Transport Visions

Freight and Logistics

The seventh of eight reports from the Transport Visions Network

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Preface

Futurology - *the study or prediction of the future of mankind.*

1. At the beginning of the 21st Century, the UK transport profession in all its guises is very active. A Transport White Paper in 1998[1] set a new agenda to address the burgeoning levels of travel demand and motorised traffic. In the face of short-term workloads and objectives it is tempting to put to one side the potentially distracting business of transport futurology. After all, has not the time for debate and imaginative forward thinking now passed with the publication of the White Paper and 'Transport 2010'[2] which outlines the Government's £180 billion spending plan for transport? Is it not now time to begin 'bedding in' the new policies and practices that will serve us for the next decade or two? The answer is no. While action is urgently needed to address present-day problems, debate is also necessary to avoid complacency about the future and the transport challenges it will bring. Hence forward thinking remains crucial.

2. Reports documenting attempts to set out transport visions are not new and examples are plentiful. In the run up to the new millennium, many people contemplated the future of transportation and numerous documents were published presenting predictions and visions. In the UK, the RAC Foundation[3] convened an advisory group in 1992 to assess the relationship between cars and the environment and to identify research priorities. Then in 1997 the Engineering Council[4] set up working groups to examine challenges and solutions for the UK's future transport needs. They started with a simple vision of 'access for all' and 'transport without costs' and identified what was required to realise the vision, including a timetable for action. Within the Department for Trade and Industry's (DTI) Foresight Programme of 1999 a task force examined the implications for transport of four different 'environmental' futures for the period 2010-2040. The task force produced recommendations for policy and research that were designed to be robust against each of the futures.

3. The Institute for Transport Studies at the University of Leeds[5] attempted to provide a vision for the future of transport in Britain for the next thirty years by interviewing transport stakeholders about what might happen and how it could be achieved. The Europe 2020 group[6] considered the future of transport and communications in Europe. They looked at the impacts on population, lifestyles, economy, environment, regional development, urban and rural form, goods transport, passenger transport and communications of three different scenarios relating to economic growth and environmental futures.

4. David Banister[7] presented a 'Eurovision' for sustainable urban development and transport in 2020 developed by specifying environmental, regional development and efficiency targets, tracing two paths towards the targets and back-casting to determine actions required to achieve them. William Garrison and Jerry Ward[8] offered their visions of transportation systems that will better serve the future needs of the United States. They include better ways of managing congestion, new types of vehicles, new possibilities for cities designed to meet the varied needs of their inhabitants and different ways of moving people and freight over long distances.

5. What, then, is the justification for yet another transport visions report or indeed a series of reports? There are three principal justifications. Firstly, the world is an ever-changing place and attempts at transport visions must be regularly revisited and revised in light of the developments we experience in society, such as the emergence of mobile communications. Also the uncertainty of the future means that no single vision can claim to be accurate. The only certainty is that transport and travel patterns will always be dynamic. Visions from a variety of perspectives enable a more informed consideration of the future.

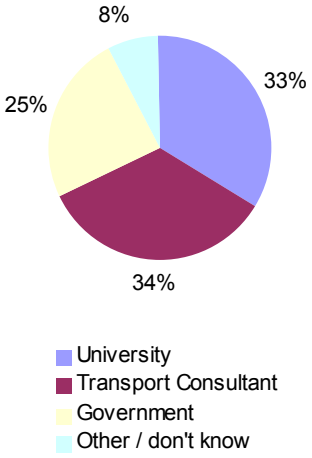
6. Secondly, we are at a propitious point in time in the UK. The present and pending acuteness of car dependence, traffic congestion and their associated effects has pushed transport high on the public and political agenda. Longstanding solutions to problems are no longer appropriate (at least by themselves) and politicians and other key decision-makers are prepared to listen to new and possibly radical propositions. The time is ripe for the imaginative thinking and innovation that can be derived from transport futurology.

7. Thirdly, almost without exception, all previous vision documents have been the product of senior professionals. Listed in the acknowledgements of such reports are the likes of Professors, Chief Executives, Chairmen and Directors. Conspicuous by its absence is the explicit acknowledgement of young professionals. All the reports in this series have been produced exclusively by young professionals - men and women aged 35 or under. Being 'young' does not give any special insight into the future. However, with young professionals comes the prospect of new ideas and perspectives that can potentially challenge existing mindsets. Furthermore, the young professionals of today will be the decision makers of tomorrow with a responsibility for delivering effective solutions. It is hoped that the act of engaging young professionals in a transport visions debate will in itself be of value to the individuals concerned by assisting in their professional development

and the forging of new professional relationships with important future influence.

8. This report and others in the series are a product of the Transport Visions Network. The Network was conceived by Drs Glenn Lyons, Kiron Chatterjee and Greg Marsden of the Transportation Research Group (TRG) at the University of Southampton. The TRG has been responsible for securing funds for co-ordinating and reporting on the Network. Funding has been kindly provided by the Engineering and Physical Sciences Research Council, the Rees Jeffreys Road Fund and the Department for Transport. The Network was established at the end of 1999 and formally began its operations in February 2000 with the aim of addressing and reporting on eight transport Themes during a 36 month period. Membership of the Network has been open to anyone aged 35 or under. The membership predominantly consists of transport professionals who have a range of background disciplines and experience. Membership has totalled around 260 people with local authorities, transport consultancies and universities all well represented alongside other organisations.

Network membership by employer type



9. The reader will find that the discussion is focussed on visions for the United Kingdom, reflecting the fact that the Network's founders are UK based, as are the majority of its members. Nevertheless, during its lifetime Network membership also has had representation from a number of other countries including: Australia; Austria; Belgium; Brazil; Canada; Chile; China; Czech Republic; Denmark; Finland; Former Yugoslav Republic of Macedonia; France; Germany; Greece; Hong Kong; India; Indonesia; Iran; Italy; Japan; Malaysia; Mauritius; Netherlands; New Zealand; Norway; Pakistan; Portugal; Republic of Ireland; Romania; Russia; Singapore; South Africa; South Korea; Spain; Sweden; Switzerland; Taiwan; Thailand; Turkey; United Arab Emirates and the United States of America.

10. So, what do we hope the value and impact of our reports will be? Pragmatists might be anxious to determine whether or not the reports can shed any light on solving today's problems. Others might expect that our reports should abandon convention and offer truly provocative and far-fetched forays into a distant future. Perhaps we have been able to reconcile both of these aspirations. Our principal goal is to challenge existing mindsets and to reinforce the importance of forward thinking in transport research, policy and practice. We hope to reach a wide variety of audiences and provoke fresh ideas and perspectives. If we have been successful then our reports should help to influence current policy debate. We hope they will also inspire a stream of adventurous research proposals.

Introduction

To the reader in a hurry -

This report presents the Network's views on the future of freight and logistics. It begins with a consideration of the current and expected future context for freight and logistics. It considers present policy approaches to the problems of goods movement before introducing the Network's own ideas and solutions which are developed within the contexts of three different scenarios for the future of society: Going Global; Nation State; and Local Living. Each scenario considers how freight and logistics might operate under a given future state of society. The report concludes with an overview assessment of the outcomes of scenario development.

11. The Transport Visions Network is exploring the future of transport in the 21st Century. The first report in this series, *Society and Lifestyles*[9], considered a myriad of issues and trends that are shaping or have the potential to shape the way we live in the future and our travel needs. It presented six different scenarios for the future. In the second report, *Transportation Requirements*[10], the Network set out twelve guiding principles for the design of future transport systems. These principles were established to guide the development of solutions and ideas during all subsequent themes and are listed below:

Transportation Requirements

1 There should be an equitable distribution of access to a range of key real and virtual destinations that support people's quality of life.

2 The absolute level of resource use for transport activities should be controlled and the resource efficiency of mobility should be maximised.

3 Users should pay the full internal and external costs of transport and these should be made transparent. Where appropriate, transport uses or users providing external benefits should be subsidised.

4 In the provision and operation of transport systems the adverse effects on the environment should be minimised according to agreed principles and targets.

5 There should be discrimination and prioritisation between different types of trips and activities.

6 Transport should not exacerbate the adverse effects of lifestyle on health and safety and should aim to reduce these effects wherever possible.

7 Electronic and other non-mobile means of communication should be considered as transport options and treated accordingly in policy and practice.

8 Land use efficiency should be maximised and net land take by the transport system minimised.

9 The reliability of the transport system and its operation should be regarded as a fundamental system management goal.

10 Transport should not exacerbate problems of social participation and should aim to reduce these problems wherever possible.

11 Stakeholders should play an integral role in the entire life cycle of problem identification, solution formulation, implementation and evaluation.

12 Transport users should be enabled and encouraged to make fully informed choices.

12. The third report in the series, *Land Use Planning*[11], considered the role of land use planning in shaping transport. Visions were developed for four different aspects of land use planning. The fourth report, *Vehicles and Infrastructure*[12], examined ideas for vehicles and infrastructure that could apply to the UK surface transport network in the future. Six visions of how vehicles and infrastructure might change to address current and future transport problems were developed.

13. The fifth report in the series, *Local Travel*[13], offered a range of solutions to problems associated with local travel. Solutions were presented in the form of a 'toolkit for local travel'. The toolkit offered a set of options which local areas could adopt and develop selectively as they saw fit according to their own local circumstances and aspirations. The sixth report in the series, *Long Distance Travel*[14], looked at ways to improve the experience of undertaking long distance travel, to reduce the need for long distance travel and to enable more sustainable long distance travel modes to compete with

less sustainable ones. Visions for the future of four different types of long distance travel were developed.

Freight and Logistics - The Network's Approach

"Freight transport is not an end in itself, it's purely a service, whether it's deep sea, pipeline, canal, air, rail or road haulage, it's merely a function of supply and demand. "

14. In developing ideas for the future of freight and logistics the Network focussed primarily on the factors that give rise to current and future demand for goods movement. Demand is derived from meeting consumer needs and desires. This approach is consistent with the Network's previously stated aim to closely examine the behavioural and social factors that give rise to and influence travel.

15. The Network's approach reflects the composition, knowledge and strength of its membership. The expertise and interests of the majority of Network members has consistently lay in the fields of transport planning and personal travel: *"We are best able to talk on personal travel because it's what we do and what we work on. Other than a consumer perspective, unless you are in the thick of the business it's hard to conceive of the realities of the freight industry, the barriers, constraints and drivers."* However, the Network did succeed in recruiting a number of freight and logistics specialists into its membership during the discussion of this theme.

16. The Network recognised that across wider society there was a strong sense that consumers had little knowledge of the processes involved in producing, distributing and disposing of the goods that they purchase and consume. A study by the Royal Highland Education Trust suggested that education might be necessary in the future to avoid an almost total detachment of consumers from the supply chain processes underpinning their consumption patterns. The Trust surveyed 126 eight and nine-year-olds at four inner-city schools in Glasgow, Edinburgh, Aberdeen and Dundee. 70% of the pupils thought cotton came from sheep and almost a third of pupils did not know that eggs came from chickens. The Trust was surprised by some of the survey findings: "A lot of children thought we grew peaches, oranges and lemons, they didn't make the link that we don't have the sunshine to grow these crops in Scotland. A lot of children have never been to the countryside and on a farm".[15]

17. The Network deemed it unwise to attempt to produce a technical report to advise the freight industry on potential future developments in the sector. Instead the report is intended to be a broader thinking piece aimed at policy makers and planners and focused on possible future directions with regard to societal needs and demands and their consequent implications for the operation of freight and logistics.

18. The report has been assembled from the contributions of a wide range of individuals from the Transport Visions Network, through structured email debate and a workshop. The suggestions put forward do not necessarily reflect a consensus of opinion. Italicised quotations appearing in the text of the report without any attribution are statements made by Network members during either email or workshop discussion.

19. During the period of email discussion, Network members were asked to consider how freight and logistics might operate, in as efficient and sustainable a manner as possible, under three different future scenarios:

- Going Global - a future society guided primarily by globalisation
- Nation State - a future society guided primarily by national self-sufficiency
- Local Living - a future society guided primarily by local self-sufficiency

20. In seeking to develop ideas and solutions that promote efficient and sustainable goods movement it was considered necessary to define these terms. Sustainability has been defined as: "meeting the needs of the present without compromising the ability of future generations to meet their own needs"[16]. In terms of defining efficiency the Network recognised that the freight transport sector has been greatly focused on realising cost efficiencies in the movement of goods. This focus has undoubtedly yielded benefits for society. However, it has also brought disbenefits that a narrow, cost-based interpretation of efficiency is unlikely to consider. In generating ideas and solutions to improve the efficiency of goods movement the Network was keen to address any unpaid for external economic, social and environmental costs or impacts of freight transport e.g. congestion, pollution and inefficient use of vehicles and infrastructure, described in the Government's own policy objectives for sustainable distribution (see Section 1 of this report).

21. Following the email discussion, a workshop of Network members took place to consider emerging concepts and to develop further ideas of how goods movement might operate under the alternative future scenarios. These ideas are presented in Sections 2.1 to 2.3. This discussion is preceded in Section 1 by an overview of the context for goods movement in the UK and a more extended discussion of the scenario methodology employed in this report. The report concludes with an overview of the outputs of Section 2 and some general comments on the future of goods movement.

1 The Context for Freight and Logistics

The Statistical Context

22. In order to develop ideas, solutions and visions regarding freight and logistics it is useful to examine how goods movement is currently undertaken. The following statistical information tabulates current and historic trends in freight transport. However, it was stated that care needed to be taken in the interpretation of statistics relating to freight transport: *"Freight transport statistics tend to focus on tonnage as their principal measure (either in terms of tonnes lifted or tonne kilometres). For commodity classification, they generally use Nomenclature Statistique de Transport (NST) codes, which are the European standard commodity classification codes for transport statistics. The combined use of tonnage and NST codes is useful for the analysis of a traditional economy, which is dominated by traditional high weight, low value freight movements (e.g. coal, steel, bulk agricultural produce). However, it is less appropriate for the consumer-led, lower weight and higher value freight movements typically found in a modern economy. With the analysis of passenger movements, the "unit" being moved changes little over time; this is not the case with freight transport".*

Table 1: UK Domestic freight transport by mode in billion tonne kilometres[17]

Mode	**Year**			
	1993	1996	1999	2001
Road	134.5	153.9	156.7	156.9
Rail	13.8	15.1	18.2	19.7
Water	51.2	55.3	58.7	58.8
Pipeline	11.6	11.6	11.6	11.5
All modes	211.1	235.9	245.2	246.9

23. Table 1 shows that road transport has accounted for just under two thirds of all domestic goods movement over the last decade in terms of billion tonne kilometres. The share of domestic freight carried by each mode has been very stable with no more than a 2% variation in share for any mode over this period.

Table 2: UK Domestic freight moved by commodity in 2001 (excludes freight moved by water) in billion tonne kilometres[18]

Commodity	Billion Tonne Kilometres
Agricultural products and live animals	13.0
Foodstuffs and animal fodder	33.7
Solid mineral fuels	8.3
Petroleum products	18.5
Ores and metal waste	1.2
Metal products	8.1
Minerals and building material	25.8
Fertilizers	1.2
Chemicals	8.3
Machinery, transport, manufactured and miscellaneous articles	62.9
All commodities	188.1

24. Table 2 shows that machinery, transport, manufactured and miscellaneous articles account for a larger proportion of domestic freight movement (33%) than any other commodity grouping. Indeed, the share of domestic freight movement accounted for by this commodity group is almost double that of the next largest commodity grouping (foodstuffs and animal fodder).

Table 3: Percentage share of freight moved by mode on national territory in 2000[19]

Country	Road	Rail	Inland Waterway	Pipeline
United Kingdom	84	10	-	6
Austria	40	37	6	17
Belgium	71	14	12	3
Denmark	72	10	-	18
Finland	73	26	-	1
France	75	16	3	6
Germany	69	15	13	3
Greece	98	2	-	-
Irish Republic	92	8	-	-
Italy	87	9	-	4
Luxembourg	72	19	9	-
Netherlands	47	4	43	6
Portugal	87	13	-	-
Spain	85	9	-	6
Sweden	61	39	-	-
EU Average	74	14	7	5
Hungary	55	27	5	13
Norway	64	14	-	22
Switzerland	65	34	-	1
Japan	55	4	41	-

25. Table 3 shows that the modal share of road freight in the UK is some 10% above the European Union (EU) average. The modal share of rail freight in the UK is 4% below the EU average. Whilst Government policy can act to influence modal choice, topography, situation and natural resources can limit the extent to which modal use can be changed. For example, the Netherlands is able to achieve a comparatively high share for freight by waterways (43%), largely because of the extensive network of inland waterways available and viable for freight movement in that country, and as such benefits from the reduced environmental impact associated with this mode.

Table 4: UK International freight lifted by mode in million tonnes[20]

Mode	**Year**			
	1990	1992	1994	1996
Sea	320	333	369	368
Rail	-	-	1.2	9.2
Air	1.1	1.1	1.5	1.7
All modes	321.1	334.1	371.7	378.9

26. Table 4 shows that sea transport accounted for nearly the entire volume of UK international freight lifted during the period 1990-96. Taking account of both rail traffic and lorries on the shuttle, freight traffic through the Channel Tunnel has expanded rapidly since opening in May 1994. Although the volume of freight handled by UK airports is very small, it has grown by over 50% in the period and has a high monetary value. Around 70% of air freight is carried in the bellyhold of passenger aircraft and the share carried in dedicated 'freighter' aircraft has changed little in recent years.

Table 5: UK port freight traffic by type in million tonnes[21]

Traffic Type	Year				
	1991	1993	1995	1997	1999
Liquid bulk cargo	260.5	271.1	289.8	285.6	288.2
Dry bulk cargo	117.2	106.7	116.1	115.0	112.5
Roll-on, roll-off traffic	51.8	58.8	65.8	75.6	78.4
Container traffic	36.4	40.6	47.6	53.3	58.4
All semi-bulk cargo	21.5	20.9	21.8	21.6	21.0
Non-oil traffic with offshore installations	4.8	4.9	4.3	4.4	4.2
Conventional cargo	2.5	3.3	2.9	3.1	2.9
All traffic	494.6	506.2	548.2	558.5	565.6

27. Table 5 shows that total UK port traffic has increased by 14% over the period 1991 to 1999. Growth has been fastest in container traffic (60%) and roll-on, roll-off traffic (51%). In terms of share of total traffic, the principal changes have been a fall in liquid and dry bulk cargoes (from 77% to 71% of total traffic) with a corresponding rise in roll-on, roll-off and container traffic (from 17% to 24% of total traffic).

Table 6: UK (non-fuel) imports by country of origin and commodity group in 1996 in thousand tonnes[22]

Country	Foodstuffs	Basic materials	Manufactures	All goods*
Irish Republic	2,025	605	1,949	4,746
Belgium & Luxembourg	881	641	3,290	5,076
France	2,466	972	5,420	9,607
Netherlands	2,371	1,859	3,574	8,109
Germany	784	922	8,046	10,714
Denmark	612	355	117	1,123
Iberia	2,127	84	2,761	5,346
Italy	824	500	1,864	3,901
Scandinavia / Baltic States	316	3,763	12,971	17,155
Austria & Switzerland	27	29	454	695
Central Europe	191	506	190	898
Other Mediterranean Europe	451	325	1,084	1,938
Mediterranean outside Europe	54	633	822	1,511
Australasia	624	463	352	1,450
Africa	1,301	417	546	2,265
Gulf / Indian subcontinent	415	28	858	1,305
South East Asia	77	730	1,126	1,933

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Table continued

Country	Foodstuffs	Basic materials	Manufactures	All goods*
Other Far East	56	614	2,889	3,567
USA	2,623	1,073	2,868	6,575
Other North America	13	1,715	309	2,037
Central and South America	1,113	2,760	1,240	5,115
All origins	19,351	18,994	52,752	95,090

*Includes goods not included in the three identified commodity groups.

28. Table 6 illustrates that a majority (55%) of UK imports in 1996 were manufactured goods. Scandinavia and Baltic States were the source of the highest proportion of manufactured goods imported amongst the UK's trading partners, followed by Germany, France and the Netherlands. In terms of imports of basic materials Scandinavia and the Baltic States were again the UK's leading trading partners followed by Central and South America, the Netherlands and North America. The leading source of UK foodstuff imports was the United States followed closely by France, the Netherlands and Iberia. Across all commodity groups Scandinavia and the Baltic States were the origin of most UK imports followed by Germany, France and The Netherlands.

Table 7: UK (non-fuel) exports by country of destination and commodity group in 1996 in thousand tonnes[23]

Country	Foodstuffs	Basic materials	Manufactures	All goods*
Irish Republic	311	4,581	2,717	8,070
Belgium & Luxembourg	1,005	1,425	4,678	7,444
France	1,976	2,668	3,055	8,308
Netherlands	3,483	1,694	4,687	10,271
Germany	973	3,004	3,228	7,916
Denmark	66	968	317	1,383
Iberia	1,474	130	3,733	6,403
Italy	269	1,854	1,639	4,137
Scandinavia / Baltic States	101	10	6,049	6,318
Austria & Switzerland	41	110	367	770
Central Europe	186	10	77	375
Other Mediterranean Europe	51	1,607	587	2,335
Mediterranean outside Europe	28	725	250	1,023
Australasia	220	25	279	553
Africa	20	457	918	1,431
Gulf / Indian subcontinent	58	27	2,800	2,926
South East Asia	136	897	599	1,681

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Table continued

Country	Foodstuffs	Basic materials	Manufactures	All goods*
Other Far East	1,399	714	325	2,475
USA	46	2,260	832	3,140
Other North America	-	-	528	528
Central and South America	1	382	690	1,075
All destinations	11,833	23,549	38,374	78,582

*Includes goods not included in the three identified commodity groups.

29. Table 7 shows that manufactured goods accounted for the highest proportion (49%) of UK exports across all commodity types in 1996. Scandinavia and Baltic States were the leading destination for UK exports of manufactured goods, followed by The Netherlands, Belgium and Luxembourg and Iberia. In terms of exports of basic materials the Republic of Ireland was the UK's leading export destination followed by Germany, France and the United States. The leading destination of UK foodstuff exports was the Netherlands followed by France, Iberia and the Far East (excluding South East Asia). Across all commodity groups The Netherlands was the destination of most UK exports followed by France, the Republic of Ireland and Germany.

30. When Tables 6 and 7 are compared it can be seen that of the 173,672 thousand tonnes of international goods traffic involving the UK in 1996, 55% of traffic was imports and 45% was exports. The UK had a trading deficit of some 16,508 thousand tonnes of goods. The deficit was greatest for manufactured goods at some 14,378 thousand tonnes. However, the UK actually had a trading surplus in relation to basic materials of some 4,555 thousand tonnes of goods.

31. When looking at the UK's balance of trade in all goods with individual trading partners the highest deficit occurred in relation to trade with Scandinavia and the Baltic States at some 10,837 thousand tonnes, followed by Central and North America, the United States and Germany. The UK's highest trade surplus was with the Republic of Ireland at some 3,324 thousand tonnes of

goods, followed by Belgium and Luxembourg, the Netherlands and the Gulf and Indian Subcontinent.

The UK Policy Approach

32. The UK Government's policy priorities in relation to domestic freight transport were set out in the 1998 Transport White Paper[24]. Primary emphasis was placed upon the need to achieve modal shift from road to rail, waterways and shipping, and this required better modal integration. Further emphasis was put on the need to achieve sustainable distribution that is efficient and has minimal environmental impacts. In order to achieve this aim it was stated that quality partnerships needed to be developed at a local level to tackle distribution issues. It was also stated that the environmental 'friendliness' of vehicles needed to be improved. Inefficiency in fuel use and light running were identified as key problems. It was stated that 30% of lorries were running empty, a figure unchanged since 1988.

33. In 1999 the Government published its strategy for sustainable distribution[25]. The strategy identified the key future trends for freight and logistics as being growth in the service sector, e-commerce and international distribution networks. The strategy identified the principal transport impacts of freight and logistics as being:

- Congestion, with consequent impacts on reliability and efficiency and speed of movement
- Inefficient access, with consequences for economic growth and social inclusion
- Inefficient use of transport infrastructure
- Waste through inefficient distribution
- Environmental damage including pollution, noise and disturbance from freight movements and development pressures on the environment
- Accidents, injuries and ill health associated with freight movements

34. The strategy outlined a series of measures which together would facilitate more sustainable distribution and these were:

- Integration between modes to improve efficiency and competitiveness
- Integration with the environment so the freight industry plays its part in achieving government environmental objectives
- Integration with land use planning to improve the strategic development of freight transport infrastructure and promote more sustainable patterns of goods distribution

- Integration with wider government policies for health, education and the economy so freight contributes to a fairer more inclusive society

35. The Government's Ten Year Plan for Transport[26] aimed to provide the funding to support the sustainable distribution strategy. It stated that competitive and efficient freight was central to the success of both transport policy and the UK economy as distribution accounts for 10% of GDP. It identified congestion as the biggest obstacle to this success. The plan included a £4 billion investment in rail freight to increase volumes by 80% by 2010 to achieve a 10% market share, up from the current 8% (see Table 1). One way to achieve this would be by investing in longer trains, each of which would free the roads of 60 lorries. It was predicted that this would cut road congestion by 3%. The investment would also yield 50 new rail freight terminals, better interchanges, line upgrades, freight lanes, priority routes and improved access to ports.

36. The Rail Regulator, in his review of freight charging policy published in October 2001, announced that "there should be a very significant reduction in access charges for freight operators, of around 50%. The Strategic Rail Authority (SRA) will fund the shortfall in Railtrack's revenue requirement from freight operations, estimated to be approximately £500 million over the course of the current control period"[27]. This was hailed at the time as a significant element of the strategy for meeting the rail freight aims.

37. However, subsequent progress towards these aims has been somewhat derailed by financial problems faced by the SRA, the body set up to provide strategic direction for the UK's railways[28]. In December 2002, the Department for Transport (DfT) decided to cut the SRA's budget for the period 2003/4 to 2005/6 by £312 million. In response the SRA announced the suspension of new Freight Facilities Grants and Track Access Grants, the only Government capital support for rail freight, for at least 15 months with no certainty of resumption thereafter. The SRA also postponed or cancelled a series of gauge enhancement schemes to allow 9ft 6 inch containers to be transported by rail on standard wagons[29].

38. According to the Rail Freight Group, the representative body of the rail freight industry, these events have cast considerable doubt on the prospect of the Government's targets for rail freight being achieved: "For freight, the success story of privatisation, the sudden withdrawal of freight grants with no prospect of early reinstatement, the cancellation of gauge and capacity enhancement projects and the veiled threats of downgrading of the network through the

vehicle of the Regulator's Interim Review will kill off the green shoots of growth in new markets. By stealing the Ten Year Plan budget allocated to freight, the SRA has killed any chance of achieving the 80% growth target. This will be a blow to the 91% of the public who would like to see fewer heavy lorries on the roads, to the ports industry struggling to compete with Antwerp and Rotterdam for direct calls on the World Shipping Circuit, and to UK plc dependent on getting goods to consumers and exports to market on our increasingly congested road network."[30]

Road User Charging

39. In November 2001 the UK Treasury published a consultation paper entitled 'Modernising the Taxation of the Haulage Industry' outlining proposals for charging Heavy Goods Vehicles (HGV's) using either a time-based or distance-based method. The resultant proposals were announced in the 2002 budget: "The Government will ensure that lorry operators from overseas pay their fair share towards the cost of using UK roads and has consulted on options for introducing a road-user charge that would apply to lorry operators regardless of nationality. The consultation revealed a strong preference from haulage associations, general business organisations and environmental groups for a distance-based lorry road-user charge. The Government will introduce a distance-based lorry road-user charge in 2005 or 2006 and will ensure that the UK haulage industry does not pay any more as a result of a new charge and will introduce offsetting tax reductions for the industry."[31]

40. The Freight Transport Association (FTA) supports HGV charging: "Government, in consultation with industry, will introduce a distance-based charge for trucks from 2006, using Global Positioning Systems (GPS). The overall tax take from trucks will not go up, but the burden of road tax will be redistributed. Low-emission trucks using the most appropriate roads and times of the day when road space demand is lowest will pay least. The FTA supports this approach, which encourages environmental improvement and road safety. However network reliability benefits can be delivered only if this is rolled out to motorists, who account for over 80% of traffic. Such a step would not be anti-car, but pro-movement. A satellite-based, point-of-use charge can apply to all roads, including those in town and city centres obviating the need for roadside camera enforcement planned for congestion-charging schemes in city centres, releasing road users from the bureaucratic tangle that this would entail"[32].

41. Some Network members considered that the decision to make the charging scheme fiscally neutral was made to avoid upsetting the road freight industry: *"In the interests of sustainability and integrated transport espoused in prior Government policy documents a bolder and more effective strategy might have been hoped for. A combination of time, distance and*

emission based charging, which takes into account the availability of suitable alternative modes, could bring about real change. It could act to internalise the external costs of road freight, achieve modal shift to rail and water, reduce environmental impact and reduce congestion… The current policy approach cannot be viewed as a long term solution; rather it could provide a stepping-stone to further legislation. It is essential that real opportunities for legislation to achieve modal shift are not ignored in the long term".

Incentives for Shared Use

42. The Network also favoured an alternative strategy to tackling the problems of inefficient goods movement by road. It was argued that sometimes incentives rather than penalties are appropriate when trying to bring about change. One approach would be to provide fuel duty rebates for the elimination of empty running.

43. In order to encourage less empty running, emphasis upon co-operation between companies to achieve consolidation is required. However, progress towards such co-operation is often hampered by the logistics package being seen by individual companies as providing them with a competitive advantage over their competitors. Whilst this is an obstacle that needs to be recognised, it need not be insurmountable. It was noted that in some geographically remote areas of the UK, companies are recognising the benefits of such an approach in relation to rail freight movements: *"Safeway overnight distribution from the central belt to the far north of Scotland has been inefficient as they only move 5 or 6 containers each night. Marks & Spencer have encountered similar problems. There is scope for the two companies to work together and share loads. Local and regional authorities should promote these ideas and provide incentives like grant funding or tax breaks for such good practice ".*

44. Initiatives of this nature could be developed through the establishment of Freight Travel Plans (based on the principle of workplace travel plans but where the emphasis is on developing a more sustainable movement of goods, rather than people): *"The success of Freight Travel Plans would depend on support from the freight transport industry. And as important, if they are to earn the confidence of industry and maintain credibility, local authorities need to undergo a cultural or paradigm shift, away from regarding freight traffic purely as a 'problem' to be reduced through punitive measures. It requires a more pro-active approach to the notion of sustainable distribution and freight transport planning. Whilst local authorities are currently limited to what they can achieve in this area (they have no powers to require companies to establish plans or subsidise rail-freight) much more can be done in terms of encouraging, enabling and facilitating change".*

45. In the future, technological developments (GPS or smart tagging systems) should enable a much higher and more effective degree of tracking and tracing of lorry movements. This will enable lorries running under capacity to liase with other local companies

that require goods distribution with the aim of increasing the efficiency of each trip. Under these conditions lorries could collect and distribute goods with a degree of speed and flexibility comparable to taxi services.

Port Development Pressures

46. In terms of international freight transport, the main problem facing the UK appears to be the availability of sufficient capacity at UK ports capable of accommodating deep sea, containerised shipping. The Government appears to apply a similar policy approach to port development as it does to airport development. The approach bears resemblance to the 'predict and provide' approach that was applied to road transport for many years. This involves the acceptance of projected growth in demand for services and infrastructure and consequent provision for this demand.

47. In its report on long distance travel[33] the Network challenged the Government's approach to air travel and called for demand management strategies to be applied. This stance was taken in the wake of the decision to allow the development of a fifth terminal at London Heathrow airport after a protracted planning inquiry. The Network detected striking parallels between this episode and the current planning inquiry relating to the proposed expansion of port facilities at Southampton and concentrated upon Dibden Bay[34]. As in the case of the Heathrow inquiry the decision is likely to come down to a choice between advancing the UK's economic interests and protecting the local environment. The inspector's report is due towards the end of 2003 and the eventual outcome is likely to have as profound an impact on the Government's policy approach to freight and logistics as any of its previous policy publications on the issue.

International Policy Approaches

48. An appreciation of some international approaches to the problems of freight and logistics could assist in addressing some of the UK's problems. The Swiss approach to shifting freight from road to rail offers a template for Europe[35]. The Alpine region, being on the north-south European transport axis, suffered from a continued high growth in transit (through) traffic. A referendum in 1994 put an 'Alpine Initiative' to the Swiss people, which was accepted and the government was bound by the outcome. The original text of the Initiative concentrated on international transit traffic only, and requested that this all be moved from road to rail. However, as this is contradictory with the EC policy of non-discrimination, the Swiss government had to develop a policy that met the requirements of the Alpine Initiative whilst at the same time remaining non-discriminatory. This was achieved by setting a target number of permitted trucks transiting Switzerland and the Alps. The figure was set at 650,000 a year, representing a 50%

reduction on 2001 traffic levels[36]. The Swiss Government aims to achieve the target by 2007 via a range of transport policy measures:

- Heavy Vehicles Fee (HVF)[37] - a charge levied on all HGV's travelling on all roads in Switzerland of about 1 pence per tonne-kilometre travelled. An emission factor is applied, with 'cleaner' vehicles being charged less. The charge is based on the maximum laden weight of the vehicle - not the actual weight - therefore discouraging empty journeys. Revenue is hypothecated to achieve other transport objectives. The HVF came into operation on 1st January 2001.

- Opening of a new rail link through the Alps in 2007. This will be assisted by other measures to improve the attractiveness of rail – better transhipment centres at border areas, and the use of piggyback vehicles for HGV's to be transported on low floor rail wagons[38].

49. Austria suffers similar problems and has its own Ecopoint scheme, which through the greater use of cleaner vehicles has achieved a reduction in Nitrogen Oxide emissions of 56% over the last decade[39]. However, it has been unsuccessful in reducing traffic levels. On joining the EU the Austrian Government allocated member states an ecopoint quota for their hauliers (ecopoints equate to a transit trip). If the number of transit trips in any year exceeded a given limit, then the ecopoints given to that member state would be reduced the next year, forcing transport of freight by other modes.

50. In addition, both Austria and Germany are introducing road user charges on heavy goods vehicles similar to the Swiss approach. The Austrian scheme ('Truck Toll') applies to the entire motorway and will be levied on all vehicles with a gross weight in excess of 3.5 tonnes. The key objective of the scheme is to raise revenue for investment in road construction and maintenance. The scheme is scheduled to commence on 1st January 2004 respectively[40].

51. The German scheme ('Toll Collect') applies to the federal motorway network and will be levied on all goods vehicles with a maximum permissible weight exceeding 12 tonnes. The main objectives of the scheme are to increase the contribution the funding of infrastructure, and to encourage a modal shift in freight traffic from road to rail and also inland waterways. The scheme comes into operation on 31st August 2003[41].

Technological Developments – E-Commerce

52. The Network has recognised in its earlier reports that whilst national and international government policies will undoubtedly shape the future of freight and logistics it is likely that the influence

of technological developments will be more significant. Certainly the pace of change is more likely to be dictated by technological rather than political developments. It is widely accepted that electronic commerce (e-commerce) will continue to grow in significance with extensive consequences for the operation of freight and logistics. E-commerce is the exchange of information across electronic networks, at any stage in the supply chain, whether within an organisation, between businesses (B2B), between businesses and consumers (B2C), or between the public and private sectors, whether paid or unpaid[42].

53. The implications of e-commerce for freight transport are by no means clear-cut. United Parcel Services state that consumers are not purchasing more goods, but their mechanism of purchasing is changing. A distributor may only have to deliver 3 vehicle loads of goods to 15 retail locations in a specific time period. With more e-shopping and associated demands for doorstop delivery, the same company may have to deliver 3 vehicle loads to 150 different locations in the same amount of time[43]. This increases the risk of failure in the last mile of the supply chain, resulting in increased customer dissatisfaction and increased numbers of trips. These new business methods could result in increased freight traffic and congestion. Consumers may still window shop and then purchase on the Internet, so making their initial journeys as well as having home delivery, although these initial journeys may be more likely to be made by non-car modes should they not have to transport the goods home themselves.

54. If consumers do more online shopping then shopping itself will change. Possible outcomes include: abandoning retail stores in favour of delivering directly to customers from warehouses; abandoning large retail stores and adopting a boutique strategy; or maintaining large retail stores and competing on price[44].

55. Cairns has said that: "even with a relatively small number of customers, and vans which can only carry a few loads of shopping each, 70-80% of vehicle miles should be saved if customers no longer travel to the shops by car, but have their shopping delivered by delivery vans instead"[45]. Most shopping trips are short trips. Replacing these trips is likely to have little effect on an individual's mileage, but a large effect on business.

56. Deliveries can be at home (requiring customer attendance), to the home (some form of secure storage at the house), to work (again requiring customer or administrative attendance) or to a collection point. The first option is time costly, the second option is quicker for the consumer, but demands many trips for the business. The third option works well in flexible work environments, and in

situations not involving perishables or particularly heavy items. The fourth option is easier for business, though the consumer needs an additional trip. Small shops could facilitate this fourth option and earn extra income by providing a reception service. If these are close enough to the destination then trips can be made en route or by walking. Ideally, businesses would use 'environmentally-friendly' vehicles for their local deliveries to minimise the impacts of any additional freight vehicle movements.

57. Punakivi and Holmström[46] looked at the environmental aspects of home delivery, using modelling to show that e-grocery could significantly reduce traffic emissions. Results suggested that unattended reception could reduce fleet operational costs by 60% over attended reception. Unattended fixed day deliveries could significantly reduce CO and HC emissions and lower traffic mileage by 8 to 13%. Mileage savings are likely if consumers are concentrated in housing estates or along bus routes. B2C deliveries will increase although this growth is likely to be spread over a substantial time period. This will therefore not dramatically reduce consumer mileage, but it will affect shop locations and shopping behaviour.

58. There is considerable debate concerning the impacts of Internet shopping on personal travel patterns. It has been suggested that people may use the time they save by shopping on line to undertake other activities involving travel. However, there is little evidence either to support or refute this view and research is required to monitor and analyse these impacts and determine how they might be mitigated or supported where appropriate.

Technological Development – Smart Tags

59. A range of emerging technologies could be employed to improve the efficiency of freight movement in the near future. These might include value networks - multi-enterprise arrangements focused on integrating information flows and knowledge to meet strategic business objectives. A system of urban area delivery control (co-ordinating goods delivery and service vehicle movements in and out of urban areas) could be achieved using GPS (possibly through the European Commission's GALILEO satellite radio navigation system[47]) and/or Global Systems for Mobile Communications (GSM) combined with tagging technology. A dedicated 'urban freight movements co-ordinator' could organize all collection/delivery/service vehicle schedules on behalf of companies operating in this area, building on the example of the German Güterverkehrszentrum or freight village concept[48]. The application of such an approach would clearly require issues of commercial confidentiality, exclusivity and competitive advantage that often feature strongly in the design of the logistics systems of large companies to be addressed.

60. Smaller scale innovations at the household level like the introduction of smart technologies have considerable potential to improve supply chains. This might involve direct ordering from customers via 'smart bins' with smart tags (inter-active 2-way bar codes). These tags would provide producers with enhanced customer and product information. For example, the tag would be able to track the movement of the product and the date of purchase and consumption: *"It's like vend and manage inventory one step further. Your kitchen cupboard is an extension of their warehouse. It would make forward planning and product delivery much more efficient because demand forecasts could be very accurate. Decisions would have to be confirmed with an Internet ordering catalogue or a fridge till. Microwaves will also interact with smart tags on ready meals so you can't burn the dinner".*

61. Such technological developments could have profound consequences for freight distribution systems. Whilst the user interface might seem trouble free, behind the facade, orders will travel around various distribution networks and goods movement will increase as ordering becomes more a matter of individual choice and whim.

The Personal Touch

62. To envisage the future of freight and logistics as being technology driven would be consistent with mainstream thinking. However, it is possible that already perceptible behavioural trends may lead to an enhanced role for the human or personal touch in future freight and logistics: *"We assume IT is a better future, but thinking simple might take us further forward. Life is getting complex because we don't challenge the way we are moving goods round. We say we need it to go and we need an IT system that will support it. Once you've supported it you get even more complex and fragmented. We are producing more and more products and transporting them further and further, working longer and longer hours producing more and more fantastic technologies to make life easier and simpler, but it doesn't. We are more stressed than ever. Why not keep it simple and rely on human beings to apply common sense; they are far more intelligent than smart tags? Take advantage of the human brain, it's the most sophisticated technology we've got. When we go to buy a product we want to know if it's the right tool or washer, how many of us go to the hardware store and find a member of staff rather than looking for it ourselves?".*

Scenario Methodology

63. In seeking to develop ideas concerning the future operation of freight and logistics in the UK it was decided that employing a scenario based approach would be appropriate. This was determined on the basis that a variety of different futures were possible: *"Scenario planning is about not putting all your eggs in one basket and saying this is most likely to be the future and therefore we must act accordingly with our policies. We can't be certain so let's see what different futures are out there. We may have a hunch that one scenario is more plausible*

than another, but we run risks if we channel all our energies into solutions and forward planning for that one scenario and ignore others".

64. Three scenarios were developed according to different interpretations of how spatial range will be regarded in future for the operation of freight and logistics and these are outlined below:

- Going Global - In this future, society will function on a global level with national and regional boundaries becoming increasingly insignificant. People will consider that spatial range should not act as a barrier to the production and consumption of goods with a resultant stimulation of new and existing international markets.
- Nation State - In this future, the nation state will constitute the most important context for economic, political and social development. Society will decide that the best way to provide for the production and consumption of goods will be from within its national boundaries with regional development and specialisation replacing international markets wherever possible.
- Local Living - In this future, society will operate primarily on a local level. Society's production and consumption of goods will be provided, as far as is possible, from within the local community - be that a city, town or village - with local diversity rather than international markets being the means of satisfying the demands of consumer choice.

65. The merits of the scenarios and questions such as how and why they might in practice come about were not issues for debate. Each scenario was designed to represent a future state of society to be taken as a given by the Network. Debate then centred upon the possible ways in which goods movement could be addressed under each scenario, in as efficient and sustainable a manner as possible. The Network's views and ideas are presented in Sections 2.1-2.3.

2.1 Going Global

In this future, society will function on a global level with national and regional boundaries becoming increasingly insignificant. People will consider that spatial range should not act as a barrier to the production and consumption of goods with a resultant stimulation of new and existing international markets.

Virtual Globalisation

66. In a future society where spatial range is not considered a barrier to the production and consumption of goods, serious questions would arise regarding the sustainability of freight transport. Fears might be raised that a state of hypermobility would develop as goods and services travel further and further around the globe and at faster speeds to fulfil the demands of time-critical supply chain processes. However, the Network challenged the view that increasing demand for international goods and services inevitably meant increasing levels of freight transportation. In essence, the Network felt that there is the possibility of a future of 'global sustainability' within the Going Global society.

67. Technology was identified as having an important role to play in facilitating more sustainable global goods movement. The Network

believed that there was strong potential for the transport of certain goods to be replaced by virtual alternatives. For example, developments in Internet and computer technology have enabled downloading of information and in future this could be the principal means by which a wide range of information-based goods and services are provided in 'dematerialised' form. The principal barrier to such developments would appear to be worries regarding licensing and the ability of the producer to maintain control over the supply process, as well as the quality and integrity of its products, when disseminated through this media. The most popular and well-known example of the manifestation of these concerns has been through the unlicensed provision of music products via the Internet by companies such as the music swapping service Napster[49].

68. It was recognised that moves to address these obstacles were discernible in mergers and partnerships between media and entertainment companies and Internet companies such as Time Warner's merger with America Online (AOL)[50]. Such partnerships are likely to be widely replicated in future as producers seek to ensure that their goods are delivered to customers through approved providers.

69. The Network felt that the potential for dematerialisation of goods was considerable. Of course, it was recognised that the notion of technological advancement resulting in a reduction in the use and need for physical goods had long been heralded and that in reality, new technologies such as the Internet and email had often resulted in 'paper mountains' rather than in the 'paperless office'. However, past experience need not dictate future reality. The ordering of books in hard copy from Internet based companies might be supplemented or replaced by downloading the material: *"Technology will make downloading information a lot quicker; in 10 years time you will download books in a matter of seconds and the quality of the machine-human interface will be improved so much the reading on screen on a monitor or hand held will be easy and comfortable. You might even be able to read your digital book in the bath"*.

Home Assembly

70. Where dematerialisation of goods is impossible because of the size or nature of the product, smart robots (which could be a standard feature in every household) could download the information necessary to assemble the most complicated manufactured goods. This could mean that virtually all products are 'flat packed' when delivered and assembled at point of consumption. Licensing would again be an issue as companies that invest in research and development would be unwilling to distribute that information every time they sold a product. This could be resolved by some form of intelligent discrete licensing: *"It could work*

like ticketing for rail travel, when you buy a train ticket it determines who gets paid what, it could be the same with home assembly. Make a vacuum cleaner at home and the company get x amount of money".

71. The efficiency benefits for freight and logistics of home assembly might be considerable, particularly for the supply of products which have a wide international coverage, but which have to be adapted or customised for different markets. With assembly postponed until the product reaches the customer or local warehouse, the customisation processes could also be delayed until this late stage offering potentially large savings in terms of inventory levels. Flat packing is unlikely to bring substantial savings in terms of transportation costs as product weight, rather than volume is the key factor for the vast majority of products, particularly when the supply chain involves containerised shipping where weight per unit is key. However, when the product is removed from containers for distribution to the local warehouse, retailer and/or final customer, the improved efficiency of storage and increased capacity gained should lead to efficiency savings in terms of warehousing and local goods movement costs.

72. The problem of reverse logistics (returns) would require close attention as it could threaten to undo all the other efficiency savings of home assembly. When consumers buy products via home delivery mechanisms a much larger proportion of products go back to the supplier than in conventional retailing. Co-ordinated white van deliveries and collections are likely to increase in these circumstances replacing car trips to retail facilities, although current experience suggests that such co-ordination is difficult to achieve - many companies operate reverse logistics systems that are independent of the initial delivery system.

73. The two-way information exchange enabled by the Internet offers the prospect of a step change in terms of the qualitative provision of consumer demand. Customers are increasingly demanding more sophisticated and tailor-made goods and services and if these requirements can be fulfilled then the problem of returns may be substantially addressed as the onus is placed on the consumer as well as the producer to provide accurate information: *"In the US there are companies operating online who make clothes to order, a customer goes to the web and gives the exact measurements to the supplier and they will make a garment to specification. It's a success because only 30% of women meet standard sizes. It's not the automation of process it's the e business behind it which allows people to get their exact order in. If you are manufacturing for the individual the order goes straight to the manufacturing site with no warehouse stockpiling, it's made and sent out. Bespoke product ranges are becoming increasingly popular".* This has beneficial consequences for efficient goods movement because it enables producers to provide

for actual demand rather than predicting demand and providing accordingly. The downside potentially is that the product range available to consumers becomes almost limitless and bespoke goods production could yield substantial inefficiencies in supply chain processes.

New and Improved Modes

74. New and improved modes could enable more sustainable global freight movement. In a society where pressures towards globalisation have broken down international barriers and international interconnectivity is the predominant philosophy, transportation systems would have to be developed or shaped to meet these requirements. These circumstances might lead to the development of high-speed underground/underwater freight transport to complement or replace some forms of air and sea freight transport. This could lead to the development of a global network of evacuated tube transport through modularised, powered containers filled with hydraulic fluids. The technology would be comparable with the vacuum tubes that used to operate within shops and for postal deliveries along a pipeline network across London[51].

75. An alternative new mode, which could bring great benefits for global goods movement, is teleportation. Scientists in Australia have recently managed to teleport beams of light[52]. In the long term, teleportation may be applied to move manufactured goods and raw materials, although human beings and foodstuffs may prove a more challenging prospect! In 1895 the President of the Royal Society, Lord Kelvin, stated that heavier than air flying machines were impossible[53]. Would it therefore really be sensible to dismiss a potential role for teleportation in freight transport of the future?

76. There are perhaps more realistic immediate prospects for the improvement of existing freight transport modes. There are a number of projects being carried out to create fast ships, which can revolutionise the timeframes for sea freight[54]. For example, the FastShip[55] expects to provide a transatlantic service from Philadelphia to Cherbourg in 3.5/4 days; current container ships require 7 days.

77. The fast ship might replace or complement some forms of air freight, e.g. some perishable goods could be shipped fresh rather than frozen or transported by air. This would serve to reduce the environmental impact of such goods movement. The greatest potential benefits of fast ship technology are likely to be derived in the transport of high value time sensitive goods which are not suited to air freight transport: *"If you have a container of champagne it has to go by sea because of it's weight, there's a saving if it moves by fast ship because you get it out and sell it quicker. If the cost of financing is $100 a day*

and you save 3 days on your transit that's a $300 saving somewhere in your supply chain. The question then is how much extra are you prepared to pay for transport. If it's increased by $250 you are still saving $50 a time". Whilst doubts remain regarding the potential profitability and technological ability to actually deliver the substantially reduced journey times it would be short sighted not to anticipate that these obstacles could be addressed in due course.

78. Potential also exists for the improvement of air freight in terms of speed and environmental impacts. A new hypersonic jet engine is being tested which researchers believe could revolutionise long-haul air travel, cutting the trip from London to Sydney to just two hours[56]. The Scramjet engine provides propulsion at speeds above Mach 5 by capturing atmospheric air to mix with on-board fuel. These engines are therefore more efficient than conventional rocket motors because they do not need to carry an oxidant with them. This means future hypersonic vehicles will have room to carry more payload. Improved journey speeds should be pursued and exploited in a way that redistributes goods movements across modes in favour of more environmentally friendly and sustainable modes.

Product Preservation and Modification

79. Time pressures are largely responsible for many of the environmentally damaging aspects of freight transport. The growing emphasis upon just in time (JIT) delivery and the increasing demand for highly perishable goods all year round has meant that speed of delivery rather than efficient movement is the key factor in many areas of freight transport.

80. In attempting to cut warehousing costs and to be able to react quickly to changes in consumer demand, great pressures have been placed upon supply chains and particularly on freight transport systems. As long as transportation costs are seen as a small component of overall costs then inefficient transportation practices are unlikely to be fully addressed.

81. Improving the speed of freight transport through improving existing transport modes (including the Internet) or introducing new transport modes may not be the only means of improving the sustainability of global freight and logistics whilst continuing to provide for consumer demand. One way to reduce reliance upon fast but inefficient and intensive goods movement could be to explore the potential capabilities of science and technology to preserve and modify products, or the conditions in which they are transported/stored to extend their shelf life.

82. A Network member pointed to the fact that the industry was already looking to employ preservation technology to reduce the intensity of freight movement: *"We launched a product with Thermoking called Afam[57] for use on our container ships. Refrigerated containers normally*

operate deep frozen or chilled, but this is more sophisticated. It has a microchip that controls the level of product decay and adjusts the container to allow more oxygen and preserve nutritional value. Broccoli from China has always been air freighted. We've shipped broccoli in one of these containers and it's arrived in saleable condition. Air freight is more expensive than moving a 40' refrigerated container where you can guarantee your product arriving in good condition. Most of these things are seasonal, if you take an extra 28 days and know it will arrive in good condition you extend the time you can purchase the crop. It could also help farmers in poorer countries unable to export these fresh items ".

83. The Network discussed a similar example where preservation technology could radically alter how a product is transported. Orange juice is currently flown in from Florida. The process is profitable because the product is expensive, high quality and fresh: *"If Tim Henman does well at Wimbledon and the sun comes out then demand for fresh orange juice goes up and planes are chartered because it cannot be stored in the UK".*

84. Advances in preservation technology could develop an orange juice with an extended shelf life that still retains the quality of the product. This could mean that a year's supply of orange juice could be moved over from the USA in a 30 day shipment rather than by 200 or more ad hoc air freight deliveries. It could be transported in bulk in a tanker and bottled or contained at the port of destination, a practice used in the transportation of some forms of alcohol where a ship docks and pumps the alcohol through a pipeline. This significantly reduces the transportable volume of the product during sea movement by removing the substantial weight of glass and other forms of packaging. It also provides an opportunity to increase the efficiency of freight systems through standardisation of primary packaging combined with sophisticated closed loop recycling and reuse schemes.

Tax Incentives for Warehousing

85. It was argued that if science and technology can change the way we transport perishable goods then we should also contemplate changes for other types of products. Reducing the intensity of the movement of non-perishable goods would require regulatory rather than technological solutions. Principally there would be a need to provide a mechanism by which long term storage of goods replaced JIT oriented supply chain processes. Currently many companies view warehousing negatively because retaining high levels of stock increases inventory costs. The situation could be reversed by the introduction of tax incentives to encourage storage practices: *"Tackle the cost and demand issue at the cost end. Engineer a situation by which companies can stock up products with reduced costs to themselves (through new business banking practices). Have a mechanism by which excess products at the end of lines can be returned or sent on to recycle if they are no longer required to be used again with a minimal cost to each player in the supply chain for doing*

so. Introduce tax breaks to encourage high levels of stock retention, perhaps through a concessionary land use charge for warehousing. This approach would enable longer term storage to counter the importance of JIT deliveries and reduce logistics demands".

Port Development

86. In a society where international goods movement will expand dramatically beyond current levels there will be immense pressure to expand the capacity of shipping, particularly to avoid modal shift to air and road transport. This will entail the expansion of port facilities in the UK requiring extensive infrastructure development and integration with existing and new land transport infrastructure. Currently there is a very uneven distribution of traffic across UK ports, with some of the more popular ports operating close to, or even beyond capacity. This is partly due to the fact that traffic is concentrated at a small number of ports which are able to accommodate container ships which are also expanding in size: *"Felixstowe is full, they can do one more finger extension there, Southampton is over capacity with massive knock on delays. Drivers hang about and then can't drive because of legislation. Whitehaven was the largest port to the USA, but it couldn't take the ships that go to Felixstowe".*

87. The current industry approach to meet port capacity demands is to expand existing facilities at the main UK hubs such as the planned massive expansion of facilities at Southampton through the Dibden Bay development[58]. This mirrors the approach taken elsewhere in Europe where facilities at ports like Rotterdam[59] and Barcelona[60] are being expanded. As well as the issue of terminal capacity at the ports themselves, there are considerable capacity constraints on the inland modes, particularly in south east England where road and rail congestion is a significant problem. Unless these wider problems are tackled, expansion of existing ports alone is unlikely to provide a sustainable or economically viable solution.

Trans-Shipment Hubs

88. The Network was keen to explore alternative options for expanding port capacity in the UK in the context of a future of expanding global trade. One option would be to develop a single trans-shipment hub for the European continent with feeder services to individual countries: *"Current ships go on long circuitous paths rather than shuttling backwards and forwards. It's starting to change. Other continents have trans-shipment hubs; Europe is one of the last continents that still stop for a day at every port".*

89. In seeking to develop a European trans-shipment hub the biggest issue to resolve is the regulatory framework. Many European ports are state controlled and so gaining co-operation and agreement for a single hub may prove difficult. However, in a society where pressures towards globalisation have broken down international barriers and international interconnectivity is the

predominant philosophy, transportation systems would be shaped to meet these requirements.

90. It was suggested that an appropriate location for a single trans-shipment hub to serve the UK in the first instance, and if then successful to serve the European continent, would be Scapa Flow in the Orkney Islands[61]. This would provide an island port with a good length of quayside for trans-shipment where smaller vessels would distribute out to other points. Developing a trans-shipment hub at Scapa Flow would be less constrained by land use planning and capacity considerations than any attempt to expand existing ports like Southampton or Felixstowe. The principal remaining concerns would be environmental and specifically related to wildlife protection.

91. The Network also raised the possibility of mobile trans-shipment. This could be applied to the transport of high value time sensitive cargoes whereby small speedboats could collect goods from larger ships offshore and operate fast ferry services to mainland ports. There would be no need for ships to dock as they could refuel in mid sea. The weather is the principal, although perhaps not insurmountable, obstacle to the deployment of such an approach, at least in the context of the North Atlantic and the North Sea. This idea strongly parallels the Lighter Airboard Ship (LASH) Carrier system whereby a ship takes LASHs aboard by on-board cranes. In the seaport the LASHs are used for transporting goods along inland waterways, removing the need to tranship the cargo[62].

92. In order for offshore trans-shipment of high-value time-sensitive cargoes to be a viable option, a more flexible approach to containerised shipping is required: *"If you want to send goods by sea you have to fill a whole container, which is limiting when you've got small, high-value parts. By the time you've filled a container they will be crushed. Otherwise you come down to the shared use and if it's not totally your freight it goes astray and you lose the traceability"*. The answer would be to provide an alternative standardised unit smaller than a sea going container (the potential for such technology to be applied in the movement of rail and road freight is being realised through the minimodal system[63]). Currently container sizes are internationally standardised across modes, but pallets are not as about 15 companies provide different ranges and sizes. A standard container could be divided into 8 pallet-sized containers that would plug together to form a container load. Pallets would be separately identified so they could be tracked through the system, an important issue when trying to attract high value products.

Trans-European Rail Freight Network

93. The Network was keen to include proposals for the improvement of rail freight within a scenario of increasing global goods movement. Efficient interchange facilities between sea and rail are crucial to this development with good distribution systems necessary to move products from large containers to smaller units for localised distribution. UK rail infrastructure would need to be upgraded to accommodate freight movement on a larger scale, in terms of route capacity, terminal capacity and loading gauge.

94. Dedicated high-speed rail freight networks were seen to offer a possible way forward. It was noted that plans exist to (re)build a freight line on the old route of the Great Central Railway[64] from north west England, via the midlands, London and the Channel Tunnel, to northern France and continental Europe. The original line was conceived as a link to a channel tunnel in about 1880 and closed in the 1960s: *"It was the last main line built in the UK, well engineered, virtually straight (offering potential for the highest speeds of any line going north) and built to take freight, so we pulled it up and built houses on it. The plans are getting into NIMBY trouble in Parliament because of too many local authority objections over land take".*

95. In a future where society seeks to removes barriers to global freight movement it would be likely that schemes along the lines of the Central Railway proposal would be adopted. If there is increasing global goods movement there will be capacity limits for all modes and businesses and transport operators will have to co-operate.

96. New rail freight networks would need to comply with trans-European standards relating to inter-operability meaning that more advanced rolling stock, built to standards comparable to the French TGV system, would be employed in the UK. Such investment in new vehicles and infrastructure would cut journey times further enabling rail freight to be competitive with other modes: *"Some freight trains could run much faster on curves than passenger trains, as passenger comfort restricts speed through curves before the technical limits of speed and cant are reached (hence tilting trains). Boxes of apples don't complain about lateral G. You can't do the same with aggregates, but perishables, and many JIT items could be light enough, or loaded low enough (on new trains not required to meet platform heights or carry air conditioning kit underneath the load space)".*

97. The Network was also keen to promote the use of high speed passenger rail facilities by freight where appropriate, particularly in relation to high value, time sensitive freight. It was acknowledged that such an approach has been used for many years in relation to the movement of parcels and mail, although now virtually non-existent in Britain, and this could be expanded for other types of goods movement. Freight trains could be electronically coupled to

the back of passenger trains and then electronically diverted off. This kind of operation has been developed in Germany where the Bonn to Berlin rail service separates freight and passenger units within 10 minutes when stationary. Research is also taking place in Germany into the high speed coupling and uncoupling of small train units in motion at around 100 miles an hour where units could join, separate and divert to different locations. Similarly, the utilisation of superconducting magnetic levitation technology (maglev) pioneered in Japan also has the potential to support very high-speed freight movements[65].

Rationalised Global Market

98. With trends towards international co-operation and interconnectivity identified in a going global society, it is possible to envisage a rationalised global market. This could equate to national/continental level specialisation in goods production and distribution as technology and resource clustering occurs. In this vision the world would be separated into farmers, manufacturers, assemblers, distributors and consumers and global trade patterns would become more predictable. There would be international distribution centres e.g. all fruit and vegetables destined for Europe would pass through the Brussels distribution centre before being inspected, tested and redistributed.

99. All freight transport would be organised on Trans Continental Multi Modal Freight Networks, which could include dedicated international freight rail lines and single continental trans-shipment hubs with smaller feeder services to individual countries. All countries would appoint freight controllers who would administer freight traffic in their nation assigning imports and exports to available transport facilities and thus minimising inefficient and wasteful practices.

2.2 Nation State

In this future, the nation state will constitute the most important context for economic, political and social development. Society will decide that the best way to provide for the production and consumption of goods will be from within its national boundaries with regional development and specialisation replacing international markets wherever possible.

Regional Specialisation

100. In a future scenario where goods production and movement is based around recognised networks of regional production, the operation of freight and logistics will face different challenges and opportunities than in today's society. The revival/rebirth of indigenous manufacturing and primary industries as well as foodstuffs will fundamentally alter goods transportation.

101. It is possible that the economic organisation of a regionally focussed nation state would replicate historic specialisations. For example, the traditional centres of heavy industry such as the coal mining areas of South Wales and Northumberland may be revived with related manufacturing industries located nearby to maximise the efficiency of production. Such developments would be likely to

have beneficial consequences for goods movement. Statistics in Section 1 demonstrate that the majority of goods moved in the UK are raw materials rather than manufactured goods and these movements are likely to reduce if manufacturing and heavy industry are located in close proximity.

102. It would be unwise to concentrate particular industries solely within one region: *"If you are focusing all your raw materials in one area and transporting it to every other region you will have empty running returns because there's no handling compatibility. A mix of industries across the country is necessary with some specialisation, but products need to be compatible for 2 way flows. Such a strategic approach to regional specialisation would ensure the more efficient operation of freight transport".*

103. An economy based on regional specialisation would result in local freight transport impacts that would need to be addressed. In particular, more nationally produced goods will require more land use development for manufacturing industries. Whilst this development might aid economic regeneration it might generate traffic which is incompatible with existing land uses: *"If you put land to a use that employs less people, but generates a lot more freight, the local impacts might be severe"*. Careful attention would have to be given to the needs of balancing economic, environmental and social interests in such circumstances.

From Hub and Spoke to Spoke-to-Spoke

104. It was argued that in a nation state scenario a spoke-to-spoke system (whereby goods movement occurs between producer and retailer/consumer directly, without passing through a central hub) might generate significant transport efficiencies. This was based on the belief that hub and spoke systems lead to goods being transported unnecessarily: *"Goods from one town are transported to a hub in another region and then transported back again for sale. There are unnecessary lorry trips and loading and unloading steps. Each handling adds costs, delays, and risks damage to the goods".*

105. Spoke-to-spoke systems can eliminate a significant proportion of goods going through the hub or even one or both local depots, subject to sufficient volumes being generated between specific spokes to allow efficient operation. Goods with a common final destination or local depot can be identified at the initial packing stage, with routing planned to skip unnecessary legs. It requires constant intervention from the buyer or salesperson to achieve this, otherwise the despatch warehouse will route the goods through the hubs. This occurs not only for reasons of simplicity, but because despatch staff do not know what happens to goods once they are loaded on trailers. They are unaware that they might have a lorry load of goods going to the same place on 3 or 4 different trailers. If

despatch staff are trained to plan loads they can see opportunities for consolidation of which the sales team would be unaware.

106. An alternative to logistics training for despatch staff would be to employ barcoding, which reduces the need for human intervention in the distribution process. A barcode containing product destination information could be applied at the local depot. Warehouse staff or an electronic carousel could then deliver the goods to the right delivery bay or storage area. GPS would enable more predictable arrival times for goods vehicles, which would then be more efficiently loaded as goods have already been retrieved from storage. The truck driver would have a barcode reader to check his load is correct. En route the order could be altered electronically to respond to sudden changes.

107. Hub and spoke freight distribution systems are not the most efficient and sustainable options in purely transport terms. However, decisions relating to goods movement are usually based upon overall economic and cost efficiency rather than transport efficiency: *"Companies can afford to have a proportion to be moved back and forth between hub and spoke because transport costs are so small compared to other freight distribution expenses such as unit costs, staff costs and processing. More time spent packing delays the product getting to the hub. Consumers expect supermarkets to be fully stocked and many now operate on a 24/7 basis. The speed in which products can arrive at hubs to be processed and distributed 'just in time' is why they're so widely used. More time spent sorting goods according to final destination at the point of origin reduces speed of movement. Anyway it would be erroneous to assume final destination is always known for goods when they arrive at the first depot. It may not be until they reach the distribution hub that sales have been finalised and exact locations known".*

108. In order for hub and spoke systems to be replaced by a more transport efficient approach there need to be more powerful incentives to use less transport. For commercial organisations to make more sustainable use of transport there needs to be a competitive advantage to be gained through transport efficiency.

Freight Villages

109. The Network did accept that it was possible to utilise hub and spoke freight distribution in a more sustainable manner than presently applied in the UK, particularly if volumes are significant and allow non-road modes to be used on some of the links to the hub(s) or between hubs. A series of regional freight villages could facilitate regional specialisation and strategic planning by offering nodal points in a national system of production and movement of goods. A freight village is a "defined area in which all activities relating to transport, logistics and goods distribution, are carried out by various operators. In order to encourage intermodal transport for the handling of goods, a freight village must preferably be

served by a multiplicity of transport modes (road, rail, deep sea, inland waterway, air)"[66].

110. Such freight villages already exist in Europe. They have a central co-ordinator acting on behalf of all the companies, taking orders, and organising service vehicle movements. They have a rail line and the companies receive incentives from their Government for using it. To apply this concept in the UK, local authorities must take greater responsibility backed by parliamentary legislation. The planning approval process for new developments is key in clustering people together. Individual companies cannot usually justify using rail and need co-ordination to achieve consolidated goods movement. Planners could ensure all developments located at the same site produce goods compatible with rail movement. The planning process could incorporate conditions requiring companies to use rail where appropriate.

Freight Lanes

111. A more predictable network would place demands upon transport infrastructure that could radically change the operation of road freight. This might result in dedicated freight-vehicle-only lanes, or a combination of freight and high occupancy passenger vehicles to maximise use, particularly on motorways. Such a regime of lane allocation could be further developed with the aid of electronic enforcement. Use of freight lanes could be restricted to fully laden goods vehicles. This would incentivise a reduction in empty running because use of the freight lanes would ensure more reliable and predictable journey times.

112. Road freight could emulate rail freight in terms of vehicles communicating with one another and locking together in road trains with the prospect of full automation in the long term. Road freight might be further regulated by temporal restrictions on motorway access. This would build on existing practice whereby many hauliers avoid using highly congested areas of motorway for most of the day, only using them after the evening peak or in the early morning.

113. One problem with temporal restrictions relates to the end leg of freight movement when vehicles enter urban areas and delivery times are restricted by noise regulations and hours of businesses. These issues may be addressed by the creation of out of town freight depots where access is available on a 24 hour basis with goods held until appropriate delivery times or transferred to smaller delivery vehicles powered by electricity to generate fewer environmental impacts. The potential for improvement to conventional lorries in terms of noise and other environmental impacts also exists.

Flexible Rail Freight

114. In a strategically planned national economic system centred upon a geographically recognised and predictable network of production and distribution (in which manufacturing and primary industries would play an increasing role in economic activity) rail freight would be likely to play a much greater role in goods movement than at present. This might entail the construction of a dedicated freight rail line from north to south (see section 2.1) allowing lorries to be placed onto the rail units to retain flexibility for end destinations.

115. An alternative approach to make rail a viable door-to-door option for goods movement and eliminate the need for a significant proportion of road freight would be to apply a mixture of technological and spatial solutions. Currently use of rail requires sufficient volumes to be moved between two points to create economically feasible block trains. Goods can rarely be put on a train in station B to be delivered to station C when the train is running from A to C via B. If this were to become possible the apple orchard and hypermarket could each have a platform, with trains moving like passenger units from station to station, dropping off and taking on freight instead of moving wagons from end point to end point. This intermediate loading and unloading of consignments is similar to the traditional 'mail by rail' type of operation and could feasibly be extended to a much wider range of goods.

116. Smart land use planning could be applied to (re)create production and consumption centres directly connected to the rail system: *"These production centres could have two sides like an airport, a 'rail side' where unregistered equipment like forklifts, straddle carriers etc. could move and load cargo without costly reloading to road equipment for the last few metres to the production facilities or warehouses. On the 'road side' normal street registered vehicles could carry out deliveries and pick-ups".*

117. To increase efficiency, a self-discharging wagon could be constructed. Currently, in terms of loading and unloading, many freight wagons are inefficient and slow, particularly where goods have to be physically handled rather than transferred between modes in a unit load. Wagons could be fitted with side loader arms to load and discharge containers. The train could then pull into a freight station with platforms on both sides of the track. Arriving units would be discharged to the right and departing units loaded from the left. If this was supported by similar smart positioning and guidance systems as used by ports then freight trains could be fully automated and be as smooth and efficient as passenger trains: *"It could leave and take individual boxes at the stations e.g. the system would tell that on wagons 2, 7 and 8 are boxes for station XYZ. On the other hand, station XYZ would have units departing for ABC, which would be placed in*

platform exit bays 2, 7 and 8. This flexible system could remove the need to invest in multimodal terminals".

Waterborne Freight

118. UK ports would need to adapt to a future where national rather than international movement of goods would predominate. The role of ports might primarily be to enable a strategic coastal shipping network to operate effectively. Whilst coastal shipping is likely to prove viable for the movement of certain heavy goods it would require subsidy or the introduction of a pricing structure to encourage short sea shipping for the mode to become viable for a wider range and scale of goods movement. Alternatively, if a network of regional production centres were established at existing ports it is possible to envisage a more prominent role for short sea shipping in national goods movement, particularly to transport heavy industry materials and manufactured goods.

119. Inland waterways might also perform an enhanced role in national goods movement. At present, transporting goods by river or canal is primarily employed to move heavy goods, such as coal and waste, inland from coastal areas. Such movement is only appropriate for goods that are not highly time sensitive, as the process usually takes significantly longer than road or rail transport. However, such movement is highly efficient in environmental terms. The energy required for mechanical lifting is provided by water when using this mode and boats are highly fuel efficient, using the same amount of fuel in four months that a lorry uses in four days. Given these advantages an expanded role for inland waterways might be worthy of promotion: *"The Thames is the most under used resource in London. You see some freight but it's mainly tourist boats. You could move goods as far as the M4 corridor".*

120. One Network member drew attention to an idea to revolutionise the role of inland waterways in the UK that had been developed by one of his senior colleagues: *"There is a 90 metre contour running almost the full length of England. In 1942 Thomas Pownall proposed the 'Grand Contour Canal', a lock-free ship canal on the contour connecting most parts of England, and linked to the main river systems by boat lifts*[67]*. Put a slight tilt on it (1 in 20,000) and widen it. 'River England' could then transfer millions of gallons of water from the wet Lake District to the arid South East while transporting large barges carrying the contents of the majority of HGVs using the M6, following the example of the Rhine. In terms of route, Birmingham presents a problem as does the Cotswolds/Chilterns. It would cost billions, but water is reputed to put 30% on property values, so landowners should be keen to have such valuable real estate thrust upon them!"*

Airships and Conveyor Systems

121. A further form of transport considered under a nation state scenario was the airship[68]. It was stated that landing and take off area requirements are massively reduced with airships compared to

conventional aircraft and the two modes bore no comparison in terms of environmental impacts. However, it was considered impractical to deploy airships for national distribution. Instead they might perform a role in moving goods within regional distribution centres. Given the high level visibility of airships, significant advertising revenue could be drawn from their deployment. Any wider deployment of airships would be likely to be restricted to transporting goods from the UK mainland to small offshore islands like the Isle of Wight, the Isle of Man or the Western Isles of Scotland.

122. An alternative transport mode for use in moving goods from regional distribution centres to local delivery points or end users was inspired by advanced airport baggage handling systems: *"A driverless automated tube would carry your product from a hub to local delivery points (every population centre would have a series of local delivery points), dropping off when it gets to your part of the city and returning to the hub for reloading like a baggage handling system. If goods production is no longer designed for shelf display then packaging could be simpler and recyclable and waste would be greatly reduced. Empty packaging would also return to the hub for recycling on the system. This would create a more flexible goods delivery network. The system could also operate on a much smaller scale to provide home delivery for consumers. It could be build it into new housing developments and integrated with electronic cabling. The system could also be introduced in existing settlements when work is done to improve sub service infrastructure such as the introduction of high bandwidth cable".*

2.3 Local Living

In this future, society will operate primarily on a local level. Society's production and consumption of goods will be provided, as far as is possible, from within the local community - be that a city, town or village - with local diversity rather than international markets being the means of satisfying the demands of consumer choice.

Local Authority Freight Transport Fleet

123. A society where goods production and distribution is undertaken on a local level wherever possible would have radical implications for freight and logistics. As small businesses and individuals are engaged in goods movement on a local level to a far greater degree than at present, and large scale international and national goods movement is reduced, freight transport methods will have to adapt accordingly.

124. With many goods movements internalised (vehicle movements that begin and end in the local area) the local authority could have a strategic role in planning, managing and controlling goods vehicle trips. With many small centres of production it is unlikely that individual producers will use their own (fleet of) goods vehicles. With more centres of production, more goods vehicle trips will also take place. The local authority could extend its role of planning and management to franchising out the operation of a fleet of goods vehicles to service the local area. This enables the central

optimisation of patterns of collections and deliveries, including the allocation of movements to specified routes and times of day.

125. For such a scheme to meet environmental and sustainability requirements it would be necessary to ensure that local delivery vehicles were powered by renewable energy sources. Given the reduced quantity of goods being moved from production locations, the power requirements needed to move freight will be compatible with electric, solar and water powered vehicles or even man powered vehicles, e.g. bicycles, provided that such modes are able to move goods with sufficient time efficiency. Bicycles are already used to transport freight in the UK, particularly in urban centres such as London. Delivery to the end user could be made to the door by municipal van or to neighbourhood distribution points (corner shops) within walking distance where pre-ordered items could be collected on foot with a shopping trolley[69].

126. If local living is manifested in the form of widespread production at a household level then individuals will require freight vehicles to move their goods. They are likely to need small vehicles unless they work collectively. In such a context, goods movement could be organised in a manner comparable to the principles of a car share scheme. Producers would be part of an association of traders who would share access to a vehicle or a series of vehicles. The Local Authority supplies the vehicles and you use it when you want it: *"its like Marks & Spencer and Tesco sharing a fleet of lorries for goods distribution, but on a micro level"*.

Bus-Trucks

127. In seeking to provide transport facilities to support distributed, small-scale supply chains it might prove beneficial to harness some of the flexibility associated with passenger transport. Dual purpose vehicles could be employed to allow passengers and goods to be transported on demand, in a similar way to the present day use of post buses in rural Britain. This would make greater public transport provision financially viable by using vehicles off-peak for goods movement. The marginal cost of such operations is already low given the availability of vehicles and drivers. Therefore high asset utilisation would result: *"Some buses in peak periods run to capacity but like trains you can't afford to run extra buses in the peak if they can't make money off peak. Supposing we had more buses running peak, which off peak became trucks and moved goods around or a hybrid of the two where you had half a bus and half a truck, or half a bus and half a recycle end. Some buses are designed to be power washed on the inside. Concertina seats could press down to create freight storage and you could have sealed and insulated roll cages. Chuck your stuff in the back. You'd be able to create an increased fleet size of passenger transport for your local community at the same time being able to cater for many to many distribution"*.

A Role for Animals

128. A future of localised movement could herald a return to the widespread use of animals for freight transport, the dominant mode of goods movement for many centuries in the UK and still one of the most important modes in a global context. In the UK, working horses are still used in the movement of alcohol and timber and their role might be expanded to other types of local freight movements in the interests of sustainability. For longer distances, birds might be used to move lightweight, high value, time sensitive goods and information. Pigeon post was a vital communication tool in the First World War and technology could be harnessed to enable more complex goods movements in this manner by the use of microchip implants.

Recycle and Exchange Culture

129. Local living might be facilitated by a move towards local trading in used goods, building on present day activities such as car boot sales, where unwanted goods are exchanged between individuals thereby prolonging their productive lives, maintaining product choice and dampening new production. Technology could be harnessed to promote such activities in a manner comparable to the online goods auctions. In this way people could sell goods to the local community, without having to set up retail facilities. Local trading could be undertaken at daily markets offering a wide range of goods. Such markets could be viewed virtually with online ordering available. E-procurement could also help to promote local produce as local businesses could bid for contracts quickly and cheaply.

130. Producers could access markets and car boot sales by bus truck or by using local authority-provided freight transport vehicles. An innovative, new freight transport vehicle might be designed and provided by the local authority with the capacity to carry multiple loads of goods such as containerised car boots. Consumer access to these facilities could be by park and ride or bus. In a culture of recycling, the reduced need for elaborate goods packaging would lead to efficiency savings. For example, one could transport fruit and vegetables from the garden to the home, the local shop or the market without the need for treatment, such as waxing, and packaging processes necessary to protect these commodities over long distances in refrigerated vehicles. In such circumstances, re-use of packaging (e.g. through refill systems) becomes a workable opportunity. Where local producers are situated near to inland waterways canal based goods movements could be envisaged whereby boats link farms and communities to markets over short distances.

Argos-isation

131. In a future where co-ordinated local delivery is favoured, retail practices might adapt so that customers can order from town centre stores but goods delivery is made separately from a warehouse to

the home. This would allow greater use of non-motorised and collective transport modes to access town centres and greater use of warehousing facilities and neighbourhood distribution centres. This would result in fewer goods vehicles travelling to shopping centres: *"You have the shop front so people can do their shopping but you don't allow purchasing. You still go to the town centre, place your orders and go home on the bus. So instead of goods being delivered into town you have out of town warehouses. Fewer goods vehicles then go into towns to deliver to multiple centres and fewer cars come in to collect goods. Everything is put in massive warehouses for the local area".*

Retailer Consolidation

132. The Network considered the potential for more efficient goods movement to be facilitated by a more strategic approach to grocery retailing. This might involve a clearer separation of retailer functions by product type with shops divided into those that sell fresh goods (freshgrocers) and those that sell durable items (duramarkets).

133. Freshgrocers could sell fresh produce, but only a few durable items to avoid conversion into convenience stores. Their size could be limited and they could be located near residential areas. Concessions would be available, but restricted to personal ownership and one concession per person. This guarantees their independence and restricts chain building and puts local farmers and shopkeepers on equal negotiating terms. There should be an outlet within walking distance (1 mile) of any home in urban areas.

134. Duramarkets would sell only durables and other household items. They could be much larger sized outlets than freshgrocers. Economies of scale would be the driving force behind these shops. The size of consumer packages would be at least twice the current standard; enough for a typical 4-person family. These centres would be connected to the rail system. They would be large enough to warrant full trainloads from central warehouses elsewhere in the country. Such retailer consolidation would increase load factors in private cars from shop to home and reduce delivery runs from factories to shops by bundling cargo flows in logistics centres to enable more long distance freight movement by rail. The redesign of consumer packages and drastic increase of lot sizes would facilitate optimal load factors for long distance freight movement.

Conclusion

135. The visions generated under each of the scenarios attempt to improve the efficiency and sustainability of goods movement. Table 8 below shows how a range of efficiency and sustainability objectives could be met under each of the scenarios:

Table 8: Approaches to achieving efficiency and sustainability under each scenario

Objective	**Vision Ideas to Meet Objectives**		
	Going Global	Nation State	Local Living
To reduce freight tonne-kilometres travelled	Virtual Globalisation	Regional Specialisation	Retailer Consolidation
To promote use of more sustainable modes	Product Preservation and Modification	Freight Villages	Bus-Trucks
To make better use of transport infrastructure and services	Trans-European Rail Freight Network	Freight Lanes	Local Authority Freight Transport Fleet
To reduce development pressures on the environment	Trans-Shipment Hubs	Conveyor Distribution Systems	Recycle and Exchange Culture

136. In current UK society, goods movement supplies the nation with a mixture of local, national and global products. In order to determine the significance of the Network's scenarios, it would be helpful to ascertain what proportion of UK freight transportation is currently related to local, national and global produce. However, in practice it would be very difficult to obtain reliable data: *"Many products are hybrid, goods come in; are moved inland, then the next leg you don't know whether that's from port originally. Commodity trading also means*

that various products are regularly moved around the world. It is difficult enough to try and determine domestic transport distances. Fish is landed in Yorkshire, brought down to Billingsgate for sale, and then moved to Aberdeen where it is sold again and then sent elsewhere for processing".

137. Elements from all three scenarios might be included in a desirable future system of freight and logistics with perfectly free trade and where transport costs are deemed significant. Products such as eggs and apples could be supplied locally; other goods like barley and hops are suited to particular regions and to a national supply system, whilst specialised products like railway rolling stock or computers might be most economically supplied by a few international production centres. One could imagine a model in which the three different forms of freight distribution - global, national and local - all operated for specific products to minimise transportation.

138. However, whichever scenario or combination of scenarios is eventually realised, the establishment of a 'Strategic Transport Authority' may be desirable, to take on the transport challenges of the future and to properly integrate various modes. It could also level the playing field by creating a balanced market place between road and rail, or to fully exploit the potential benefits of waterborne transport, in order to optimise the efficiency and sustainability of goods movement.

139. There will always be occasions where transport costs are outweighed by inter-regional cost differences and localised shortages of specific products. Given these constraints, the most efficient and sustainable system of freight and logistics is one which can adapt to changing needs. One way to ensure this is to have all the possibilities operating from the start. Thus a significant proportion of the population could keep chickens and pigs under their apple trees and sell the produce to their neighbours. Nonetheless a substantial proportion of the egg, bacon and apple requirements could be met from regional growing areas, and a smaller proportion from international trade. Expanding existing second-string supply chains could solve any temporary problems with any particular part of the system. Most freight would be transported over minimum distances, with some transported further and some small-scale local production as an insurance policy.

140. Transportation systems have evolved to meet consumer needs and these have changed dramatically over the last 20 or 30 years. Containerisation has allowed people to choose to manufacture wherever they like because they have a standard means of moving goods. It seems likely that the share for global goods in the UK will grow because the UK is increasingly becoming a service sector

economy. This makes the UK increasingly reliant upon overseas trade for manufactured goods and raw materials.

141. However, to blindly project forward present day trends as a basis for forecasting future needs is a dangerous and generally unwise practice. The rapid and radical changes in society and its consumer demands that have occurred in recent decades show us that the future is anything but predictable. The received wisdom that consumer demands for ever-greater choice and complexity of products will predominate may not prove to be the case: *"A new supermarket has opened in Swindon. It's absolutely massive and sells absolutely everything including 50 types of olive oil. I can't shop there; it's aisles upon aisles, I'd rather go to a smaller shop. Choice has gone too far, it's not a good experience".*

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