

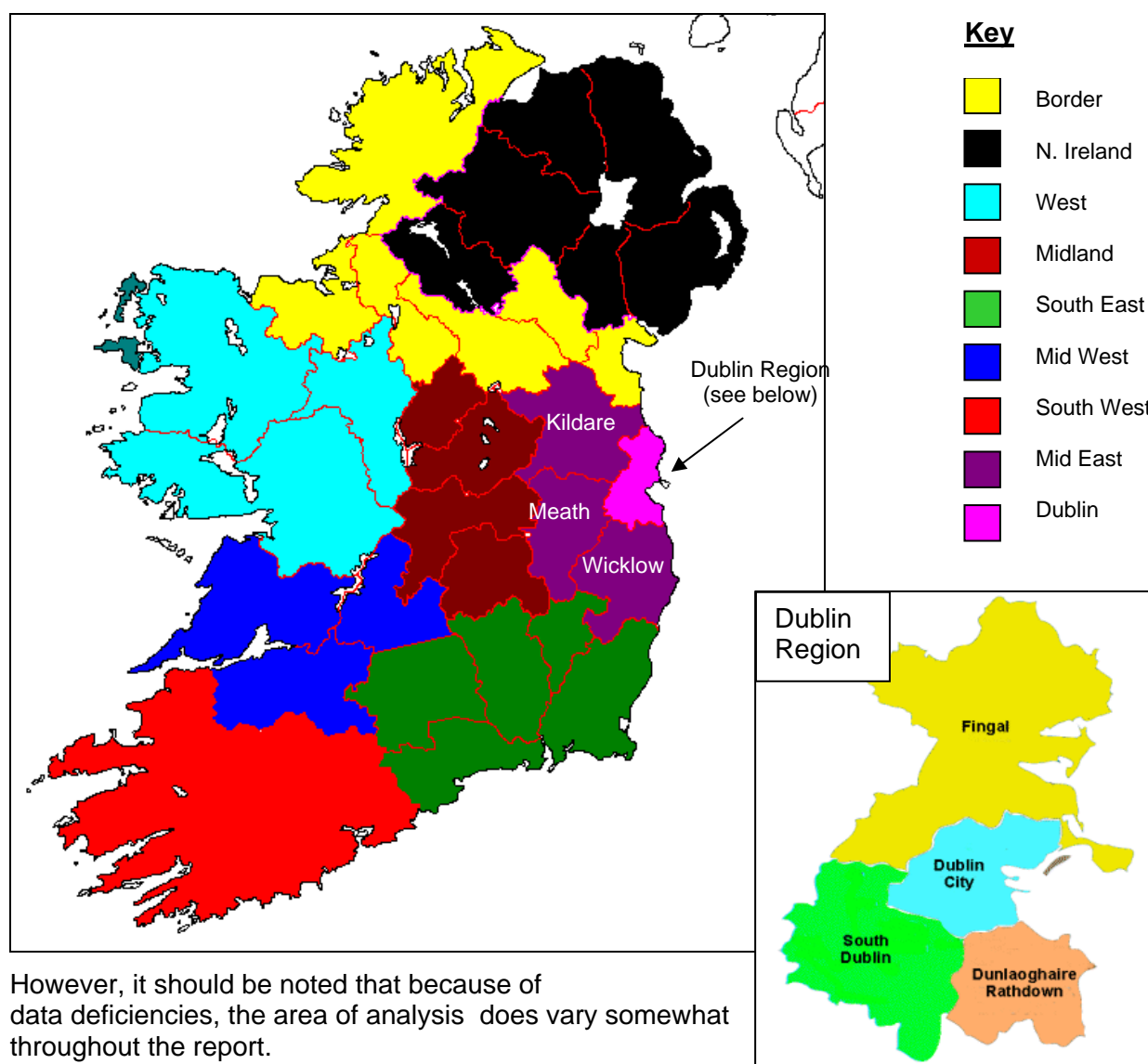
APPENDIX A - IDENTIFYING CURRENT FREIGHT TRANSPORT ACTIVITY	22
1.1. STUDY AREA	23
1.2. HGV CLASSIFICATION.....	24
1.3. DATA LIMITATIONS	25
1.4. FREIGHT ACTIVITY ANALYSIS	26
1.5. RAIL	41
1.6. SEA	45
APPENDIX B - FORECASTING GROWTH IN FREIGHT ACTIVITY	48
1.1. TRENDS IN ROAD FREIGHT ACTIVITY AT THE NATIONAL LEVEL	49
1.2. THE DETERMINANTS OF ROAD FREIGHT ACTIVITY.....	50
1.3. OVERVIEW OF FORECASTING APPROACH.....	51
1.4. FORECASTS OF GROSS VALUE ADDED IN THE ECONOMY	51
1.5. FORECASTS OF FREIGHT TONNES CARRIED FOR THE DUBLIN REGION, 2000-2016.....	54
1.6. FORECASTS OF ROAD FREIGHT TRIP ACTIVITY IN THE DUBLIN REGION, 2001-2016.....	55
1.7. CONCLUSIONS.....	58
APPENDIX C - REVIEW OF DUBLIN GOODS DISTRIBUTION SYSTEMS AND INTERNATIONAL EXPERIENCES.....	59
1.1. REVIEW OF CURRENT WORKING PRACTICES IN DUBLIN AREA.....	60
1.2. INTERNATIONAL RESEARCH	65
1.3. FREIGHT PRACTICES IN COMPARABLE CITIES.....	68
APPENDIX D - REVIEW OF DUBLIN'S FREIGHT TRANSPORTATION NETWORK	73
1.1. EXISTING ROAD NETWORK CONSTRAINTS.....	74
1.2. WEIGHT RESTRICTIONS	74
1.3. HEIGHT RESTRICTIONS ON THE EXISTING ROAD NETWORK	75
1.4. PLANNED ROAD IMPROVEMENTS.....	76
APPENDIX E - LOCAL AUTHORITY PROVISION, POLICY AND LEGISLATION.....	79
1.1. DUBLIN CITY COUNCIL.....	80
1.2. MEATH COUNTY COUNCIL	82
1.3. KILDARE COUNTY COUNCIL	82
1.4. SOUTH DUBLIN COUNTY COUNCIL	82
1.5. DUN LAOGHAIRE RATHDOWN COUNTY COUNCIL	83
1.6. OTHER COUNCILS WITHIN THE GREATER DUBLIN AREA	83
APPENDIX F - EVALUATION OF STRATEGY MEASURES	84

Appendix A - Identifying Current Freight Transport Activity

1.1. Study Area

The study area for this investigation is the Greater Dublin Area, as defined in the DTO Platform for Change and the Strategic Planning Guidelines. It comprises the administrative areas of Dublin City Council, and the county councils of Fingal, Dun Laoghaire Rathdown and South Dublin that form the “Dublin Region”. The Greater Dublin Area also includes the counties within the mid-East region of Kildare, Meath and Wicklow, as indicated in figure A1.

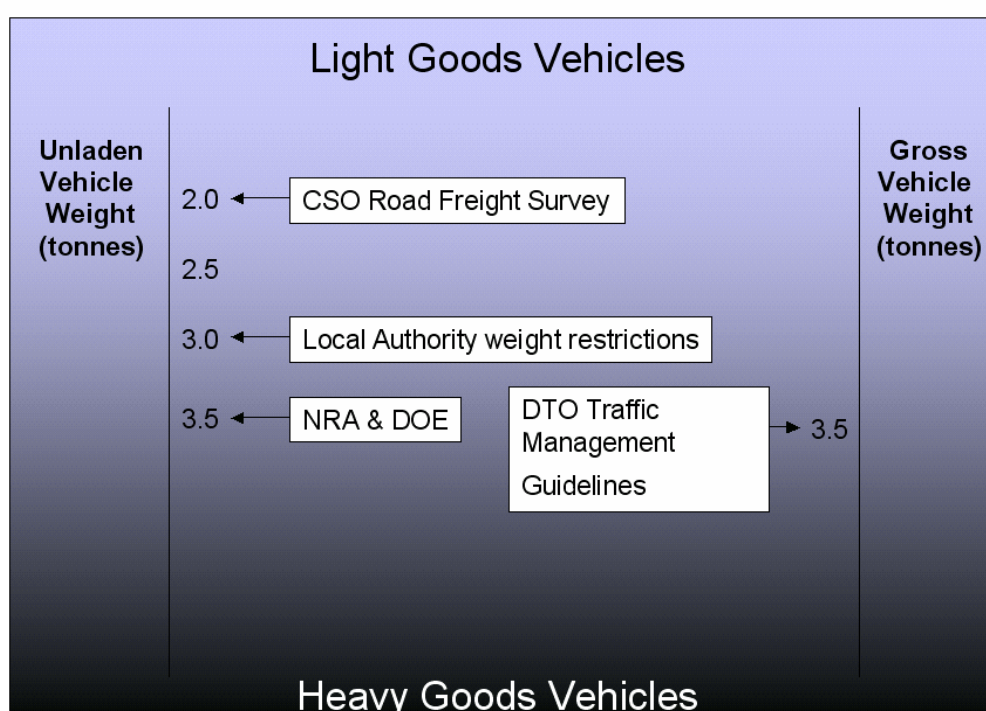
Figure A1: Counties and Regions within Ireland



1.2. HGV Classification

The various agencies, organisations and consultants with an interest in freight use different threshold weights to discern heavy goods vehicle from a light goods vehicle, as illustrated in Figure A2. The following paragraphs give a brief summary of the main definitions in use.

Figure A2 Criteria used for classification of Goods Vehicles



Traffic counters and tolling systems work on the basis of number of axles. NRA counters and reported data define vehicles with 3 axled vehicles and above as being heavy goods vehicles. This equates approximately to a 1.5 tonnes (unladen) definition. Where appropriate, the definition that has been used is specified in the particular section of the report.

It should be borne in mind that light goods vehicles dominate the commercial vehicle fleet. The Irish Bulletin of Vehicle and Driver Statistics stated there were 33 000 heavy goods

vehicles (3.5 tonne unladen definition) and 200 000 light goods vehicles registered in the country for the year 2002.

In logistical terms, a freight journey represents part of the supply chain in an overall distribution system. The logistics industry actively seeks to improve performance and provide efficiencies leading to economic savings. The road haulage element is likely to be the most unreliable element of the process, and is a significant factor when planning for just-in-time deliveries, etc.

1.3. Data Limitations

Strategic planning for freight movements is hindered by a lack of data. Although a road freight survey is undertaken by the CSO on an annual basis, it is limited in its usefulness for urban freight transport planning because:

- It excludes goods vehicles of less than 2 tonnes unladen weight;
- It excludes foreign registered good vehicles; and
- Restrictions of sample size limit the extent to which it can be used to provide information on freight activity at a regional level or by type of goods carried.

1.4. Freight Activity Analysis

This section examines the current level of freight activity in the Greater Dublin Area, concentrating on road transport as well as summarising the situation relating to rail and also shipping. The objectives of the analysis were to:

- Quantify the aggregate level of road freight activity in the Dublin Region;
- Identify the structure of that freight activity in terms of its origin and destination;
- Establish the daily and seasonal pattern of road freight activity.

Because more comprehensive data on aggregate road freight activity are available at the national rather than the Dublin regional level, it was thought appropriate to build up a picture of national road freight activity in the first instance. Subsequently this information was used to inform an estimate of road freight activity in the Dublin Region. The Dublin Region is here defined as the area of the four Dublin local authorities.

Aggregate road freight activity is measured initially in terms of tonnage carried. This reflects the fact that there is greater data availability for this performance measure than for others such as vehicle kilometres or trip rates. However, based on assumptions about average loading, the data for tonnes carried are then used to generate data on freight vehicle trips.

Data Sources

At the outset, it should be recognised that there are limited data available with which to make an assessment of road freight activity. This means that the estimates set out below have been derived from a numbers of sources, combined with assumptions made by the consultants. The principal data sources are:

- The annual CSO Road Freight Survey;
- The annual CSO Statistics of Port Traffic;
- The National Roads Authority road traffic count data;

- Annual Canal Cordon Counts undertaken by Dublin City Council; and
- Dublin Port's Origin-Destination Survey, 2001.

The CSO compiles an annual Road Freight Survey of goods carried by road freight. As this is the only extensive database on freight traffic, it must form the basis both for a depiction of current traffic volumes at the aggregate level and forecasts of same. However, the Road Freight Survey is not fully comprehensive and adjustments were made to the data at a national level to reflect a number of factors. These national level adjustment factors are then used to inform adjustments to be made at the Dublin regional level.

In particular, an adjustment was required to take account of the fact that the Road Freight Survey comprises Irish registered vehicles belonging to the motor taxation class goods vehicles with an unladen weight of 2 tonnes and over only. This means that any freight carried by vehicles below 2 tonnes unladen weight is excluded. In an area such as Dublin, there will be a significant amount of freight carried by such smaller vehicles, particularly in respect of retail distribution. In the year 2002, the total number of goods vehicles licensed in the State was 233,069. Of these, 50,020 were large vehicles, leaving 183,049 vehicles under 2 tonnes.

The estimates of road freight activity both nationally and in the Dublin area were derived from the above sources.

Road Freight Activity Nationally

Table A1 summarises the resulting estimate of Freight Tonnage on Irish Roads for the year 2000. Total activity is estimated at 215.5m tonnes. Of this, 90.5 per cent reflects journeys within the country and 9.5 per cent relates to international journeys. It should be noted that international freight traffic by non Ro-Ro modes are recorded in the Road Freight Survey as national journeys, as the road vehicle journey originates and terminates at ports.

Table A1: Road Freight Tonnage on Irish Roads by All Vehicles by Type of Journey, 2000

Type of Journey	Tonnes Carried (Millions)	Proportion of Total (%)
National Journeys		
Vehicles less than 2 Tonnes ULW	17.1	7.9
Vehicles Greater than 2 tonnes ULW	178.0	82.6
Total National	195.1	90.5
International Journeys by Road	20.4	9.5
Total	215.5	100.0
Of which Port Traffic	45.3	21.0

Source: Goodbody Economic Consultants Estimate

It is estimated that 61.4 million tonnes of road freight were carried on journeys in the Dublin Region in the year 2000. Almost 54 per cent of the tonnes carried in the Dublin Region are internal, originating and terminating within the area. A further 43 per cent of tonnes carried are of domestic origin or destination. International Ro-Ro and cross-border traffic gives rise to 11.7 per cent of road freight activity in the Dublin Region. The traffic using the port (Ro-Ro, Lo-Lo and bulk) accounts for 26.2 per cent of the total.

Table A2: Road Freight Tonnage Using the Dublin Region Road Network, 2000

Type of Journey	Tonnes (m)	Carried	Proportion of Total (%)
Total Journeys within Dublin	27.8		45.2
Of Which:			
Vehicles Less than 2 Tonnes ULW	3.8		6.1
Vehicles Greater than 2 Tonnes	24.0		39.1
Total with Rest of Country	26.4		43.0
Of Which:			
Journeys to/from Dublin from Rest of Country	25.8		42.0
Domestic Journeys Transiting Dublin	0.6		1.0
International Journeys by Road	7.2		11.7
Of which:			
International Journeys to/from Dublin	4.9		8.0
International Journeys through Dublin	2.3		3.7
Total	61.4		100.0
Of which: Port Traffic	16.1		26.2

Source: Goodbody Economic Consultants Estimate ; Note: Dublin is the area of the four Dublin local authorities.

Note: Statistics based on CSO Road Freight Survey, 2000

These statistics indicate:

- The importance of the Dublin Region nationally as a conduit and focus for freight activity;
- The very large volume of freight traffic that moves exclusively within the area;
- The very significant role of Dublin's ports as generators and attractors of traffic in the Dublin area; and
- The relative unimportance of Dublin as a focus for domestic transit traffic.

Road Freight Trips for the Dublin Region

While tonnage carried is a good indicator of road freight activity, data relating to freight vehicle trips are important from the point of view of road infrastructure and traffic management planning.

An estimate of trip making by road freight vehicles in the Dublin Region was derived from the tonnage data of Table A2 by dividing by the estimated average load.¹

It is estimated that there are 18.3m road freight trips annually that are on the Dublin Region road network. Of this, 13.8m or 75 per cent are internal to the Dublin Region. Of the internal trips, the majority (9.6m) are made by vehicles less than 2 tonnes ulw.

These statistics indicate:

- A very high proportion of road freight trips are internal to the Dublin Region;
- That while small vehicles are relatively unimportant in terms of tonnage carried, they account for half of trip making activity in the Region;
- International and port traffic is less important in trip-making than in tonnage terms, reflecting the larger vehicles used for such journeys.

¹ The assumptions with regard to average load were as follows:

- For vehicles less than 2 tonnes unladen weight, the average load was approximately 0.4 tonnes;¹
- For vehicles over 2 tonnes unladen, not foreign or port originating or terminating, the average load is 6.6 tonnes. This was derived from our Road Freight Survey sample; and
- For vehicles over 2 tonnes unladen and using the ports or foreign originating or terminating, the average load was 14.1 tonnes. This statistic was derived using data provided by Dublin Port and the CSO.

Based on these assumptions, a summary of road freight trip data for the Dublin area was derived as per Table 2.5.

Table A3: Road Freight Trips for the Dublin Region Road Network, 2000

Type of Journey	Trips (Millions)	Proportion of Total (%)
Total Journeys within Dublin	13.79	75.3
Of Which:		
Vehicles Less than 2 Tonnes ULW	9.58	52.3
Vehicles Greater than 2 Tonnes	4.21	23.0
Total with Rest of Country	4.00	21.9
Of Which:		
Journeys to/from Dublin from Rest of Country	3.91	21.4
Domestic Journeys Transiting Dublin	0.09	0.5
International Journeys by Road	0.51	2.9
Of which:		
International Journeys to/from Dublin	0.35	2.0
International Journeys through Dublin	0.16	0.9
Total	18.29	100.0
Of Which: Port Traffic	1.14	6.2

Source: Goodbody Economic Consultants Estimate

So far, this section has concentrated on determining the overall volume of road freight activity in Dublin. However, the diurnal, daily, seasonal and locational pattern of activity within the Dublin Region are equally important from the point of view of informing policy development. The next two sections deal with these issues.

Diurnal and Seasonal Pattern of Road Freight Trip Making

The pattern of freight activity by time of day is a crucial input to both the determination of the policy issues that need to be addressed in relation to freight transport and the design of appropriate policy responses.

Traffic count data are a valuable source of information on road freight trip making activity by time of day. These data were analysed to establish diurnal patterns for three types of road infrastructure viz.

- Radial routes;
- Port access routes; and
- The M50 circumferential motorway

Radial Routes

On interrogation of the traffic counters on the National Radial routes similar trends in relation to time-of-day, weekly, monthly and volume increases for commercial vehicle movements are apparent. Figure A3 indicates concentric rings representing 10, 25, 50, 75 and 100 km distances from Dublin centre. Examples of each distance are:

Cavan	100km
Dundalk	75km
Dunleer-Navan	50km
Maynooth-Naas-Greystones	25km
Blanchardstown	10km

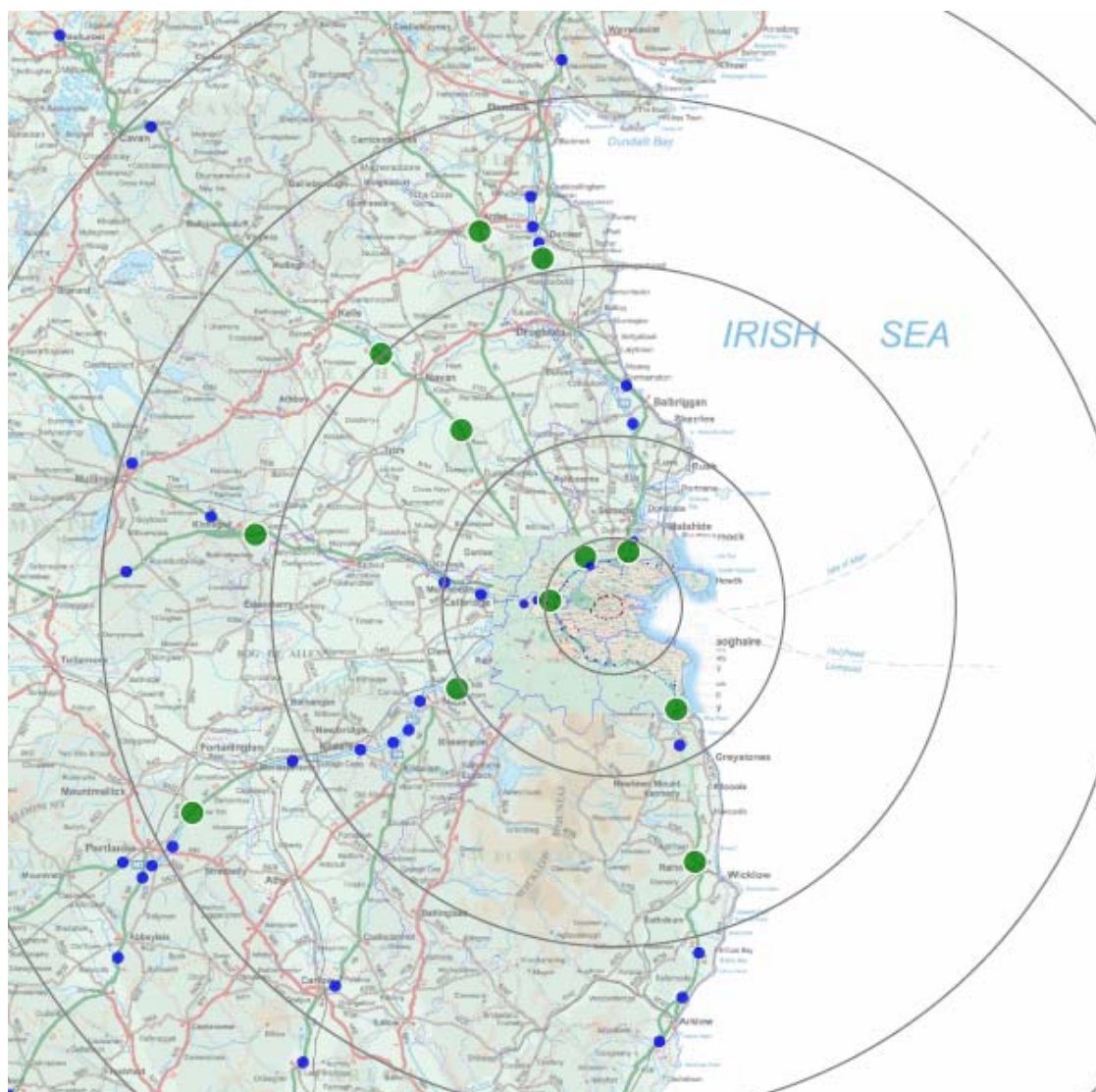


Figure A3 : Distances from Dublin City Centre

Figure A4 shows average hourly eastbound flows by hour of week on the N4 radial route to the west of the city at:

- Kinnegad (red) 50km
- Maynooth (green) 25km
- M50 at Quarryvale (blue) 10km
-

HGV flows at each location are indicated by the equivalent lower series on the graph.

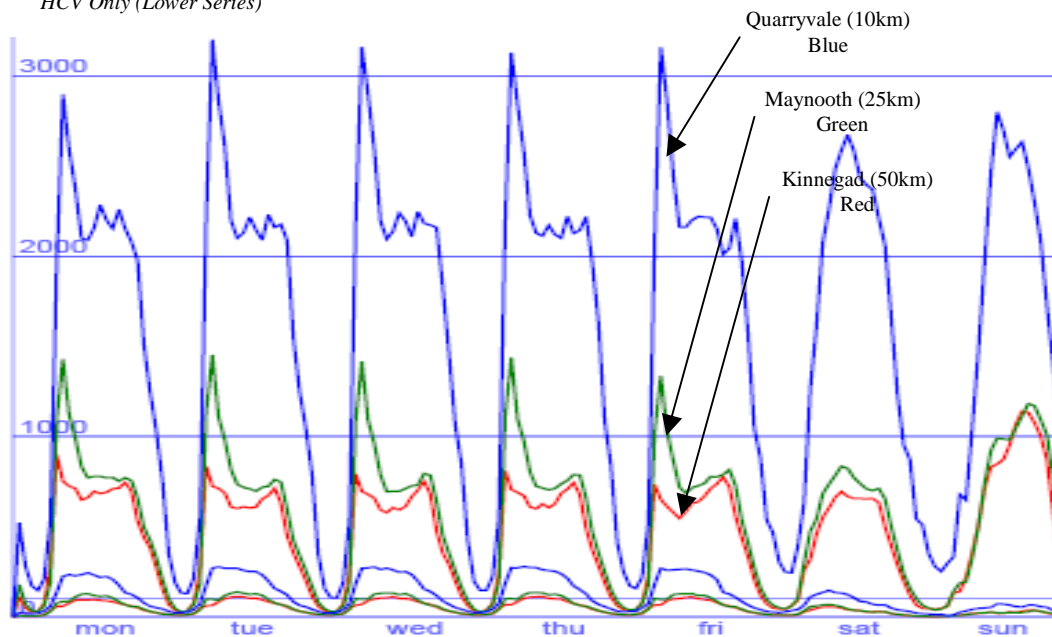
The analysis shows that overall traffic volumes increase slowly on the national routes between the 100km and 50km bands. After this there is a sharp increase in volume on the immediate approaches to the city.

Figure A4 : Eastbound N4 Traffic Volumes

AVERAGE HOURLY COUNTS

All Vehicle Types (Upper Series)

HCV Only (Lower Series)



There is a minor increase in eastbound volumes between Kinnegad and Maynooth (c.400 vehicles). Between Maynooth and the M50 there is a significant increase in commuter traffic that increases volume to almost 3000 vehicles per hour.

Regarding HGV flows:

- there is very little increase in volume between the 50km and 25km cordon
- between the 25km cordon and the 10km cordon (M50) HGV numbers double
- the HGV proportion of flow declines the closer we get to the city, as general traffic volumes rise rapidly (see Table 1)
- peak HGV volumes generally occur between 11am and 1pm
- saturday volumes are approximately 50% of weekday volume
- sunday volumes are negligible

As an estimate, at the M50 itself the approximate composition of HGV traffic is approximately:

50% - arising outside the GDA (50km area)

10% - arising between 50-25km bands

40% - arising within 25km of Dublin City Centre (generally industrial estates around the M50)

Table A4 : N4 Hourly Flows

Hour	Kinnegad			Maynooth			Quarryvale		
	All Vehicle Types	%HGVs	HGVs Only	All Vehicle Types	%HGVs	HGVs Only	All Vehicle Types	%HGVs	HGVs Only
100	100	14	14	116	11	13	448	7	31
200	61	26	16	72	20	14	294	9	26
300	44	35	15	52	28	15	197	15	30
400	39	48	19	49	35	17	173	18	31
500	40	44	18	51	37	19	222	18	40
600	69	45	31	96	40	38	484	11	53
700	171	28	48	258	25	65	1655	8	132
800	429	16	69	527	14	74	2500	8	200
900	509	13	66	594	15	89	2330	9	210
1000	511	14	72	583	16	93	2247	9	202
1100	583	14	82	650	14	91	2087	10	209
1200	640	13	83	730	14	102	2146	10	215
1300	676	12	81	783	13	102	2254	10	225
1400	691	12	83	833	11	92	2371	9	213
1500	718	11	79	896	11	99	2307	9	208
1600	776	10	78	1021	9	92	2235	9	201
1700	862	8	69	1206	7	84	2300	7	161
1800	903	6	54	1256	5	63	2233	6	134
1900	849	6	51	1138	5	57	2188	6	131
2000	756	7	53	903	5	45	2144	5	107
2100	553	7	39	594	6	36	1794	4	72
2200	373	8	30	428	6	26	1444	4	58
2300	249	9	22	294	7	21	1088	5	54
2400	167	12	20	199	8	16	861	5	43
	10669		1190	13329		1361	38002		2987

Within the Greater Dublin Area the links with the highest measured volumes of HGVs in indicated in Table A5 in descending order.

Table A5 : HGV Flows on National Primary Routes

Route Counter ID - Year	Location	Yearly Total HGVs (Inbound)	Yearly Total Vehs (Inbound)	% HCV's
n07-38-2003	Kill	1150639	10750262	11
n07-36-2003	Kildare Town	1082373	8421711	13
n04-40-2003	Quarryvale	1054141	13756893	8
n07-35-2003	Athy	904030	6789425	13
n01-20-2003	Airport	788105	12637154	6
n04-37-2003	Lucan	680088	10802720	6
n02-23-2003	Finglas	619417	3917838	16
n07-21-2003		562139	3418307	16
n07-31-2003		503659	4380940	11
n01-09-2003	Dunleer	493356	3435039	14
n04-35-2003		492641	6645876	7
n07-23-2003		471062	3297493	14
n07-20-2003		439040	2426455	18
n04-32-2003		427993	3930287	11
n04-34-2003		427516	4184974	10
n01-01-2003		420990	3194144	13
n01-10-2003		401707	3480859	12
n08-27-2003		399260	1979965	20
n01-08a-2003	Balbriggan	383133	2716608	14
n02-24-2003		378118	5191421	7
n08-30-2003		337389	2246969	15
n08-23-2003		323389	1774801	18
n11-26-2003	Fassaroe	318890	6993756	5
n01-17-2003		312016	3081618	10
n01-08b-2003		274732	1908526	14
n07-18-2003		270122	2180445	12
n03-17-2003	Navan	260785	3264839	8
n04-28-2003		239726	2339823	10
n03-13-2003		197454	2256560	9
n02-06-2003		193492	1455069	13
n02-15-2003		183957	1363280	13
n04-31-2003		173826	2044896	9
n06-25-2003		171703	1429783	12
n11-12-2003		163450	2433635	7
n11-14-2003		162360	2427681	7
n04-39-2003		103222	1716658	6
n11-19-2003		75908	1137371	7
n07-28-2003		43152	304209	14

Port Access

Dublin Port undertook origin-destination surveys of traffic in the North Port in July 2001, with particular reference to HGV traffic. The surveys comprised twenty-hour roadside interviews, forty eight hour manual classified traffic counts, and seven day automatic traffic counts carried out on the Tolka Quay Road. During a twenty-four hour period, 2,944 HGVs were recorded leaving the port, with 1,582 entering the port. The reason for the differences in inbound and outbound traffic is that Alexandra Road is also an important route into the North Port, but HGV traffic is not allowed to leave by this route.

Figure A5 provides a full analysis of inbound freight and other vehicular movements by time of day. HGV activity builds up in the early morning to peak in the hour beginning at 8am. There is a slight decline in traffic in the mid-morning before reaching high levels in the hour beginning at 11am. Inbound traffic then remains at a high level until 5pm, when it declines sharply for a couple of hours. It then builds up again to a peak in the period 8pm to 10pm.

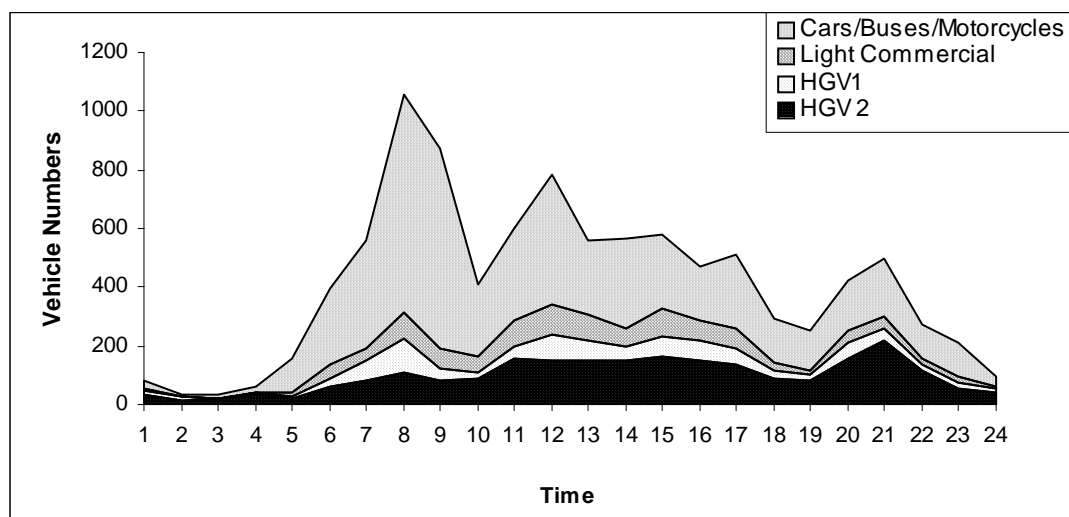


Figure A5: Inbound HGV Traffic Flows in Dublin Port

Figure A6 provides the full profile of outbound traffic. There are heavy HGV flows exiting the port in the 7am to 10 am period. Volumes remain high throughout the day until 6pm. There is then a decline before rising again in the hour beginning at 8pm.

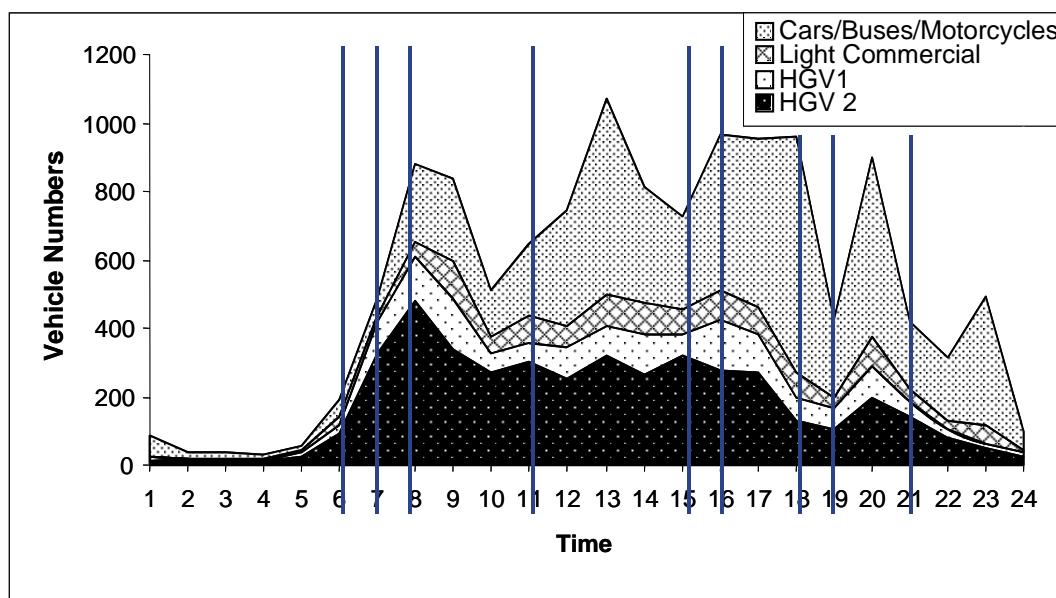
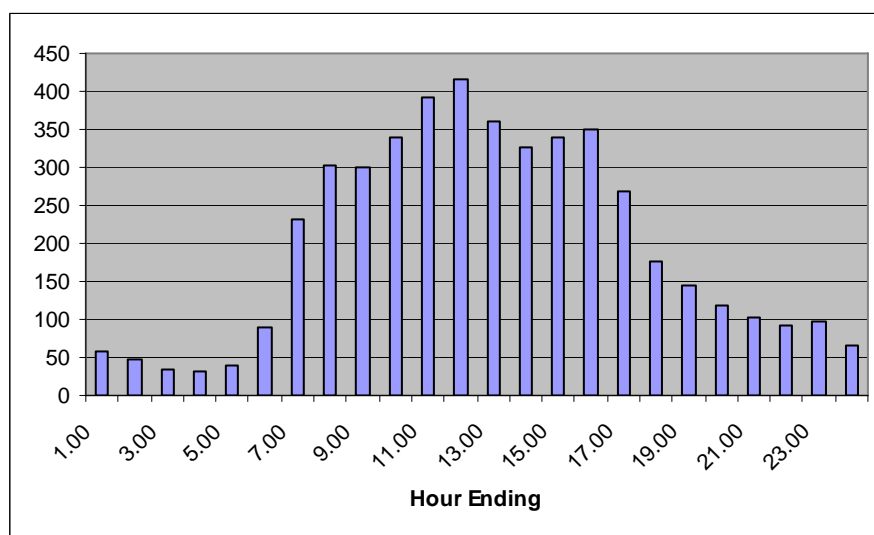


Figure A6: Outbound HGV Traffic Flows from Dublin Port

The M50

Figure A7 provides an overview of vehicle volumes at the West Link. This indicates that freight vehicle flows rapidly build up to a high level in the morning commuter peak, rise to a peak at 1pm and maintain a high level until the late afternoon, when a decline in volumes occurs to coincide with the evening commuter peak

Figure A7: West Link HGV Traffic Flows



Road Freight Traffic in the Greater Dublin Area on a Zonal Basis

Prior to the commencement of the Study, the Dublin Transportation Office collected primary data from the Road Freight Survey in relation to one day's activity. These data consisted of 2,129 trips with the origin and destination, weight of goods carried and type of goods carried on each trip.

These data were coded to the 66 large zones used by the DTO for traffic modeling. From this a 66 zone origin-destination matrix could be calculated. Such a matrix was calculated in respect of both the weight of goods moved and the trips made.

Having examined the data, a large number of cells in the matrix were found to be blank, as the vehicles surveyed did not make a trip on the day in question. Consequently, it was decided to expand the sample, through further data collection in relation to other days in the week. As a result, a sample of 3,933 trips has been established. This has been coded into the 66-zone matrix.

Based on this matrix, the zones that generate and attract the largest volumes of freight traffic in the Dublin area have been identified in the main body of the report. Dublin Port

and the city centre are major generators and attractors of freight traffic. Other areas with significant industrial and commercial activity, such as Blanchardstown and Clondalkin, also give rise to substantial freight activity.

1.5. Rail

Rail freight trends and policy context

Nationally, the volume of freight activity from direct rail freight operations has declined significantly over the past decade. The total tonnes carried by rail have declined from 3.33m tonnes in 1992 to 2.612m tonnes in 2001 equating to approximately 4% of the total freight task in Ireland. The Irish overland freight market is one of the smallest in Europe in terms of the volumes available and the lengths of haul involved, and this has inevitably constrained rail's share of the market compared to the EU average currently estimated at 8%.

The market, traffic flows and train services

The freight market in and around Dublin is fast growing (in particular import-export traffic), but rail currently only has a significant involvement in a very limited number of sub-sectors of the market, in particular:

- traditional bulk traffics to and from private sidings eg oil, mineral ores and beet – typically single-customer trainload movements which best suit the economics of rail
- palletised distribution of Guinness kegs to thousands of pubs and clubs throughout Ireland
- container traffic, overwhelmingly Deep Sea and European flows to and from Dublin port

Much of the growth of import-export traffic through Dublin port is based on roll-on roll-off ferry services conveying standard road tractor units and semi-trailers. Because of restricted rail 'loading gauge' (in particular limited height clearance through tunnels and overbridges) none of this market is available to rail within Ireland, unlike the situation on the European mainland where higher loading gauge clearance enables 'piggyback' trains to convey road trailers and 'rolling motorway' trains to convey both tractors and trailers. In Ireland, only the container ('lift-on, lift-off') market is available to rail since the generally more limited height of containers can be accommodated more readily within the prevailing rail loading gauge.

Regular bulk oil and cement trainloads are operated, and some of these traffics are also conveyed as 'tail loads' on the rear of unit load trains. Daily 'unit-load' trains conveying

containers and palletised traffic (in particular Guinness kegs) operate from Dublin to Belfast and a range of destination railheads (plus intermediate calls) within Ireland, as follows:

- Cork – 8 per day
- Ballina – 2 per day
- Waterford – 2 per day
- Sligo - 1 per day
- Limerick – 1 per day
- Tullamore – 1 per day

It is understood that there is significant spare capacity available on these trains, in particular for routes other than the main Cork flow. This, as noted in the Arup report², offers up the prospect of Irish Rail being able to expand its container volume without a commensurate increase in haulage costs.

Rail Network

There are two key operational freight railheads in Dublin, namely the North Wall container terminal, and the Heuston terminal for Guinness traffic. In addition, there are private sidings within Dublin Port, in particular for bulk oil trainloads.

Apart from in the immediate vicinity of sidings, all freight trains have to share capacity with passenger traffic. Due to the density of local, regional and inter-city train services on key routes – in particular north towards Belfast and south west towards Cork, Limerick and Waterford – there are very limited paths available for freight during daytime hours. However, much freight traffic runs at night when there are far fewer pathing constraints.

In the absence of additional daytime path capacity, the capacity of each train is critical. At present trains of up to 1,000 tonnes gross weight can operate to and from Limerick and Cork, for other routes 780 tonnes is the maximum. This may provide some constraint on meeting potential demand in the future, but a more critical factor for containers may be the length of train which can be accommodated within signaling sections and freight loops on these routes. To Cork and Limerick the maximum train length can accommodate up to 42

² Assessment of Intermodal and Port Access Requirements (Arup, October 2000)

twenty foot length containers, on other routes 36 twenty foot length containers is the maximum.

All routes have sufficient loading gauge clearance to accommodate the standard maritime 8'6" high container, and 9' high containers (up to 2.5m wide) can operate on all routes except to Belfast and Sligo. 24 new low-platform wagons have been ordered to accommodate containers up to 10' high, including the 9'6" maritime container which will eventually become the norm for Deep Sea traffic.

Other Restrictions and Obstacles

Rail freight capability and quality of service has suffered through a practical requirement for the freight division to compete with Irish Rail's passenger division for the allocation of a limited resource of train drivers (rather than having their own dedicated train crew resources).

Bulk rail traffic of heavier commodities such as mineral ores often involves movement between premises which are directly rail-connected (ie with no road collection and / or delivery required). In such circumstances rail can compete with throughout road haulage over relatively short distances, even under 80 kilometres, particularly if regular and substantial trainload volumes are on offer from private siding to private siding. However, the overwhelming and increasing majority of the Irish freight market involves transits between locations which are not, and cannot be, rail-connected. In such circumstances rail in theory has to compete on the basis of an 'intermodal' service, typically using containers with road collection, rail trunk haul, and road delivery.

ISO (International Standards Organisation) containers have the advantages of consolidation of cargo into a single unit load, standardisation of equipment, and avoidance of double-handling of the goods. The drawbacks of the container are its relatively heavy tare weight, and the capital cost of intermodal transfer cranes. The consequences are that containerisation is predominantly applied for flows where a transfer between modes is unavoidable, eg through ports.

Ireland offers relatively limited lengths of haul by international rail standards, eg 240 road kilometres for truckers between Dublin and Cork, and this has a significant impact on the

size of the potential market available to rail. While a detailed breakdown and analysis of rail costs versus road haulage is not within the scope for this study, British and international experience suggests that currently hauls of 500-600 kilometres are required for rail's low 'line haul' (variable) costs to overcome the high fixed cost of road-to-rail crane transfers and local road feeders. Such lengths of haul are simply not available within the economic geography of Ireland, with even Belfast to Cork being only 400 road kilometres for the trucking competition.

However, for movements to ports such as Dublin, rail has only one additional road feeder compared to throughout road haulage (since all containers must change mode at the port), so the breakeven point versus road can be as low as 250-300 kilometres. Therefore, as also identified in the 2000 Arup report, intermodal sea-to-rail traffic is a key potential market for Irish Rail. Unfortunately, due to the general factors outlined above, and a specific lack of integration of Dublin port berth development with rail infrastructure, rail-to sea traffic has declined.

This is also part of a general trend of rail freight decline in most of Europe. In addition, Ireland lacks the very long hauls and heavy coal traffics which are key elements of the rail freight business in mainland Europe. In Britain, however, the decline has been reversed, and rail now has a market share of around 10%, which is partly due to government financial intervention.

Summary

The Strategic Rail Review published in 2003 recommends that the freight business should be constituted as a separate commercially focused enterprise within the broader Iarnród Éireann structure. The report recommends that this newly formed separate entity should focus on commercial traffics and those non commercial traffics that it is directed by government to pursue, possibly linked to system of grant aid.

However, even with institutional change it is likely that rail freight in Dublin will continue to decline. Its relevance to a strategy for improved freight distribution in Greater Dublin – taking due account of environmental and congestion costs – is likely to be minimal.

1.6. Sea

Port-related Freight Analysis

This review assesses the movement of freight to and from the Irish hinterland, through the Greater Dublin Area resulting from port and shipping activities in Dublin and Dun Laoghaire. The review is based on meetings with port and shipping stakeholders and an assessment of relevant data.

Port Statistics

In the period between 1994 and 2002 trade volume through the port of Dublin has increased by 134% from 9.5m tonnes to 22.2m tonnes. Over the same period (1994 to 2002) vessel calls have risen from 3,707 to 7,749, an increase of 109%. Since cargo development has increased at a greater rate than the number of vessels calling at the port the indication is that on the marine side of activity in Dublin, economies of scale have been achieved through greater load factors and larger vessels. The statistics for 2002 are detailed in Table A6.

Table A6 : Port of Dublin freight trade throughput 2002

Trade description	Volume
Total port throughput comprising :	22.2m tonnes
Conventional freight :	
Liquid bulk	3.5m tonnes
Dry bulk	1.4m tonnes
Break bulk	0.1m tonnes
Unit Load Mode :	
Roll on Roll off (trailers)	549,000 units
Lift on Lift off (containers)	456,000 teu (twenty foot equivalent units)
Trade cars	118,000 units

Of the total cargo that passed through the port only 22% was conventional (bulk) freight, ie liquid bulk, dry bulk and break bulk. The remaining majority of cargo was shipped on either RoRo (Roll on Roll off) ferries or LoLo (container) vessels, carried in trailers and containers. These two methods of transport are collectively known as the 'unit load' mode.

In 1994 the tonnage ratio of bulk cargo to unit load cargo was 39%. While overall bulk volumes have increased they have not been increasing at the same rate as unit load cargoes. This has specific implications for road based freight transport. Trailer and container freight tends to be moved to and from the port by road although containers are physically suitable for transport by rail. Bulk cargoes are generally handled through storage facilities in the port and can be transported by road, rail or transhipped by smaller coastal vessels to other Irish ports.

Import volumes have consistently exceeded exports over the period from 1994, at a level of 2 to 1, generally being due to a surplus of bulk imports, primarily oil and loaded import containers exceed the number of loaded outbound containers.

Over the past decade the greatest change round has been in the RoRo sector where new routes, new services and larger vessels have led to a fourfold increase in the number of RoRo units passing through the port. This trend reflects the current imperative for ferry operators to deliver direct services into the country's capital and major consumer area to satisfy customer demands.

All shipping and transport companies contacted stated a preference for direct services into Dublin based on its serving the country's major market. Increasing provision for ship and terminal handling capacity at the port is strengthening that position in relation to competing ports.

Therefore the great majority of cargo passing through the port is delivered and collected by road vehicle. Most of the traffic on the north bank enters and leaves the port via Alexandra Road and Tolka Quay Road, meeting the East Wall Road at separate junctions controlled by traffic signals. East Wall Road is itself a busy single carriageway road, but the only outlet for trucks destined to or from all parts of Ireland.

Origins, destinations and inland distribution systems

Anecdotal evidence obtained during discussions with shipping and port operators confirmed agreement on a clear split between the inland destination of unitised import cargoes and origin of unitised export cargoes. In summary the view is that 70% of import units (largely

consumables) are delivered to points within the Greater Dublin Area. For exports the converse is true with 70% of export cargoes are loaded at points all over Ireland outside of the Greater Dublin Area.

Port-related freight movement – consultation Issues

During the course of discussions the following issues were raised :

- ❑ Limited, daytime and weekday only, opening times and strict 'reception windows' for hauliers at receiver and manufacturers premises outside of the docks have cascaded through the system to the extent that port terminal opening times and haulier working times are equally restricted.
- ❑ Strict 'reception windows' at receivers and manufacturers means that hauliers cannot plan an import delivery to coincide with an export collection from these premises for fear of missing the 'slot'.
- ❑ There is very little 'back-to-back' loading of containers. Containers are generally delivered, unloaded and then returned to one of several storage depots set up on the port specifically to handle empty containers. Hauliers make better income and an increased margin on three Dublin jobs in one day, as opposed to a single 'country' job because of the high fixed element in the rate accepted by the market. Hauliers also reported a shortage of drivers, especially those willing to work nights and long distance Continental operations.
- ❑ Lo-Lo activity is located in the south port area meaning that journeys to the north are tolled at the East Link bridge. Given the impending opening of the Port Tunnel the tolling strategy should be reviewed to ensure containers find it attractive to cross the Liffey at the East Link and use the new facility.

Appendix B - Forecasting Growth In Freight Activity

This section presents the methodology used for forecasting road freight activity in the Dublin Region up to the year 2016. Forecasts of tonnes carried are made first and supplemented with forecasts of trip activity.

There are a number of steps in developing a forecasting methodology. These are:

- ❑ Establishing the determinants of tonnes carried – these are usually economic factors that give rise to freight activity;
- ❑ Developing a statistical relationship between these determinants and tonnes carried;
- ❑ Making assumptions about the future trends in these determinants; and
- ❑ Forecasting future volumes of tonnes carried, based on the trends in determinants and the statistical relationship established.
- ❑ Using this forecast of tonnes carried to derive forecasts of trip making.

One of the problems with implementing the above methodology is that, because of a change in regional classification, we do not have historical data on tonnes carried.

1.1. Trends in Road Freight Activity at the National Level

During the 1990s, the number of freight tonnes carried on Irish roads by vehicles over two tonnes unladen weight increased by nearly 140 per cent (see Table B1, below). This implies an annual average growth rate of 9.1 per cent. While the period as a whole witnessed large growth in freight volumes transported, the majority of this growth took place in the latter period and coincided with strong growth in the Irish economy. Between 1996 and 2002 for example, the volume of freight transported on Irish roads grew by an average annual rate of 17.4 per cent. A similar rate of growth was experienced in the Greater Dublin Area.

Simple extrapolation of these trends would not produce realistic estimates of future freight activity. The economic growth of the 1990s, which gave rise to these trends, is unlikely to be repeated in the future. Rather, there is a need to relate freight activity to the likely future economic growth rates. The next sections seek to establish the determinants of freight activity and use the relationships derived as a basis for forecasting future freight traffic volumes.

Table B1: The Trend in Road Freight Tonnage

Year	Freight Tonnes Nationally (millions)	Freight Tonnes Originating in the Greater Dublin Area (millions)
1990	81.4	na
1991	80.1	20.9
1992	83.9	23.2
1993	80.8	na
1994	84.6	24.9
1995	85.3	24.0
1996	88.3	26.1
1997	103.8	33.3
1998	142.9	44.1
1999	164.0	49.5
2000	194.1	58.7
2001	203.8	61.8
2002	230.6	69.2

Source: CSO Road Freight Survey

Note: a historical series for the Dublin Region only is not available.

1.2. The Determinants of Road Freight Activity

The determinants of road freight tonnage were analysed through:

- ❑ A times series analysis that related the above national trends to a set of economic factors; and
- ❑ A cross-sectional analysis that examined how economic factors influenced the freight tonnage generated in different regions at one point in time (1999)

The broad conclusions of this analysis were as follows:

- ❑ Tonnage carried is broadly determined by the Gross Value Added (or Gross Domestic Product) of the economy;

-
- ❑ Tonnage carried is more closely related to the Gross Value Added (GVA) in the Agricultural and Industrial Sectors than that of the Service Sector;
 - ❑ The Agricultural Sector is a more intensive generator of freight traffic than the industrial sector;
 - ❑ The elasticity of tonnes carried with respect to agricultural and industrial GVA is 0.20 and 0.97 respectively.
 - ❑ Trends in industrial GVA will thus be the prime factor determining growth in tonnes carried. This is not only because of the higher elasticity, but also because of the fact that industrial GVA is predicted to grow strongly, while that for agricultural GVA will stagnate.

1.3. Overview of Forecasting Approach

The forecasting procedure had been developed based on the following approach:

- ❑ Forecast trends in National GVA;
- ❑ Derive equivalent trends in regional GVA;
- ❑ Establish regional GVA trends by sector (agriculture and industry); and
- ❑ Use the econometric models to forecast future tonnes on the basis of regional GVA at the sectoral level.

1.4. Forecasts of Gross Value Added in the Economy

A key input to the forecasts is an estimate of future GVA. The only available forecasts for the economy as a whole for the period 2000-2016 are those published by the Economic and Social Research Institute in its Medium Term Review.³ The review presents forecasts of GDP, which is a close approximation to GVA. The historic and forecast growth rates are set out in Table B2.

³ Medium Term Review, 2001-2007. Economic and Social Research Institute. September 2001.

Table B2: Average Annual Growth Rates in GDP by Sector, 1990-2016.

Period	Agriculture (%)	Industry (%)	Services (%)	Agriculture and Industry (%)	Total (%)
1990-1995	-0.9	7.3			4.4
1995-2000	1.3	12.2			9.4
2000-2005	2.3	7.4	2.9	6.9	4.8
2005-2010	0.6	5.8	4.0	5.4	4.7
2010-2016	-0.1	4.0	2.6	3.7	3.2

Sources: ESRI and Goodbody Economic Consultants estimates.

The table illustrates the very substantial growth in GDP of 9.4 per cent during the period 1995-2000. The major driver of this growth was the industrial sector (12.2 per cent), with the service sector experiencing a lower growth. The forecasts for the period 2000-2016 are for much more modest growth in GDP, from 4.8 per cent in 2000-2005, declining to 3.2 per cent in 2010-2016. These economic forecasts formed the Base Scenario for the forecast of freight tonnes.

Although the same slowing down of growth in GDP in Agriculture and Industry combined is observed, it is expected that these sectors will perform better than GDP as a whole. The reason for this is that the ESRI is predicting that the growth in Services will fall below that of Agriculture and Industry combined, as was the case in the 1990s.

However, given the known relationship between freight tonnage and GDP in Agriculture and Industry, it is clear that in the period 2000-2016 the rate of growth in freight tonnage will be much less than in the 1990s.

As is common with long-term forecasts, the economic growth forecasts of Table 3.2 are based on the assumption that the economy comes close to achieving its long-term potential. In practice, performance may fall short of potential, and it is wise to consider some alternative scenarios in this regard. The first of these (Alternative Scenario A) is based on

the assumption that while GDP growth as a whole will be unchanged from the Base Scenario; the services sector will perform better than is envisaged. The reason for this alternative approach is the realisation that the industrial sector performed very strongly in the 1990s, and that the success achieved in attracting inward investment in that period may not be repeated. In order to test for a scenario in which the services sector plays a more important role in the economy, an alternative set of projections for GDP were used. This assumed that, while GDP as a whole would grow as before, the share of the services sector would remain constant at its 2001 levels. In effect, this implies a lower growth for industrial output post 2005.

The second alternative scenario is to consider what would happen if economic growth fell below that envisaged in Table 3.3. As official short-term forecasts are available for the Irish economy up to 2005, and these are in line with those of Table 3.2, it is more appropriate to consider an alternative economic scenario post 2005. The assumption was made that growth rates for both industry and services would be one percentage point lower in the post 2005 period as compared with those set out in Table B2.

As industrial output is the key determinant of freight tonnes carried, it is worth summarising the assumptions made in this regard for the three scenarios (see Table B3).

Table B3: Growth in Industrial Output under Three Scenarios

Period	Base Scenario (%)	Alternative Scenario A (%)	Alternative Scenario B (%)
2000-2005	7.4	7.4	7.4
2005-2010	5.8	5.1	4.8
2010-2016	4.0	3.5	3.0

1.5. Forecasts of Freight Tonnes Carried for the Dublin Region, 2000-2016

As the concern is with forecasting tonnes carried in the Dublin Region, a forecast of regional GVA is required. There is no such forecast available from any external authority. In making the baseline forecasts that are set out below, the simplifying assumption was made that growth rates of sectoral GVA for the Dublin Region would mirror those for the country as a whole. Based on these assumptions, three sets of forecasts were made. They are set out below.

Table B4: Forecasts of Growth in Road Freight Tonnes in the Dublin Region, 2001-2016

Year	Base Scenario	Alternative Scenario A	Alternative Scenario B
	Tonnes Index 2001=100		
2001	100.0	100.0	100.0
2002	108.7	108.7	108.7
2003	115.5	115.5	115.5
2004	122.9	122.9	122.9
2005	132.0	132.0	132.0
2006	139.6	138.7	138.3
2007	147.7	145.7	145.0
2008	156.2	153.1	151.9
2009	165.3	160.9	159.2
2010	174.8	169.1	166.9
2011	181.6	174.7	171.7
2012	188.7	180.6	176.7
2013	196.0	186.6	181.9
2014	203.6	192.9	187.2
2015	211.5	199.3	192.6
2016	219.8	206.0	198.2

The results indicate continuing strong growth in freight tonnes carried that over the coming years. Over the fifteen-year period, between 2001 and 2016, the base estimate forecasts growth in road freight of around 120 per cent or 5.4 per cent per annum. Thus, while the growth in freight transport is likely to be considerably lower than that witnessed during the boom years of the nineties, it nevertheless represents a significant challenge for transport planners.

Within the 2001-2016 timeframe, the annual growth rate in tonnes carried tends to decline in line with economic growth assumptions. Between 2001 and 2006, freight tonnes are estimated to grow at an annual average rate of 6.9 per cent. This falls to 5.4 per cent between 2006 and 2011 and 3.9 per cent during the 2011–2016 period. These figures, together with those corresponding to Scenarios A and B growth, are indicated in Table B5.

Table B5: Summary Annual Average Forecasts of Growth in Road Freight Tonnes in the Dublin Area, 2001-2016

	Base Scenario	Alternative Scenario A	Alternative Scenario B
Period	Annual Average Growth Rates (%)		
2001 – 2006	6.9	6.8	6.7
2006 – 2011	5.4	4.7	4.2
2011 – 2016	3.9	3.3	2.9
Overall	5.4	4.9	4.4

1.6. Forecasts of Road Freight Trip Activity in the Dublin Region, 2001-2016

A simple approach to forecasting trip activity would be to assume that it grows in line with tonnage carried. However, the relationship between tonnes carried and trip activity may not be straightforward. Increases in tonnage carried will not lead to a proportionate increase in trips, if there are changes in vehicle loading or vehicle size.

Data from the Road Freight Survey on average load per vehicle does not indicate a tendency for this to diminish, although year-to-year variability in this measure may be masking the true trend. In general terms, there are insufficient data on which to build a hypothesis about future average vehicle loading.

Better data are available on vehicle size from the Department of Environment and Local Government's Annual Census of Vehicles under Licence. Between the years of 1990 and 2001 there was a tendency for freight vehicles to increase in size. This trend was especially pronounced among smaller vehicles of less than 2 tonnes unladen weight: the average unladen weight of vehicles less than 2 tonnes increased by 2 per cent per annum, while that for the remainder of the freight vehicle fleet increase by 0.2 per cent per annum.

If it is assumed that these trends will persist in the future, they imply a 0.5 per cent increase per annum in the average size of the freight vehicle fleet. If the carrying capacity of the fleet increases in line with average size, then fewer vehicle trips will be required to cater for a given tonnage. Table B6 presents forecasts of road freight trip activity, assuming continued growth in average vehicle size of 0.5 per cent per annum. Once again, base and alternative scenarios are presented, corresponding to different assumptions about service sector growth.

Table B6: Forecasts of Growth in Road Freight Trips in the Dublin Region, 2001-2016

Year	Base Scenario	Alternative Scenario A	Alternative Scenario B
	Trips Index 2001=100		
2001	100.0	100.0	100.0
2002	108.1	108.1	108.1
2003	114.3	114.3	114.3
2004	121.1	121.1	121.1
2005	129.4	129.4	129.4
2006	136.1	135.3	134.9
2007	143.2	141.4	140.7
2008	150.9	147.9	146.7
2009	158.8	154.6	153.0
2010	167.1	161.6	159.6
2011	172.8	166.2	163.4
2012	178.6	170.9	167.3
2013	184.6	175.8	171.3
2014	190.8	180.7	175.4
2015	197.3	185.9	179.6
2016	203.9	191.1	183.9

Over the fifteen-year period, the base estimate forecasts growth in road freight trips of around 104 per cent or 4.9 per cent per annum. This will result in an approximate doubling of trips by 2016. Within this time frame, the level of growth in trip activity will moderate. Between 2001 and 2006, freight trip activity will grow by an annual average rate of 6.4 per cent. This falls to 4.9 per cent between 2006 and 2011 and 3.4 per cent during the 2011–2016 period. These figures, together with those corresponding to Scenarios A and B growth, are indicated in Table B7.

Table B7: Summary Annual Average Forecasts of Growth in Road Freight Trips in the Dublin Region, 2001-2016

	Base Scenario	Alternative Scenario A	Alternative Scenario B
Period	Annual Average Growth Rates (%)		
2001 - 2006	6.4	6.2	6.2
2006 - 2011	4.9	4.2	3.9
2011 - 2016	3.4	2.8	2.4
Overall	4.9	4.4	4.1

1.7. Conclusions

Freight activity is closely related to the output of the industrial and agricultural sectors. The services sector is not a major determinant of freight transport activity. Because agricultural output is not increasing rapidly, the future level of freight transport activity will be determined by the growth in industrial output. For every one percent increase in industrial output, a broadly similar increase in freight tonnage may be anticipated.

Based on a reasonable set of assumptions about future economic growth, tonnes carried by freight transport in the Dublin Region is expected to grow by between 4.4 and 5.4 per cent per annum between 2001 and 2016.

Because of increasing freight vehicle size, freight trips will not grow quite as fast: depending on economic circumstances an average annual rate of growth of between 4.1 and 4.9 per cent may be expected. These rates of growth, while lower than in the 1990s, nevertheless represent a significant challenge, given the already congested nature of road network.

Appendix C - Review of Dublin Goods Distribution Systems and International Experiences

1.1. Review of Current Working Practices in Dublin Area

During the course of the study, consultations were carried out to review of current working practices within certain industrial and retail sectors, as summarised in the paragraphs below.

Construction Industry

Deliveries in the construction industry can be broadly categorised into three distinct types: pre-assembled structures, concrete mix and general deliveries. Pre-assembled elements are typically delivered on multi-axle articulated HGVs. When over-weight and over-width loads are being moved a special permit is required, and it is often only practical to plan for such deliveries in off-peak hours.

Demand for concrete mix in Dublin has grown in recent years. Deliveries by the larger operators are made by a combination of owned-fleet and third party contracting. The vehicles used are all HGVs, varying from two-axle, rigid to 5- and 6 -axle articulated vehicles. Legally, a typical vehicle is permitted to carry approximately 7.5 cubic metres of concrete, but large quantities are usually required at building sites on a daily basis. For this reason, suppliers of concrete will often deliver continuously to one site, from very early morning and throughout the day.

General deliveries for the construction industry include bricks, blocks, wood and glass. Two-axle, rigid HGVs are typically used, and unlike deliveries of pre-assembled loads or of concrete mix, a truck will typically multi-drop to a number of different sites on any one trip.

Operators state that any restriction on delivery-times would be resisted, because for some it would require them to split loads between suburban and city-centre deliveries, and would cause them to significantly increase the number of vehicles on the road. If a restriction in the city centre had to be implemented, a ban in the PM Peak would be the most palatable, since some building sites tend to close at around 4 pm.

Newspaper Distribution

Daily and weekly newspapers are distributed either by the newspaper firms themselves (Independent Group) or by specialist distribution companies such as Newsread. Most distribution in Dublin is done by light vehicles rather than by HGVs.

The product is time-dependant, and most operators aim to deliver newspapers in Dublin's centre before 7.30 am, since they regard this as essential to meet customer requirements. However, delivering before the morning peak is dependant on punctual print runs – and delays can occur.

Distributors would not like to see any more restrictions on deliveries; once a week they are obliged to collect unsold newspapers ("returns"), and this can be done at any time of day. Some believe that they could deliver far more efficiently if they were allowed to stop directly outside of premises to complete a short drop, rather than consigned to lifting heavy loads from the nearest loading bay.

Fruit and Vegetable Distribution

Increased property prices, worsening congestion and the need for larger premises have caused many of the large wholesalers to move to the industrial estates surrounding Dublin. The fish market has all but disappeared, and all of the supermarket multiples, who account for the majority of retail sales of fruit and vegetables, are now serviced from dedicated distribution centres in North County Dublin. With the exception of Fyffes, none of the large wholesalers maintain a presence in the Markets area, which is now the focus of only secondary wholesaling to the grocery and catering industries. However, this secondary wholesaling continues to thrive, with many of the businesses housed in the Corporation Fruit and Vegetable Market and surrounding streets.

The majority of secondary wholesalers use a fleet of light vehicles to service the city-centre, with a few of the largest firms augmenting their fleet with two-axle, rigid HGVs. Most begin operations at 4 am, and attempt to deliver to any accommodating customers before 7.30 am. However, the majority of customers will only accept deliveries from 8-10 am, and wholesalers are therefore forced to travel during the morning peak. Because of the need to supply restaurants and cafes in time for the lunch market, the vast majority of deliveries are completed before 1 pm.

Distribution centres that service multiples, such as Superquinn, from out of town locations deliver their fruit and vegetables using light vehicles. Some stores need two deliveries per day in order to maximise product quality and to replenish stocks. These tend to consist of one delivery before the morning peak and one in the early afternoon.

Petroleum Distribution

Some oil companies distribute petrol and oil products to forecourt garages using their own fleets (eg Maxol) while others, such as Esso, use third parties. A small number of two axle articulated HGVs are used in areas where access is severely limited, but 5- and 6-axle vehicles are the norm, and many operators see themselves using an increased number of 44 tonne vehicles in the future.

Legislation governing the delivery of petroleum requires a competent person to be available to verify the available ullage (capacity of the receptacles). A pilot project is in operation in Dublin that allows for the delivery of petroleum by a driver, without the presence of a competent person – this effectively allows the delivery of product even when the garage is closed.

Small Grocers

Small grocers vary widely in the nature and quantity of their deliveries. Affiliated stores such as Centra or SuperValu tend to take a small number of deliveries from a limited number of suppliers. Independent stores may use a broad range of suppliers, or may even collect their stock and deliver it in their own vehicle.

The delivery of ambient food products and other supplies tends to be an activity that is spread throughout the day, although distributors do favour early deliveries. Chilled and frozen products tend to be best stored in strictly controlled centralised depots until shortly before they are sold. For this reason, distributors find it easier to have grocers accept deliveries in the early morning, rather than in the middle of the day, since this is the only basis that regular deliveries can be maintained.

Secure Deliveries

Deliveries of security items – principally cash – are handled by a small number of large firms such as Securicor. Most security vehicles are classified as light vehicles, but a small number of two-axle, rigid HGVs are also used.

An unpredictable and varied approach to the scheduling of security deliveries is a key component of the service, since it makes the task of monitoring and attacking vehicles far more difficult for criminals. Legally, armoured vans do enjoy certain exemptions, especially with regard to bans at turning on certain key, city-centre junctions. However, they do not enjoy any exemptions with regard to kerbside delivery times; and this can force them to use delivery bays some distance from the building being serviced.

Couriers and Delivery Services

The courier market consists of deliveries by motorbikes, light vehicles and HGVs. Its key characteristic is that it operates as a third party delivery services between unconnected parties.

The pattern of deliveries for these independent operators is probably an accurate reflection of the delivery patterns for the small business market in Dublin. Deliveries begin before the morning peak and continue throughout the working day; work is scheduled to optimise fleet utilisation, and to avoid concentration of activity in a narrow time period.

The Fastrack service, operated by CIE, is a notable operator of scale. It uses the rail network as the backbone of its service, and augments it with a fleet of light commercial vehicles to collect and deliver in urban areas. In Dublin, deliveries are typically concentrated in two time periods: arrivals in Dublin on the previous night's trains begin to be delivered from 9 am; vehicles then return to base and arrivals from the morning trains are delivered from 1 pm to close of business.

Drinks Industry

Some distribution is done by the breweries themselves (eg Guinness) using sub-contractors; while other deliveries are done by wholesalers or distributors such as the Gleeson Group. The bulk of these deliveries are made using Rigid, two-axle HGVs.

Generally speaking, the delivery times are dictated by the two categories of customers:

- On Trade Customers, who consist of public houses, require their deliveries after 9.30 am, since this is the earliest that staff are on their premises. The strong demand for meals at lunchtime means that publicans will not entertain deliveries after noon.
- Off-Trade customers, such as Off-licenses and multiples are prepared to take deliveries throughout the working day.

The largest supplier of kegs to the pub and hotel trade is Guinness. Where possible, they attempt to complete all deliveries in the city centre in two time periods 10am-noon and 1-4pm. Because Guinness supplies most of the leading brands, one truck would typically deliver a large quantity of beer to small number of premises (approximately five) on any one trip.

Other suppliers, such as Tennents, tend to drop only 2 to 3 kegs off at each pub, and can service over 15 pubs with one truckload. They tend to have a carefully scheduled route with specific delivery times for each pub. The bulk of deliveries take place from 9.30 am to 12 noon.

Car Transportation

Car transportation in Ireland typically involves a two-stage delivery service: cars arrive at the ports and are delivered to centralised distribution parks; and vehicles are then delivered to garage dealerships. Cars that are ultimately destined for the Dublin market are not necessarily delivered to Dublin port. For example, many cars sold by Dublin garages are imported through Cork or Rosslare. Furthermore, because demand for new car sales is highest in the early months of the year, some car transporters estimate that up to 80% of their business occurs in the first 3 months of the year.

Collections from the ports for delivery to distribution depots are already done outside of the peak hours. However, dealer deliveries must be conducted during garage hours – since that is when dealers are available to confirm deliveries. Some operators attempt to complete as many deliveries as possible within the city-centre before 8 am, particularly where 9-car units are needed. However, to a greater or lesser extent, all firms deliver throughout the business day.

1.2. International Research

In April 2003 the Organisation for Economic and Co-operation and Development (OECD) published 'Delivering the Goods – 21st Century Challenges to Urban Goods Transport'. The report illustrates that despite the different experiences of the various member countries, a number of general issues relating to goods distribution are common between participants. These are described in more detail below.

Despite the variety in size, population and circumstances surrounding each region, there are some common challenges. The significant contribution of freight transport to total traffic and moreover the contribution of freight transport to problems of accessibility, congestion, environment and safety is leading to growing awareness of the importance of urban goods transport policies. However, most countries are not adequately equipped to analyse and prepare for these challenges.

With the expected growth in freight transport, most countries are increasingly concerned about deteriorating accessibility, environmental impacts and safety. On the other hand, cities are aware that despite the problems caused by urban goods transport, deliveries within a city (both to commercial premises and to private dwellings) are essential for maintaining economic and social functions. Therefore, countries are confronted with common and difficult challenges of maintaining their sustainability and "livability" while ensuring a goods transport system that sufficiently serves their needs.

The Role of National Government Involvement In Urban Goods Transport

In many countries, problems of urban goods transport are dealt with on a local or regional level. Only a few countries have developed an explicit encompassing national policy focused on urban goods transport. The private sector requires consistent and fair approaches in policy measures to be applied throughout their supply chain. Such approaches appear to be difficult where there are no national initiatives or guidelines to ensure consistency among local or regional measures.

Lack Of Awareness And Knowledge

Urban goods transport tends to be seen merely as a cause for problems in cities, and the awareness of its importance seems to be low, not only among the general public but also among governments and city planners.

There are very few specialists of freight transport. For example, although the municipality of Paris has two hundred specialists dealing with passenger transport and traffic planning, the first specialist in urban freight was appointed to the office in March 2002. In most cities, city transport planning and traffic surveys are based only on passenger transport.

This lack of awareness and knowledge has often led to transport policies being planned mainly from the passenger transport perspective, without adequate consideration of the needs of freight transport. There does not appear to be a systematic basis for assessing the relative value of alternative passenger and freight transport uses. Another consequence of the lack of awareness and knowledge is that facilities in many cities are being poorly-designed for freight transport, eg poor access, sizes of parking places being too small for freight loading/unloading.

Regulation and Enforcement

Local regulations tend to differ among different municipalities and are seldom co-ordinated at the national level. For example, cities have different access regulations in regard to vehicle weight or size restrictions and time-windows. Regulations in the Paris region use more than 30 different definitions of a truck. This causes problems for shippers and transport companies which operate over a wide geographical area.

The Role of Public-Private Freight Partnerships

Feasible and practical solutions in urban goods transport require an integration of different interests and points of view from different stakeholders. Consultation platforms have proved to work well in the Netherlands and the United Kingdom in bringing together various stakeholders for discussing issues, planning practical and cost-effective measures and gaining support for policy measures.

Non-Market Based Urban Distribution Centres

Publicly owned or publicly-driven distribution centres tend to be unsuccessful. They often face location problems and are not successfully integrated into the private sector's supply chains. Therefore, they do not receive support from the private sector and become commercially unsuccessful. The size of a city may also be an important factor in determining the viability of urban distribution centres.

The Role of Consolidation

Consolidation, involving the use of a vehicle fleet that can carry several loads within one journey, receives attention in most countries but its implementation is not easy. A few successful cases exist in Europe and Japan. While consolidation is emerging as an important tool for solving problems, it is mainly considered a matter for the private sectors, and little attention is paid to accommodating or facilitating consolidation through policy measures.

Future Trends in Freight Transport

The OECD report further illustrates that it is likely there will be a continued growth in freight transport and a move towards integrating urban goods movement with long haul transport. Furthermore, it highlights that centralisation and consolidation will increase and there will be time compression of the supply chain leading to reduced delivery times and just in time deliveries. With reference to these future trends the OECD report goes on to make some general suggestions as to how to deal with the complex and conflicting issues involved in dealing with the development of the freight transport industry. These recommendations are summarised below.

- **National Government Initiatives.** There is a need to set policies, objectives and frameworks at the national level for the freight industry.
- **Consultative planning** to ensure participation of key stakeholders in the planning process eg freight quality partnerships

-
- **Integration of policies.** This applies not only to all transport modes and passenger transport but also among different policy areas in order to establish a more effective urban goods transport policy.
 - The **encouragement of public awareness.** An understanding of the importance of freight transport is a good starting point for developing an efficient transport system.
 - **Evaluation of measures.** To improve freight transport an analytical base for monitoring is necessary to plan and implement effective policy measures.
 - **Consolidation** : encouragement of private sector initiatives
 - **Harmonisation of regulations.** Regulations need to be harmonised, standardised, stable, easy to enforce and cost effective.
 - There needs **technological and conceptual innovation** and imaginative use of infrastructure to ensure optimal use of resources.
 - **Provision of adequate logistic facilities** such as loading areas, parking spaces etc.
 - And finally there needs to be some **consideration given to safety risks.**

1.3. Freight Practices in Comparable Cities

Specific information on urban freight transport policies and measures in cities/areas comparable with Dublin is also provided within the OECD report. In addition, the DELCAN report produced for Dublin City Council⁴ also outlines experiences of management measures in cities around the world. The following sections highlight some examples.

City Goods Arrangement – Copenhagen, Denmark

Copenhagen introduced a 'City Goods' arrangement for a trial period between February 2002 and October 2003. This scheme required vans and lorries, over 2 500 kg total weight

⁴ Development of a HGV Management Strategy for Dublin City to Coincide with the Opening of the Dublin Port Tunnel, Interim report February 2004, Delcan International Ltd

and wishing to enter and stop within medieval Copenhagen to have a certificate. The main objective of the scheme was to ensure the full capacity of the vans and lorries driving into medieval Copenhagen was utilised in order to bring about a reduction in the total number of lorries and vans.

The scheme involved the use of three types of certificates:

Green certificate: This could be bought for the two year trial period by vehicles which pledged to utilise 60% of their capacity (as average over a three-month period) and had engines younger than eight years. In exchange for the certificate these vehicles were given exclusive right to use attractive loading zones.

Yellow certificate: For those vehicles which could not fulfil the criteria of the green certificate. This certificate could be bought for a six-month period only.

Red certificate: For those who rarely went into medieval Copenhagen. The certificate could be bought for only one day.

A stop-zone was provided at every entrance into medieval Copenhagen where the drivers could read about the scheme, and there were parking-guards employed to check lorries and vans for their certificates and load utilisation.

A review of the scheme in September 2003 suggested that the arrangements are not a sufficiently useful tool for limiting the heavy traffic in the City of Copenhagen. The problems experienced during the trial period were:

- Computerising and verifying the validity of data concerning the utilisation of capacity.
- The possibility of exemption from the arrangement by using red certificates.
- The extent of freight traffic passing through the area.
- The lack of measurable criteria to evaluate the effects of the arrangement.

However, it was noted that there is a basis for proceeding with the fundamental ideas of the city goods arrangement particularly with the plans to introduce environmental zones in the central area of the city. A more practical and efficiently applicable 'City Goods' arrangement could be an important addition to an environmental zone arrangement.

Provision of loading/unloading zones – Paris, France

In Paris all new commercial and industrial buildings larger than 250m² must provide off-street loading/unloading areas. A similar measure is planned in Brussels which will be enforced through the inclusion of conditions in building permits.

Truck Route System – Vancouver, Canada

Vancouver has implemented a truck route system whereby all trucks with 3 or more axles and a gross vehicle weight greater than 4.5 tonne must use the designated routes. The routes generally skirt the city centre but extend through industrial/commercial and residential areas. Trucks must use the designated routes on a 24-hour basis and may only deviate to make local deliveries. In the city centre, no vehicle with a length greater than 15.25m may enter the area between 7am and 6pm, seven days a week. As such city centre deliveries take place at night or through the use of smaller vehicles.

Through and Local Truck Routes and Limited Truck Zones - New York, USA

New York has implemented a system of “through truck routes” and “local truck routes” in various districts. The “through truck routes” are intended to carry trucks that have neither an origin nor destination in an area, whilst the “local truck routes” are intended to carry trucks that have an origin or destination (for the purpose of delivery) in the nearby area. Operators may only divert off local truck routes to make deliveries using the shortest and most direct route.

Certain areas within the City of New York are also designated as “Limited Truck Zones” whereby no truck can enter except for the purpose of deliveries. Restrictions are either in place 24 hours a day or only for certain hours depending on the area.

UK Delivery Curfew Initiative

This initiative aims to investigate the possibility of allowing some night time deliveries to retail outlets given that operators will use best practice to minimise the inconvenience to local residents in terms of noise and emissions. The initiative aims to reduce HGV congestion at peak times resulting in less emissions, safety benefits especially during the

school run period and allowing fresh produce to be available in stores much earlier in the day. The Delivery Curfew Initiative does not intend to give freight operators the chance to deliver whenever they like but instead highlights that through certain practices the disturbance caused by deliveries can be minimised so that some deliveries at nighttime would be possible.

As part of the development of the initiative it was proposed that two pilot projects would take place in Leeds. After full consultation with Leeds City Council officers it was hoped that a trial could take place at a Tesco and a Sainsbury store in Leeds, in which two or three out of hours deliveries could take place in exchange for the adoption of certain best practices. The Code of Practice also suggests the use of a delivery curfew project manager and a 24-hour telephone help-line so that residents can make complaints and have these dealt with as quickly as possible.

However, despite progress being made to set up two pilot schemes, the elected representatives of Leeds City Council decided to not to proceed with the trials. The London Borough of Bromley is now currently considering trialling a similar initiative.

Lorry Route Maps – Worcestershire, UK

In Worcestershire a Lorry Route Map has been created to mitigate the impact of road freight movements within the county. The maps outline advisory routes for heavy goods vehicles, identify barriers to lorry movements and highlight suitable facilities for lorry drivers. Furthermore, they indicate points of local access to industrial and trading estates. By encouraging drivers to use the routes indicated, environmentally sensitive areas can be avoided, and conflict with local residents reduced.

The lorry route map has been developed from work carried by Kent County Council who has produced a similar high quality map. Data was collected about items that are not normally shown on a traditional road atlas including the location of strategic industrial estates and low bridges. After consultation, undertaken through the Worcestershire Freight Quality Partnership, the level of detail to be included on the maps was refined to encompass HGV filling stations, areas of peak time congestion, steep inclines, local place names, width limits, maximum gross weight limits and HGV parking bays.

The maps that have been produced have keys that are also repeated in Spanish, German and Italian to reflect the number of foreign drivers that pass through or deliver in the county.

The maps that have been produced have been praised for their clarity by lorry drivers, freight operators and freight associations. Further work is also underway to produce town centre local delivery maps, the first of which will be for Kidderminster.

Appendix D - Review of Dublin's Freight Transportation Network

This section investigates the constraints and opportunities on the road network within the study area, initially describing physical restrictions within the city and then summarising the opportunities created by planned road improvements in the wider context.

1.1. Existing Road Network Constraints

Over and above general traffic congestion in the urban network, several specific locations that have become significant constraints which impact on the freight transportation network. These include:

1. **The Quays**, where there are significant conflicting demands for road space including pedestrians, cyclists and buses.
2. **Access to the Dublin port area from the south**, with residential frontage on several of the current routes used.
3. Access from the **South Port** northwards over the tolled **East Link** bridge.
4. Access to **Dun Loaghaire** port through residential streets.
5. **M50 West Link** crossing on the M50, although no longer a bottleneck now that the second bridge is operating, it is still a concern that freight is tolled.
6. Gridlock at the **M50 / N7 Red Cow Roundabout**, often the main bottleneck in the system that will govern the overall level of service for a journey.

1.2. Weight Restrictions

At present there is no one source of information regarding existing weight restrictions in the Dublin area. Information has been received from Dublin City Council regarding 3 tonne weight limits which are in place at over 300 locations in the City. These appear to represent mainly 'environmental' weight restrictions, restricting HGV traffic from residential areas.

1.3. Height Restrictions on the Existing Road Network

Information has been received from Dublin City Council in relation to railway bridge height restrictions in Dublin city centre. Figure D1 shows the 22 locations where clearance is restricted to 4.75m or less. The majority of bridges are over side streets and there are no bridges on key arteries that pose problems to the throughput of general freight lorry traffic. There are a number of other locations at level crossings where height is restricted due to the presence of electric cables. The National Roads Authority is also compiling data relating to height restrictions of 2200 bridges the national network.

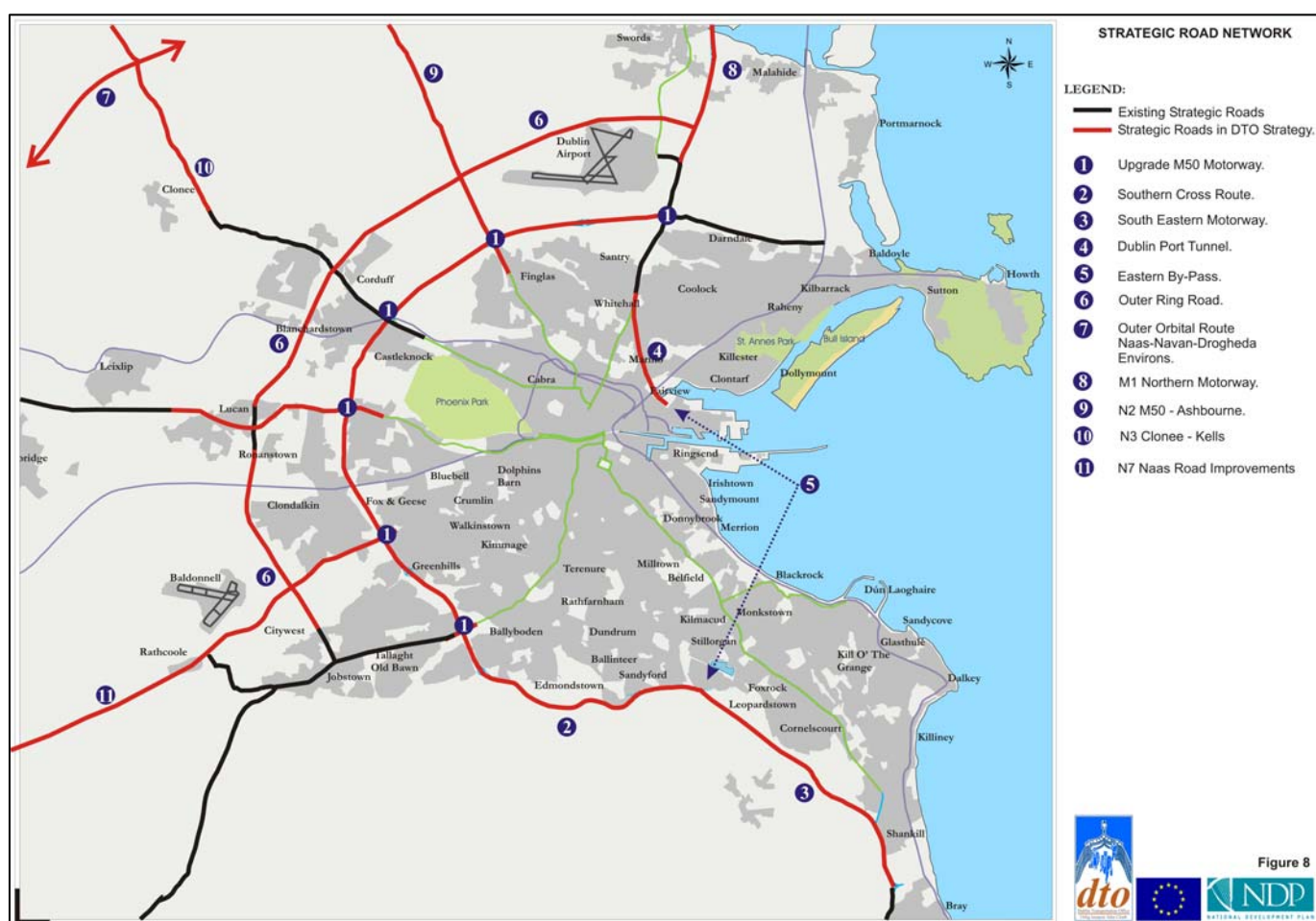


Figure D1: Bridge height restrictions

1.4. Planned Road Improvements

Figure D2 is reproduced from the DTO “Platform for Change” document and represents the major projects being progressed by the various authorities in the study area. These are described in the following paragraphs.

Figure D2 Planned Road Network for Greater Dublin Area



Dublin Port Tunnel

Dublin Port Tunnel will run from the Port to the M1/M50 directly into the north port area. The main objective of the project is to significantly reduce the amount of heavy goods traffic in the city centre, in particular, along the Quays.

The completed tunnel will provide a 6.5km long dual carriageway and is predicted to carry some 20,000 vehicles per day upon opening⁵. It is intended that the tunnel will be tolled to all traffic, except HGVs. A small percentage of HGVs will be unable to access the tunnel due to the proposed tunnel height of 4650mm. An alternative route for these vehicles is to be designated. However, at the time of writing this issue is subject to further consideration by the relevant authorities.

M50 South Eastern Motorway

The M50 South Eastern Motorway project is the final element of the M50 Dublin Ring Road and involves the construction of approximately 9.5km of motorway. Construction started in 2001, with road opening delayed by legal actions relating to archaeology. The main objectives of the scheme are as follows:

- To increase road capacity and reduce journey times and journey time variance
- To provide the final link in the M50 Dublin ring road, linking the M1/N1 route to the M11/N11 route
- To improve access to the Dublin Airport and the ports of Dublin and Rosslare
- To improve access to the seven national routes which radiate from the M50 ring road

Dublin Outer Ring Road

Fingal and South Dublin County Council are responsible for this initiative which will ultimately connect the N1 to the north of the airport to the N81 Tallaght Bypass to the southwest of the city. This strategic route will involve linking up existing routes with newly constructed roads.

⁵ source : Dublin Port Tunnel Toll Scheme “Explanatory Statement”, NRA

In the Fingal County Council section, the St. Margarets road will be upgraded as necessary and connect to a new scheme which will link the N2 with the N3. In South Dublin the scheme is being progressed in three phases.

Dublin Outer Orbital Route (DOOR)

This project is being investigated by the NRA and is currently at the planning stages. The aim of the Dublin Outer Orbital Route (DOOR) is to promote growth of the primary and secondary development centres in order to divert some growth from Dublin to self-sustaining towns in the hinterland area. This will be achieved by the provision of a national primary route to improve accessibility to the towns and link them together. The route will also provide a further bypass around Dublin and form a strategic route linking with improved national primary routes.

A feasibility study has considered four broad corridor options and identifies a preferred route which connects the M1 to the N7/M7 and links the development centres of Drogheda, Navan and Newbridge. This preferred route provides a seamless high quality route for longer distance inner city travel and inter-town traffic avoiding Dublin. The feasibility report states that the exact road cross-section type will be determined upon completion of a rigorous traffic study. It also identifies the possibility of extending the route southwards from the N7/M7 to the N11, which would serve the development centres of Wicklow and Arklow.

Appendix E - Local Authority Provision, Policy and Legislation

There are currently only limited examples of local authority initiatives to manage HGV movements. New guidelines to assist authorities controlling commercial vehicle movements have recently been published by the DTO as part of the Traffic Management Guidelines Manual. These new guidelines outline five areas for action:

- Use of planning controls - incorporation of truck management policies into development plans.
- Use of licensing controls - environmental protection conditions can be attached to an operator licence.
- Signing of suitable routes for commercial vehicles.
- Area-wide restrictions on HGV movements through the use of weight restrictions and height restrictions and associated regulatory signs.
- Creation of appropriately controlled pedestrian priority areas.

The following paragraphs discuss the various measures and policies implemented by the local authorities in the Greater Dublin area.

1.1. Dublin City Council

Dublin City Council has produced a five-year road safety plan with the general objective to reduce accidents in the city by 20%. As part of this initiative, Dublin City Council is in the process of preparing a HGV Management Strategy to complement the opening of the Dublin Port Tunnel. The aim of the HGV Management Strategy is to ensure optimal HGV usage of the tunnel. A report has been prepared by Declan (February 2004) for Dublin City Council which provides a discussion of the issues and makes recommendations. The preferred option recommended by this report, after detailed analysis of several potential strategies, is to restrict HGV movements within the city centre in peak periods except for those who have been issued with permits. The permits would be issued to those vehicles requiring access

for loading and unloading. It is intended that the restriction would be in place throughout the daytime. This preferred option is currently under consideration by the Council.

Furthermore, the council is launching a commercial vehicle delivery scheme which aims to improve general traffic flow and road safety. The scheme aims to impose additional restrictions on loading and unloading which take place on strategic routes. The restrictions will involve the introduction of 9.5 hour clearways on the strategic routes indicated in Figure E1 below. These clearways signify that on street delivery activities will not be permitted between 7.00am and 10.00am and between 12.30pm and 19.00pm. A number of marked out loading bays where commercial vehicles can safely park have been designated throughout the central area. The scheme is to be enforced by the council's parking contractor and An Garda Siochana.



Figure E1: Clearways on Strategic Routes

In the Dublin City Council Development Plan, policies to address the adverse environmental impact of traffic have been adopted. The Office of the Director of Traffic has established a noise and air quality unit to give a comprehensive overview of emissions compared with

population, land use and traffic flows within the city. In the future, data assembled will be useful in the formulation of policy for the strategic management of heavy goods vehicles.

The council have imposed three tonne weight limit restrictions in a number of residential areas primarily to prevent HGVs from parking up overnight.

1.2. Meath County Council

One of the core objectives identified in the “Transportation Infrastructure Needs” sector of the County Development Plan is:

“To permit efficient movement of goods and persons in the interests of commerce and enterprise”.

However there is no specific policy relating to HGV movements in the county.

1.3. Kildare County Council

Kildare County Council has adopted the policy of preventing HGVs access to some residential areas to preserve amenity. Furthermore:

“It is Council policy to investigate and, where feasible, provide commercial vehicle parking areas, suitably sited, landscaped and screened. The Council will encourage the provision of secure commercial vehicle parks within industrial areas in the towns of the county”.

1.4. South Dublin County Council

South Dublin County Council have adopted the policy of imposing 3 tonne weight limits on a case-by-case basis on roads within the area. In terms of preventing HGVs from parking in residential areas the following has been incorporated into the Development Plan:

“The indiscriminate parking of heavy commercial vehicles or machinery in residential areas detracts greatly from the amenities of these areas. It is Council policy to protect and improve residential amenities in all residential areas of the County. The Council will co-operate with all other bodies that exercise control over this type of parking, to eliminate the nuisance created”.

1.5. Dun Laoghaire Rathdown County Council

Dun Laoghaire Rathdown County Council have undertaken a study to establish the volume of HGVs entering and exiting the county. This study, which was completed 3 years ago, was planned to be integrated with observed HGV volumes on the South Eastern Motorway to develop a HGV management strategy. However due to the delays in completing that particular project, Dun Laoghaire Rathdown County Council have suspended the formulation of a policy on HGV management until the motorway opens. However the council have adopted a policy of imposing 3 tonne limits in traffic calmed areas throughout the administrative region. The council is also developing proposals for a designated route for commercial vehicles wishing to access Dun Laoghaire Harbour from the M50 and the M11.

1.6. Other Councils within the Greater Dublin area

It is understood that there are no specific policies relating to HGV movements in the counties of Louth, Wicklow or Fingal. Bray Town Council are however developing specific freight management measures in developing a traffic plan for the town centre.

Appendix F - Evaluation of Strategy Measures

	Potential to Meet Objectives						Phasing		
	Improve Efficiency of Goods Distribution?	Reduce Impact of Lorry Traffic?	Practical?	Enforceable?	Effective?	Economically Sound?	Short Term up to 2005	Medium Term 2005-2010	Longer Term 2010-2016
Recommended Measures									
A1 Develop advisory HGV network	high	medium	minor	medium	medium	medium	▲	▲	
A2 Implement inner city cordon	medium	high	medium	major	high	medium	▲		
A3 Consider toll adjustments on West-Link & East-Link bridges	medium	high	medium	minor	medium	low	▲		
A4 Reduce impact of loading / unloading	medium	high	medium	minor	medium	medium	▲	▲	▲
A5 Support local authority regulation	medium	high	minor	minor	high	medium	▲	▲	▲
A6 Establish forum for implementing strategies	high	high	minor	minor	high	high	▲	▲	▲
A7 Legislation	high	high	medium	medium	high	high	▲	▲	▲
Measures for Further Consideration									
B1 Develop interest in consolidation	medium	medium	medium	minor	medium	medium		▲	▲
B2 Encourage Freight Quality Partnerships	medium	medium	minor	minor	medium	medium		▲	▲
B3 Consider petrol tanker driver legal responsibilities	medium	medium	minor	minor	medium	medium		▲	
B4 Encourage backloading initiatives	medium	medium	medium	minor	medium	medium		▲	▲
B5 Land Use Planning	medium	medium	medium	minor	medium	medium		▲	▲
B6 Short Sea Shipping	medium	medium	medium	minor	medium	medium		▲	▲
B7 Improved Enforcement	medium	medium	medium	minor	medium	medium		▲	▲
Non-prioritised Measures									
C1 Greater use of rail	medium	low	medium	minor	low	medium			▲
C2 Greater use of pipelines	medium	low	medium	minor	low	high			▲
C3 Designated HGV routes	medium	medium	major	major	medium	low			▲
C4 Provide HGV priority traffic signals	medium	medium	major	major	medium	low			▲
C5 Provide HGV priority lanes	high	low	major	major	high	low			▲
C6 Instigate requirements for on-site construction waste disposal	medium	medium	medium	major	medium	low			▲
C7 Change access to pedestrianised areas	low	high	medium	major	high	low			▲
C8 Change in maximum vehicle weights	low	medium	major	major	medium	low			▲