1,091,700
6	£7,654	£18,400	£153,100	£642,900	£1,653,300
7	£7,054	£16,900	£141,100	£592,500	£1,523,700

(total figures rounded to nearest £100)

20. Table 8.3 should be compared to Table 8.1. Medium and Large organisation are likely to be able to offset these costs of replacing trailers with greater revenues received from either increases in rates per load or because they operate fleets as part of a vertically integrated supply chain and can therefore realise the gains in other parts of the business. There is a risk that micro and small organisations will incur costs of the order shown above if they chose to stay in the same area of business and be unable to recover them, with the gains shown in Table 8.1 instead accruing to either shippers or the final consumers of goods.

21. Further evidence on how smaller operators negotiate prices and choose what business they take is required to improve our understanding of the impacts on smaller firms.

Annex 9: Carbon Assessment

1. This section analyses the specific carbon impact of the potential regulation change to increase the permitted length of semi-trailers.

2. The annual average external costs and benefits of Climate Change are shown in Tables 15 and 16, on page 50, for HGVs and Trains respectively. Their Present Values are shown in Tables 17 and 18, on pages 50 -51.

3. The modelling also provides an estimate of total CO_2 equivalent emissions (Tonnes). Table A9.1 shows the change relative to the Base Case in annual average 2011-2025 and total 2011-2025 CO2 equivalent tonnes for each Option for the Best Estimate scenario. These CO_2 equivalent emissions also appear in the "Summary: Analysis & Evidence" pages for each Option.

Table A9.1: Change in CO_2 Equivalent Emissions (Tonnes) Best Estimate Compared to the Base Case, 2011-2025.

Option	Annual Average	Total
1	58,670	880,048
2	-115,699	-1,735,478
3	-112,458	-1,686,871
4	-163,271	-2,449,069
5	-97,277	-1,459,155
6	-103,634	-1,554,512
7	-100,436	-1,506,533

4. The modelling suggests that there would be increases in CO_2 equivalent emissions (Tonnes) for the +1.0metre LST Option 1. However, for the Options 2 and 3 and the longer +2.05 metre LST Options 4, 5, 6 and 7 there are predicted to be reductions in CO_2 emissions.

5. It is the switching of goods traffic from rail to road that offsets many of the carbon benefits from the use on road of more efficient longer semi-trailers. Accordingly, the scenario discussed in Annex 6 that assumes widespread take-up of longer intermodal units by the rail industry leads to reductions in carbon emissions that are three times as large (Table A9.2) as those for the Best Estimate scenario because it does not have a loss of traffic from rail to road.

Table A9.2: Change in CO_2 Equivalent Emissions (Tonnes) Longer Intermodal Unit Scenario Compared to the Base Case, 2011-2025.

Option	Annual Average	Total
8	-40,937	-614,062
9	-210,385	-3,155,775
10	-207,080	-3,106,197
11	-325,552	-4,883,278
12	-262,175	-3,932,622
13	-268,216	-4,023,235
14	-265,132	-3,976,975

Annex 10: Safer aerodynamic fronts

1. Approximately 1% of all road vehicles registered in GB are Heavy Goods Vehicles (HGVs) but they account for approximately 6% of all motor vehicle traffic and are involved in accidents that result in approximately 15% of all road traffic fatalities. The Stern review (2006) showed that in 2000 freight trucks were responsible for approximately 23% of global transport CO2 emissions, which in turn represented 14% of all global CO_2 emissions. Thus, freight trucks were responsible for approximately 3% of all global CO_2 emissions.
2. Most trucks are currently designed to allow the maximum amount of load space that can be achieved within the legally permitted maximum dimensions. This usually means that the front of the truck approximates a flat vertical surface where the cab is positioned above the engine. This design has a number of disadvantages:
    - The tall, flat, vertical structure has an inherently high drag co-efficient;
    - The relative positions of the driver's eyes and the lower edge of the windscreen leave a significant blind spot in front of the vehicle, which is a contributory factor in fatal collisions with pedestrians where the vehicle is pulling away from rest;
    - In collisions with pedestrians, the flat vertical surface distributes the loads quite evenly, which is good, but tends to push the pedestrian over which increases the chance of injuries caused by contact with the ground and of being run over by the wheels. The interaction with pedal cyclists is likely to be similar;
    - There is little space available between the driver and the front of the vehicle with which to provide a "crumple zone" to protect the driver in the event of a collision with another heavy vehicle or rigid fixed object;
    - There is little space available between the front of the vehicle and the front axle with which to provide energy absorbing structure in order to better protect light vehicle occupants (mainly car occupants but possibly also van occupants) in head-on collisions with the front of the truck.
3. It is possible to re-design the frontal shape of trucks in a way that all of the above disadvantages could be reduced or eliminated, thus reducing the fuel consumption and the numbers of pedestrian, truck occupant, car occupant and other casualties. Robinson & Chislett (2010) suggested that when estimated costs and implementation dates were considered, this "nosecone" concept (to introduce a curved profile at the front of a truck) was one of the top priorities for heavy vehicle safety. Feist & Gugler (2009) suggested that aerodynamic improvements resulting from changes to the frontal shape of trucks could result in a reduction of fuel consumption, with estimates of between 5 -10% made for the most effective improvements.
4. The UK Department for Transport (DfT) decided that, in parallel with its research into the feasibility and likely effects of permitting longer semi-trailers, research should also be undertaken into the merits of allowing additional length, irrespective of load space, for the purposes of the safety and environmental objectives described above. TRL were commissioned to undertake this work in conjunction with MIRA. This assessment is based on the full report "Safer aerodynamic frontal structures for trucks: final report" that describes the full technical analysis.

5. The assessment of the costs and benefits of safer aerodynamic fronts was based on the use of a parametric cost benefit model used by Knight et al (2008) when assessing the likely effects of longer and/or longer and heavier vehicles and by Knight (2010) when comparing the results of that model to the results from the analysis of the likely effects of longer semi-trailers. This model is described in detail by Knight et al. (2008) but can be summarised as an aggregate model of predicted freight volumes in the UK from 2006-2020 including the following variables:

    - Vehicle mass, payload and capacity

    - Fuel consumption and emissions

    - Operating costs

    - Safety performance and accident rates

- Mode shift
- Infrastructure wear
- Route restriction

6. This analysis will consider the effect that safer aerodynamic front structures will have on the first four variables, the likely effects being very small on infrastructure wear, even smaller on mode shift (no change in capacity, marginal change in operating cost) and no additional route restrictions envisaged if such structures were to be implemented. The outputs are expressed in terms of:
   - Effect on traffic (vehicle kms)
   - Effect on emissions (tonnes of CO_2, societal cost of gaseous emissions from freight)
   - Effect on safety (fatalities, monetary values for the prevention of casualties)
   - Effect on total transport costs (total road/rail operating costs plus "external costs")
7. This analysis has in the first case been based on the assumption that the safer aerodynamic frontal design would be applied to all articulated vehicles, in order to provide an upper bound to the range of impacts that could be seen. In reality, the benefits or costs will depend on the uptake seen. We would like to get evidence during the consultation of the payback to operators that these changes could offer, and hence whether manufacturers are likely to include them on new vehicles.

Possible policy options to be assessed

8. The rationale for this work sits alongside that of the longer semi-trailers work as a whole, to determine the socially optimum dimensions of heavy goods vehicles given the private and external costs that are determined by the dimensions.
9. Application to articulated vehicles has been considered in this cost benefit analysis. The intention is to isolate the effects of this measure from those of increasing trailer capacity and thus the baseline articulated vehicle will be assumed to be 16.5m long and the semi-trailer length will remain as 13.6m in all options.
10. The technical report considers increased nosecone lengths up to 2.25m, but finds that:
    - almost all of the potential casualty benefits could be obtained at nosecone lengths of 0.9m or less
    - The aerodynamic benefits were uncertain at lengths greater than 1m, being highly dependant on tractor trailer interaction
    - Increases in length of more than 1m could potentially create significant manoeuvrability difficulties, depending on exactly how the change was implemented in the vehicle design
11. For this reason, the maximum length assessed in the cost benefit analysis is 1m. An interim length of 500mm will also be considered on the basis of the results of the aerodynamics and a further length of 200mm will be considered because it is the maximum that could be added to a combination using a 15.65m semi-trailer, if permitted, without exceeding the maximum length of existing drawbar trucks and articulated buses. This leads to the matrix of assessments shown in Table A10.1.

Table A10.1 Matrix of options for cost benefit assessment

Additional length for nosecone	Standard semi-trailer aerodynamics	Optimised trailer aerodynamics
0.2 metres	✓	✗
0.5 metres	✓	✗
1.0 metres	✓	✓

Vehicle mass, capacity, and average load

12. Little information exists to estimate exactly how much mass would be added by altering the front of vehicles as considered in this report. However, the manufacturing industry provided evidence (Knight *et al*, 2010) to suggest that increasing the length of a semi-trailer would add approximately 192kg to 250kg per metre on average. The mass implications of the safer aerodynamic front with standard semi-trailer have, therefore, been based on the upper figure in this range. It has also been assumed that the addition of an optimised package of aerodynamic aids for the semi-trailer would add a further 125kg.

13. In reality, nominally similar tractors and trailers from different manufacturers will have different masses. However, Knight et al (2010) found that the mass of a standard tri-axle semi-trailer was typically approximately 6,350kg. Similar analyses for a two-axle tractor unit suggest a typical unladen mass of approximately 7,200kg for a baseline combination mass of 13,550kg such that the payload of a 5 axle combination would be 26,450kg.

14. When considering the effect that adding a safer aerodynamic front to a truck will have, it is important to understand what is constraining the loads carried. Load constraints can be defined as follows:

    - Full by mass (i.e. vehicle has reached GVW or will exceed GVW if one more load unit is put on the vehicle). CSRGT analysis suggests approximately 8% of articulated vehicle tonne kms are constrained by mass capacity.
    - Full by volume (no more space available within the truck even though GVW limits have not yet been reached). CSRGT analysis suggests approximately 36% of articulated vehicle tonne kms are constrained by volume capacity.
    - Full by both mass and volume. CSRGT analysis suggests approximately 31% of articulated vehicle tonne kms are constrained by both mass and volume capacity.
    - Loaded but not full. CSRGT data suggests that for approximately 25% of articulated tonne kms the vehicle carrying the goods is not full.
    - Empty. CSRGT data suggests approximately 27% of articulated vehicle kms involve vehicles that are not loaded.

15. On journeys where the vehicle is full by mass (1 and 3 above) then the additional unladen mass will mean that the quantity of goods carried will be reduced by the same amount in order to avoid exceeding the maximum authorised mass. Thus, the total loaded mass will not change. In theory this would mean all journeys in this condition will be at GVW but in practice the average will be slightly below GVW because most goods are divided into units of significant mass. For example if a 44 tonne vehicle was carrying 25 pallets of 1.15 tonnes each then the GVW would be approximately 43.3 tonnes, 0.7 tonnes below GVW. However, adding one more pallet to reach volume capacity would cause GVW to be exceeded by 0.415 tonnes and is therefore not possible. In order to transport the same quantity of goods additional journeys would be required.

16. On journeys where the vehicle is full by volume or not full (3, 4 or 5 above), then the additional unladen mass will not add any additional constraints on the load. However, the total loaded mass would increase by the amount of the increase in unladen weight, with consequent increases in fuel consumption and emissions.

17. Analysis undertaken to generate the model used by Knight (2010) showed that for all standard articulated vehicles the loading and constraints were as shown in Table A10.2, below.

Table A10.2 Load constraints and average loads for existing articulated vehicles

Load constraint	Tonne kms	Percentage by constraint	Vehicle kms	Laden vehicle kms	Empty running (%)	Unladen vehicle kms	Average load when laden (tonnes)	Average load including empty running (tonnes)
Weight	9,667,528,235	8.41%	369,642,044	369,642,044		0	26.154	26.154
Volume	41,316,957,528	35.93%	2,915,468,363	2,915,468,363		0	14.172	14.172
Both	35,608,202,359	30.96%	1,369,551,641	1,369,551,641		0	26.000	26.000
None	28,411,643,541	24.70%	5,995,662,827	3,406,704,002		2,588,958,826	4.739	4.739
All	115,004,331,663	100.00%	10,650,324,875	8,061,366,049	24.31%	2,588,958,826	14.266	10.798

18. Altering the average load when laden for weight constrained trips, recalculating the vehicle kms required to transport the same tonne kms, increasing the empty kms in line with the increased laden kms allows the average load including empty running to be estimated for all trips once the changes to the weight constrained trips are accounted for. Adding this new average load to the new unladen mass allows the total mass to be calculated when the average load is being carried.

Table A10.3 Mass capacities and average loads for vehicles with safer fronts

Description	Unladen mass (kg)	Maximum Authorised Mass (kg)	Maximum payload (kg)	Average load including empty running (kg)	Total mass at average load
Baseline 44 tonne 16.5m artic	14,533	44,000	29,467	10,798	25,331
Safer front 0.2m	14,588	44,000	29,412	10,790	25,378
Safer front 0.5m	14,658	44,000	29,342	10,777	25,435
Safer front 1.0m standard aerodynamics	14,783	44,000	29,217	10,756	25,539
Safer front 1.0m optimised aerodynamics	14,908	44,000	29,092	10,734	25,642

Fuel consumption and emissions

19. The changes to the mass of the vehicle and the aerodynamic drag each have an effect on the fuel consumed per vehicle km and the tailpipe emissions. These effects were modelled at full load and at a typical load as described in section 6.2 of the technical report. Knight et al (2008) showed that it was reasonable to use linear interpolation to assess the fuel consumption and emissions at masses between values modelled using this method. In this way the results shown in Table A10.4, below, were produced for use in the cost benefit model.

Table A10.4 Fuel consumption and emissions based on average load including empty running

Description	Unladen mass (kg)	Load mass (kg)	Total running mass (kg)	CO (g/km)	HC (g/km)	NOx (g/km)	PM (g/km)	CO2 (g/km)	FC (g/km)	FC Index
Baseline 44 tonne 16.5m artic	14,533	10,798	25,331	0.094	0.012	2.413	0.021	730.138	230.328	1.000
Safer front 0.2m	14,588	10,790	25,378	0.094	0.012	2.399	0.021	727.483	229.073	0.995
Safer front 0.5m	14,658	10,777	25,435	0.094	0.012	2.382	0.021	724.215	227.528	0.988
Safer front 1.0m standard aerodynamics	14,783	10,756	25,539	0.094	0.012	2.421	0.021	734.398	231.725	1.006
Safer front 1.0m optimised aerodynamics	14,908	10,734	25,642	0.094	0.012	2.380	0.021	727.367	228.422	0.992

20. It should be noted that the fuel consumption and emissions were not modelled for a 0.2m extension to the front so the figures for this vehicle option are based on linear interpolation between the baseline vehicle and the 0.5m extension.

Operating costs

21. It is reasonable to assume that the addition of additional frontal structures would add to the capital cost required to purchase a tractor unit for an articulated vehicle. Knight et al (2010) estimated that increasing the length of a semi-trailer would cost in the region of £515/metre to £590/metre. This could be used as a guide to the possible cost of changes to the front of a tractor unit. However, this would be likely to represent a lower estimate because a semi-trailer is a relatively simple structure and the front of a tractor unit is more complex with potentially conflicting requirements for packaging space for components (e.g. lights), ventilation and cooling for the engine, and various different structural properties for safety. It is therefore considered reasonable to assume that the actual cost increase associated with a safer aerodynamic front would be 50% more per metre than for increasing the length of a semi-trailer, resulting in an estimate of approximately £830 per metre.

22. Cost models for a range of standard articulated vehicles were developed as part of the wider study into longer semi trailers. These models have been modified to incorporate the capital costs and fuel consumption estimates above to predict the operating costs for the vehicles equipped with safer aerodynamic fronts. The results are shown in Table A10.5, below.

Table A10.5 Estimated operating costs

Description	Purchase price (£)	Fuel consumption (g/km)	Total costs per km (£)	Indexed costs/km
Baseline 44 tonne 16.5m artic	£63,000	230.328	£0.961	1.000
Safer front 0.2m	£63,166	229.073	£0.960	0.999
Safer front 0.5m	£63,415	227.528	£0.959	0.998
Safer front 1.0m standard aerodynamics	£63,830	231.725	£0.964	1.003
Safer front 1.0m optimised aerodynamics	£64,330	228.422	£0.961	1.001

Safety

23. A number of potential areas for casualty saving were identified:

- Car occupants in head-on collisions
- Truck occupants involved in collisions with other heavy vehicles or fixed objects
- Pedestrians and other vulnerable road users hit by the front of a truck

24. Casualty statistics show that between 2006 and 2008 inclusive there were on average approximately 188 fatalities from accidents involving articulated HGVs each year. Table A10.6 summarises the expected effect on fatalities and the fatality rate (number of fatalities per billion vehicle kms) derived from the detailed analysis described in the full report.

Table A10.6 Predicted casualty effects

	Predicted annual average fatality reduction					
Description	Car occupants	Truck occupants	Vulnerable road users	Total	Fatality rate	Index fatality rate
Baseline 44 tonne 16.5m artic	0.00	0.00	0.00	0.00	13.174	1.000
Safer front 0.2m	0.70	0.25	4.00	4.95	12.828	0.974
Safer front 0.5m	1.50	0.30	7.50	9.30	12.523	0.951
Safer front 1.0m standard aerodynamics	2.00	0.50	12.00	14.50	12.158	0.923
Safer front 1.0m optimised aerodynamics	2.00	0.50	12.00	14.50	12.158	0.923

Results

25. Based on the above inputs the parametric cost benefit model has been used to generate the change in:

- HGV km generated by the increase in mass (which have indirect impacts in increasing HGV miles)
- Operational costs (direct from fuel reduction per vehicle and indirect from increased HGV miles)
- Carbon emissions (direct and indirect)
- Local air pollutants (direct and indirect)
- Accidents (direct and indirect)

26. The results presented in the report are shown in Table A10.7, below. These results are for 100% uptake of the new vehicle fronts in the articulated vehicle market, and hence provide an upper bound estimate of the impact. They are also based on the period 2006-2020 that the model was originally put together over, are undiscounted, and do not include the cost of congestion or noise. These issues are dealt with below.

Table A 10.7 Cost benefit analysis results presented in the technical report (annual averages)

Description	Cost (£)	Cost (%)	Number of Fatalities	Fatalities (%)	CO2 Emissions (tonnes)	CO2 emissions (%)	HGV traffic (BVKM)	HGV traffic (%)
	Magnitude of changes with respect to baseline							
Baseline 44 tonne 16.5m artic	£0	0.00%	0.00	0.00%	0	0.00%	0.00	0.00%
Safer front 0.2m	-£18,706,989	-0.11%	-4.70	-1.17%	-28,551	-0.26%	0.01	0.04%
Safer front 0.5m	-£30,549,084	-0.17%	-8.84	-2.20%	-61,091	-0.57%	0.03	0.09%
Safer front 1.0m standard aerodynamics	£64,952,042	0.37%	-13.80	-3.43%	96,986	0.90%	0.05	0.18%
Safer front 1.0m optimised aerodynamics	£43,474,359	0.25%	-13.80	-3.43%	21,460	0.20%	0.08	0.28%

27. It can be seen that all safer front options result in a very small increase in traffic. This is because of the assumption that the safer front would add significant mass to the vehicle and be used on all articulated vehicles, including those carrying mass-constrained goods. The payload capacity would be reduced for the latter class of traffic, thus generating additional vehicle kms to transport the same tonne kms. This additional traffic generates additional internal and external costs. In the case of the 0.2m and 0.5m extensions these additional costs are not as great as the reduction in costs arising from the safety and environmental improvements resulting in a net benefit for emissions, casualties and total costs.

28. The options to extend by 1m clearly provide the biggest safety improvement but also require the biggest mass increases and thus generate the most additional traffic. In the case of the standard trailer the safety benefits are insufficient to offset the disadvantage in terms of fuel consumption, emissions, operating cost, and traffic generation. The optimised aerodynamic trailer option restores the environmental advantage on a per vehicle basis but this is still insufficient to reverse the environmental disadvantage of increased traffic. The assumptions regarding the additional unladen mass and how the industry would react are critical to this outcome. If the desired structures and performance levels could be achieved with little additional mass then this would become the most effective option. Similarly, if the safer front was optional and those hauliers active in the mass constrained market chose not to use it then this could increase the cost effectiveness.

29. In order to complete the analysis, the Department has adjusted and extended the model for two purposes; to include the cost of congestion and to calculate the net present value of the changes over the period 2011-2020 (the model extends only to 2020 so we have been unable to do this for the same period as the longer semi-trailers work).

30. The cost of congestion has been taken from the HGV externality work described in Annex 2 of the Longer Semi-trailer impact assessment; as the report forecasts the increase in HGV km as articulated vehicles the values in the Annex 2 are applicable. This produces the following results:

Table A10.8 Full cost benefit analysis results (annual averages)

Description	Discounted cost change before congestion and noise impacts (£)	Cost (%)	HGV traffic (BVKM)	HGV traffic (%)	Discounted cost of congestion and noise	Discounted net present value
	Annual averages Magnitude of changes with respect to baseline					
Baseline 44 tonne 16.5m artic	£0	0.00%	0.00	0.00%	£0	£0
Safer front 0.2m	-£18,924,685	-0.11%	0.01	0.04%	£4,048,598	-£14,876,087
Safer front 0.5m	-£25,701,440	-0.17%	0.03	0.09%	£10,480,203	-£15,221,237
Safer front 1.0m standard aerodynamics	£54,551,400	0.31%	0.05	0.18%	£20,902,561	£75,453,962
Safer front 1.0m optimised aerodynamics	£36,403,758	0.25%	0.08	0.28%	£31,864,962	£68,268,721

31. On this basis, it can be seen that the introduction of safer aerodynamic fronts offers net social benefits for either an increase of 0.2m or 0.5m, and costs to 1m long increases due to the impact of significant extra mass. The increase to 0.5m shows slightly greater net benefits; however given that there could be some issues with parking these longer vehicles the analysis does not allow us to conclude which increase would be more socially beneficial. Any parking difficulties also depend on whether this was implemented in parallel with a 15.65m LST or not – adding 0.5m to the current length of articulated vehicle would not result in a vehicle longer than current combinations.

32. The table above represents our upper bound estimates, as it models all articulated vehicles using safer aerodynamic fronts. The level of use is likely to depend on the cost efficiency to operators and hence manufacturers' decisions. In the consultation we include questions to elicit evidence and views on this issue; in particular because changes will depend on the acceptable payback period for

operators. In the absence of this evidence, we can assume that the change may have negligible impact if there is little takeup; and that currently our best estimate would be the mid-point of no impact and the values presented above. Hence allowing an increase of 0.2m or 0.5m is estimated to offer net benefits of £7.5m per year.

33. The benefits predicted assume that the vehicles produced achieve the same aerodynamic, mass and fuel effects as those modelled in this analysis. The analysis was based on only a very small number of frontal shapes of vehicles and the mass effects were based on assumptions that there is a relationship between the mass associated with increasing semi-trailer and tractor unit length. It is, therefore, possible that in production more aerodynamically efficient designs could be found with reduced mass penalties, which would produce greater benefits. However, unless a regulatory limit value for the aerodynamic efficiency of a vehicle combination was introduced, it would not be possible to guarantee that the changes would always result in the predicted improvements. Creating such a limit value in regulation would be challenging, particularly given that the type approval systems treats tractors and trailers as different vehicles and each tractor unit will tow a variety of different trailers during its lifetime.

Conclusion

34. The analysis described above provides a sufficient evidence base to conclude there are likely to be social benefits to allowing additional length of either 0.2m or 0.5m for the design of safer aerodynamic fronts on HGVs. The assessment above is mainly drawn from the TRL report **"Safer aerodynamic frontal structures for trucks: final report"** and has been extended to ensure full coverage of the impacts of increased HGV traffic.

35. In general safety performance improves strongly with an increase in frontal length of up to around 1m, with the biggest casualty savings for pedestrians. However, there is some trade-off with the extra unladen mass reducing payload and thereby generating some additional HGV traffic. Increases in nosecone length of around 0.2m and 0.5m have both been found to give a similar monetised net benefit of between £0m and £15m per year, dependent on take up, with a best estimate of the mid-point £7.5m per year. Uptake of the opportunity to develop these fronts is uncertain, and the Department would like to engage vehicle manufacturers to discuss the issues described in the TRL analysis and gather evidence on the potential incentives these fronts would offer operators and manufacturers.

36. Allowing an increase of 0.5m would permit vehicles longer than the current maximum length allowed for rigid truck/drawbar combinations, which the Government has already ruled out. Given that the net benefit is estimated to be similar for 0.2m or 0.5m and the shorter distance would respect the limit on rigid vehicle lengths, an increase of 0.2m provides an acceptable alternative option. Furthermore, with a 0.2m extension it would be possible to gain 0.4m for the frontal design by fitting the trailer with a close coupling arrangement (a design reducing the space needed between cab and trailer) whilst still remaining within the current length of maximum combinations on the road today of 18.75m. Hence manufacturers would still have the option of designing close to 0.5m.

References

Feist & Gugler (2009). *Guidelines for integrated design and evaluation of advanced vulnerable road user protection systems.* APROSYS deliverable D.2.1.7.

Knight I, Newton W, McKinnon A, Palmer A, Barlow T, McCrae I, Dodd M, Couper G, Davies H, Daly A, McMahon W, Cook E, Ramdas V and Taylor N (2008). *Longer and/or Longer and Heavier Goods Vehicles (LHVs) – a Study of the Likely Effects if Permitted in the UK: Final Report.* TRL Published Project Report PPR285, TRL Limited, Crowthorne, Berkshire, UK. www.trl.co.uk

Knight I, Robinson T, Robinson B, Barlow T, McCrae I, Odhams A, Roebuck RL, Cheng C (2010). The likely effects of permitting longer semi-trailers in the UK: vehicle specification, performance and safety. TRL Published project report PPR526.

Knight I (2010). *Comparing the results of the cost benefit analyses for the longer semi-trailer project and the previous LHV project.* TRL Published project report PPR527

Robinson T & Chislett W (2010). *Commercial vehicle safety priorities – ranking of future priorities in the UK based on detailed analysis of data from 2006-2008.* TRL published project report PPR486 available from www.trl.co.uk