11

EXTERNAL EFFECTS OF A FIXED LINK

11.1 Approach

11.1.1 The External Effects Considered

The last section considered some of the external effects of a fixed link - in other words, its social costs and benefits. They were those whose impact was on users and producers of transport, and as it happens they are the most readily quantified. The other effects of a link that could be material to a decision are, as with most transport investments, those that affect the homes, other buildings or land that are needed or whose environment will be altered by the change. The factors normally considered in the United Kingdom are:-

area of land and any buildings to be acquired;
traffic noise;
visual effects;
severance; and
various consequences for pedestrians and others -
dirt, fumes and other aspects of pollution, changes in accident risk, and delay in crossing roads[1].

Many of these factors can only be measured and evaluated at all well in the context of a scheme which has been designed in detail. However as will appear the number of new facilities with such environmental consequences that any of the fixed links would require is limited.

The single-track tunnel may need limited roadworks around some of the sites that are being considered for terminals in London as well as some development at a station and depots near the Channel portals. The double-track tunnel would, in the form considered here, require the same excep that it would need rather more land near the portals. It would also imply the advancement of some years of the building of the Maidstone by-pass as well as road improvements near the portals. As far as can be judged the bridge would present somewhat greater problems to be overcome in securing access to them. Because more traffic is predicted somewhat greater road improvementwould be needed elsewhere, especially along the coast roads. If the bridge had a railway on it, other problems of access would have to be

solved. A submerged tube would present some of the same problems at the portals as a bridge, but there would be a particular problem in joining the rail tunnel to the railway system. All these requirements are considered further below.

Nevertheless the main external impacts of the fixed links should not be the consequences of landtake, but of the diversion of traffic from one mode or route to others. They will be on noise, air pollution and accidents.

11.1.2 Irrelevance of Traffic Growth

The underlying base forecasts of growth in cross-Channel travel, particularly leisure travel, given in section 3 are much less than what was predicted in 1973[1], but they are still very substantial. However the forecasts are that the growth will occur whether or not a fixed link is built. As Table 11.1.1 shows, the extra travel it is predicted the fixed links would generate is a comparatively small proportion of total travel; and it would be greatest for car-accompanied travel, if there were a bridge.

While it is outside the terms of reference of this study to consider the environmental and other wider consequences of the growth in travel irrespective of a fixed link, it may be noted that:-

(a) that the much greater growth in Continental leisure travel to the U.K. than in the opposite direction mostly arises because of the assumption made that Continental per capita incomes will continue to grow faster than U.K. per capita incomes at least for some years. If that assumption proved wrong, Continental leisure trips to the U.K. would be deterred to some extent by the increase in the relative cost of a U.K. holiday while U.K. leisure trips abroad would increase because of higher U.K. incomes. On the other hand the lower the relative growth in U.K. incomes, the more important tourism is likely to be to its economy;

(b) as leisure time increases as a proportion of the working year, second and other short holidays will become a greater proportion of the whole so that the extra pressure on tourist facilities in the peak would be less than otherwise would be the case; and

Table 11.2.1 Traffic Generated by the Link

(000s of return trips)

000s / % of total traffic		Passengers-Independent or Package				Car-accompanied Passengers			
		1985		2000		1985		2000	
		Nos	%	Nos	%	Nos	%	Nos	%
One track tunnel	High	140	1.0	270	0.9	-	-	-	-
"	Low	160	1.2	210	1.1	-	-	-	-
Two track tunnel	High	190	1.3	330	1.1	200	3.6	460	3.3
"	Low	210	1.6	310	1.6	160	3.6	270	3.4
Bridge	High	60	0.4	negl	negl	310	5.9	770	5.5
"	Low	50	0.4	150	0.5	250	5.7	350	4.4
Bridge and rail	High	140	1.0	270	0.9	310	5.9	770	5.5
"	Low	160	1.2	210	1.1	250	5.7	350	4.4

(c) as the more popular areas for holidays in the U.K. and on the Continent become more crowded, tourists will go to other areas. While congestion and increased incomes may be factors encouraging them to travel further, rising energy costs in real terms will have the opposite effect.

11.2 The Measurement and Evaluation of Environmental Impacts

The main sources of opinion on the likely effects of a fixed link on the local environment have come from discussions with, and papers submitted by, officials of Kent Country Council and the G.L.C. They are drawn on freely in the remaining sub-sections of this section.

The environmental impact of the proposed link would mainly be of three kinds:-

(a) that on the built environment in the vicinity of the portals and, where relevant, the terminals;

(b) noise nuisance from changed levels of traffic movements;

(c) air pollution from changes in the level and pattern of traffic flows;

(d) changes in accident experience.

11.2.1 Built Environment

The impact of each scheme on the built environment is considered both during construction and in operation. In certain of the schemes this presents a problem as the exact size and location of the structures has yet to be decided; for example, the London terminals for the tunnel schemes.

The analysis describes the likely disruption caused during construction, and the general impact on the environment e.g. in terms of visual intrusion, once constructed and operational.

11.2.2 Transport Noise

The main sources of transport noise are road traffic, aircraft and trains. The most universal, but the most complex, is road noise. Even if one can quantify the effect of different traffic level in terms of noise levels, it is then difficult to convert this to money values. There is no evidence that exposure to traffic noise even for long durations has any adverse physiological effects, although there is some evidence that the hearing of drivers may be impaired. Thus the problem is generally one of annoyance.

Quantifying the effect of transport noise should be carried out in the following two stages:-

(a) estimate the number of households or people brought within different noise level bands; and

(b) attempt to place a valuation on (a).

The next two sections seek to determine to possibility of achieving either just the first or both stages within the current study, with respect firstly to road traffic noise and secondly to aircraft noise.

11.2.3 Road Noise

A full analysis of the effects of road noise would:-

(a) indicate the differential levels of traffic in terms of car and road freight;

(b) relate this to the expected 'base' levels of traffic on the roads affected, to give an indication of the proportional impact;

(c) indicate the implication of the different traffics on the levels of road noise; and

(d) attempt to value the noise level impact.

The analysis is restricted to those areas most affected, chiefly the road corridors in Kent. The first two stages are relatively easy in that (a) is fairly directly an output of the route choice models. The information with respect to (b) has been supplied, in terms of the non-cross Channel related traffic, by external sources. With regard to the stage (c), sophisticated models have been constructed that relate traffic levels, the mix of traffic, the surface of the road etc. to road noise as measured at a certain location[1]. Such a detailed level of analysis is clearly beyond the scope of this study. Indeed, it is doubtful whether it would be worthwhile to go any further, unless the analysis in (b) suggests that the differential impact of alternative schemes was major.

To value the noise level impact, stage (d), would first require identifying the number of households and others affected, and the extent to which they are affected. When that is done there are a number of possible approaches to the valuation of noise nuisance experienced by these people:-

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1. See A. Lassiere The Environmental Evaluation of Transport Plans, Department of the Environment, Research Report 8, 1976.

(a) the property price approach;

(b) the exclusion facilities approach; and

(c) the experimental evaluation approach.

The property price approach is to base the cost of noise on the depreciation in property values caused by the existence of noise. Most of the work done in this area has been with respect to aircraft noise rather than road noise, and these are discussed later. The few studies in traffic noise (e.g. Vaughan and Huchins 1975[1], Gamble et al 1974[2]) in the USA did find that noise drove down property values, but Diffey[3] found no such correlation, and another US survey[4] of rents paid for different apartments with different noise conditions came to the conclusion, on the basis of statistical evidence, that although road traffic noise might be disutility "the analysis of the study strongly suggests that the occupants' annoyance is not reflected in rent". A recent study carried out in the UK[5], suggests that "although traffic is a major source of noise nuisance, even at higher exposure levels, the majority are not seriously bothered by it".

Other studies have had various success but in general their authors are reluctant to generalise from what they have found. An academic expert in the field has stated that there is sufficient difficulty with the work that has been done so far to make it an unreliable guide for policy[6].

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1 Vaughan R. and Huckins L: The Economics of Expressway Noise Pollution Abatement.

2 Gamble H. et al: The Influence of Highway Environment Effects on Residential Property Values.

3 Diffey J: An investigation into the effect of high traffic noise on house prices in an homogenous sub-market.

4 R. Tourne: 'An investigation of the effect of freeway traffic noise on apartment rents'.

5 Social and Community Planning Research: 'Road Traffic and the Environment'.

6 D.W. Pearce "Noise Nuisance" in his Valuation of Social Costs Allen and Unwin, 1978.

One is then forced back on approximate methods of evaluation. The Leitch Committee[1] reports that the Department of Transport in the UK when appraising road schemes currently ignore any change in noise levels of less than 3dB (A) L_{10}, at least where hourly traffic volumes are in excess of 1200, on the ground that experience shows that a smaller change is not perceptible[2]. While questions can be raised on the appropriateness of the conclusion in urban conditions, it would seem to have some value as a yardstick, expecially in inter-urban truck roads. A doubling of the proportion of the percentage of heavy vehicles in a traffic stream at 50 km/hr increases the L_{10} level by about 1.2 to 2.2 dB(A)[1], though the exact amount will vary with speed also. As will be shown in section 11.7, forecast changes are nowhere near this level.

11.2.4 Aircraft Noise

The same methodology could be applied to the impact of the differential noise nuisance from aircraft movements[3]. In this instance, the required parameters have been calibrated for aircraft movements at certain United Kingdom airports, as part of the exercise to evaluate alternative locations for a third London airport. We shall therefore in this case illustrate the application of all four stages of the methodology to the differential air passenger movements in the UK.

Noise disturbance from aircraft movements is measured on the 'NNI scale' - 'Noise and Number Index'. A 35 NNI level is regarded as low, 45 as intermediate and 55 as high. In the original appraisal of alternative sites for a third London airport, for each of the affected airports, the number of people brought within the 35+ NNI range was calculated for a marginal increase in the throughput of passengers. These numbers varied greatly from airport to airport, being 9.5 per 1,000 passengers for Heathrow, and only 0.1 for Stansted. These parameters were subsequently updated[4] and forecasts made to the year 1990. These revised forecasts are expressed in numbers affected per 'Air Traffic Movement' (ATM). The values are only given for airports in the

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1 Report on the Advisory Committee on Trunk road Assessment (HMSO 1977), 5.14.

2 Lassiere, op.cit, pp 16,17.

3 Lassiere, op.cit.

4 Airport Strategy for Great Britain (1975).

London area. In view of the marked difference in the values between Heathrow and other London airports, it is proposed that the change in air passenger movements be split between:-

(a) those using Heathrow;
(b) those using other UK airports.

We then apply to (b) the parameters averaged over the London airports other than Heathrow (namely Gatwick, Stansted and Luton). These parameters give both the marginal increase per ATM in people in the 35+ NNI band and also that for people brought into the 45+ NNI band.

To convert the numbers affected into a value we follow the same methodology as that adopted by the Roskill commission. The number of people affected is converted into the number of households affected, on the basis of the projected household size. The depreciation in the value of property caused by the noise is the basis for the conversion of noise nuisance into money values. The Roskill Commission carried out a survey to indicate the depreciation in the values of residential property from being:-

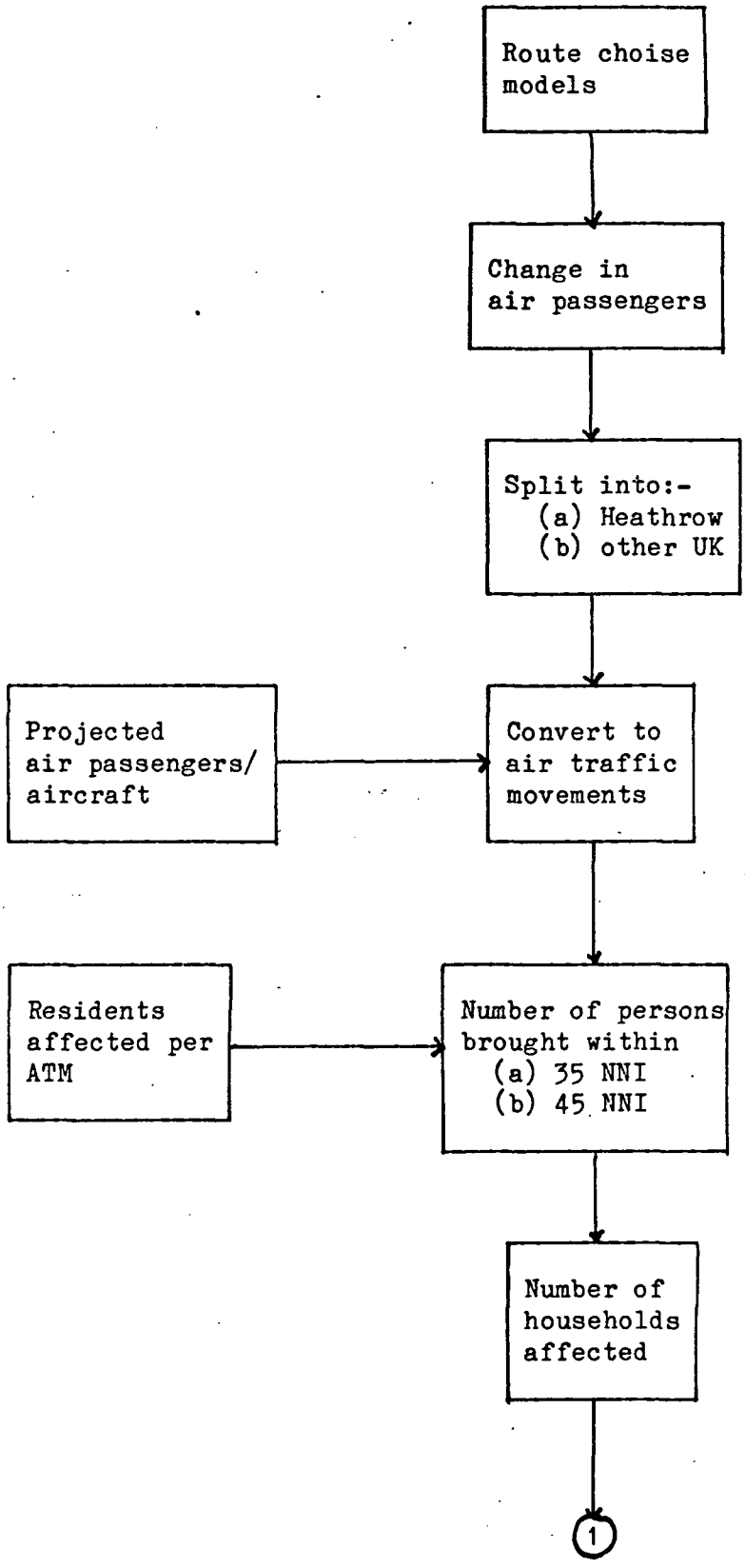
(a) brought within the 35 NNI band;
(b) being moved up into the 45+ NNI band.

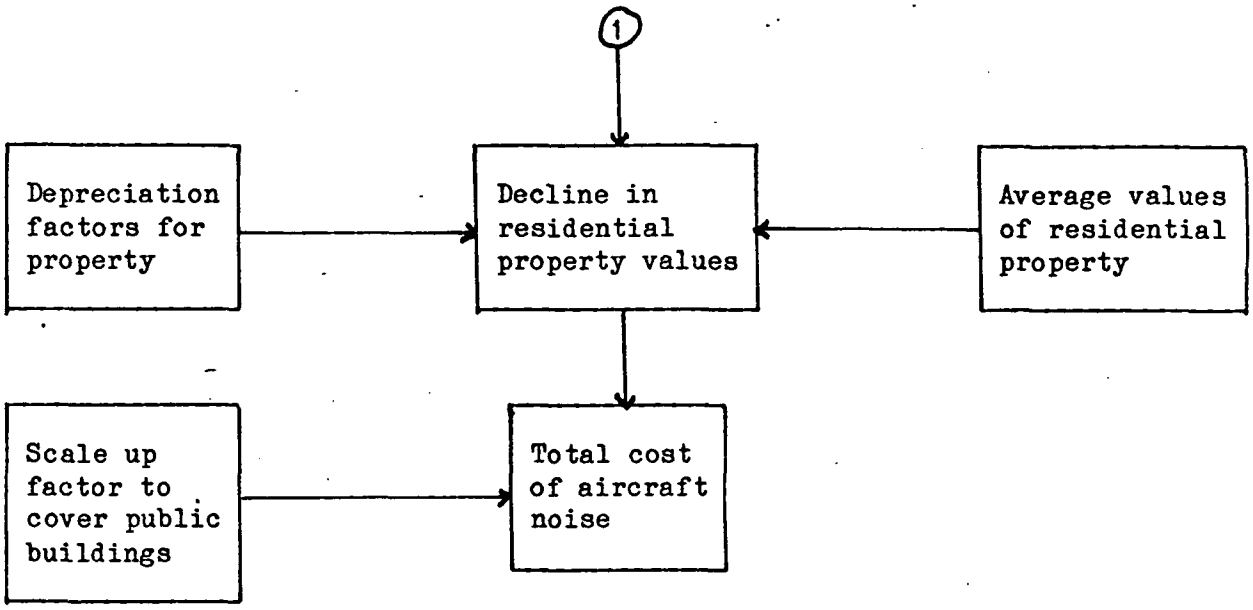
We use the same depreciation factor (%) as derived by the Roskill Commission applied to the appropriate average values of residential property. In addition, a factor is applied to the impact on residential properties to cover the cost of the aircraft noise nuisance on public buildings. This is the factor as used by the Roskill Commission, namely 1.75. The flow diagram in Figure 11.2.1 below illustrates the full procedure.

11.2.5 Air Pollutants

A fixed Channel link would give rise to changes in the levels and patterns of travel and transportation. Different levels of road traffic will give rise to different levels of pollution of the air from road vehicles. It is true that different levels of traffic by other modes e.g. air and rail will also affect the level of air pollution, but because of the relatively low levels of pollution per traffic unit by these modes, we do not intend to quantify them.

Figure 11.2.1 Methodology of Assessment of Aircraft Noise: Flow Diagram





The values of the parameters to be used and their sources are presented at Appendix N.

Vehicles on the roads cause pollutants to be discharged into the air. Losses from the fuel tank, carburettor and crankcase contribute to the hydrocarbons emitted. The main cause of air pollution is the exhaust gases. If oxidation were complete, water and carbon dioxide would be the only products of petrol in the internal combustion engine. In actual practice carbon monoxide is formed in considerable quantities, some fuel remains unchanged and some is converted into other organic compounds. Petrol also contains lead compound as 'antiknock' agents which give rise to lead compounds in the exhaust. In addition, some oxidation of the nitrogen in the air takes place so that oxides of nitrogen are formed.

Petrol and diesel engines give rise to similar products except that diesel engines in general give rise to lower levels. In particular, diesel fuel contains no anti-knock agent, and hence no lead emissions. Table 11.2.2 below illustrates the level of pollutant in tonnes per thousand vehicle kilometres as derived for U.K. vehicles.

Table 11.2.2 Pollutant Levels

(Tonnes per thousand vehicle kilometres)
(Source: Transport Statistics UK 1977)

	Petrol Vehicles	Diesel Vehicle
Carbon monoxide	0.034292	0.004866
Hydrocarbons	0.001676	0.000973
Oxides of nitrogen	0.001052	0.002879
Sulphur dioxide	0.000071	0.001500
Lead	0.000029	0.000000

In addition diesel vehicles emit dense foul-smelling smoke if they are incorrectly operated, mainly due to overloading, or bad adjustment. Visual checks in the U.K. at points on trunk roads where gradients made heavy demands on engines suggest that 15% of vehicles produce 'heavy smoke'.

Given therefore the information from the route choice models as to different levels of road vehicle movements, it is possible to convert these into the air pollution impact measured in 'tonnes of pollutant".

It is difficult to assign a monetary value to the benefit of reducing air pollution levels. The effects of these pollutants is discussed at Appendix Q. Though higher levels of pollutants clearly give rise to increased discomfort, there is no clear evidence of permanent health damage even at high urban traffic densities, with the possible exception of lead. One way of evaluating such increased levels would be to adopt an active cost avoidance approach. However, to do this we would need to relate the differential impact of the link to the overall base level i.e. to include all traffic on the relevant roads. Clearly the traffic we are considering represents a minute proportion of the overall traffic levels on European roads. If the impact were substantial in relation to the base total, then the pursuit of such an approach should be investigated. For this investment, the major impact in proportionate terms is on the Kent corridors, but as we shall see even in the most extreme case, the proportionate change in traffic levels even here is very modest. We therefore do not consider it useful to proceed to convert increased pollutant levels to monetary values.

11.2.6 Road Accidents

The U.K. Department of Transport assumes these accident rates on different kinds of roads[1]:

Type of Road	Personal Injury Accidents per 10 milion vehicle km
All purpose single carriageway	0.4
" dual "	0.25
Motorways	0.15

The basis on which the Department calculates the costs of accidents is explained in the Leitch Report[2] who concluded "we have no reason to believe that the department methods are deficient in view of the considerable difficulties of data collection and interpretation"[3]. The average costs per accident currently employed are:-

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1 Report of the Advisory Committee on Truck Road Assessment, HMSO 1977, para. 4.27

2 ibid paras. 4.28-4.33

3 ibid para. 21.15

Type of Road	Average Cost (£ at 1979 prices)
Urban roads	5860
Rural roads	10300
Motorways	10540

These costs include an allowance for the costs of unreported damage-only accidents.

11.3 The Single-Track Tunnel

The environmental and amenity impacts of such a link may be divided geographically into those:-

on the Continental side of the Channel;
in Kent; and
in London.

11.3.1 The Continental Side of the Channel

In the view of the French consultants given their discussions with the appropriate authorities no environmental or amenity problems will be caused by the tunnel.

11.3.2 Kent : The View of the Council

In 1973 B.R.'s plans required that through trains changed engines on the English side of the Channel. Their present plans do not require this as the locomotives will be able to draw current from the third rail on the British side or from the overhead supply on the Continent. Therefore all that B.R. requires for passengers is a station connecting with local services. Our understanding is that it might be at Ashford, Newington or Stanford. Kent County Council officers have told us that because of Ashford's status in their Structure Plan as a centre for growth, there is a case for preferring Ashford,[1] and the possibility of doing so is being explored by British Rail, which is also considering the location there of a freight interchange yard as well or instead. Our understanding, however, is that British Rail would prefer to locate the yard and also tracks for holding and inspecting trains at Cheriton, where there is a safeguarded site.

It is the view of officers of the Council that:-

"Although there are no detailed road traffic forecasts available for the proposal, the M20 from Maidstone eastwards would seem to provide adequte capacity for any road traffic generated by tunnel facilities, and the dual 2-lane Maidstone bypass section will require improvement even without any fixed channel crossing. Some increased traffic flows might be generated on the A259 coastal route to the west, and this again is identified in the Structure Plan as a route in need of improvement.

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1 Communication of 21/11/79 from Mr. W.H. Deakin, the County Planning Officer, who has stressed that the views put are those of officials and have not been confirmed by the Council.

> Local access into two of the possible terminal sites at Stanford and Cheriton would present little problem but road access to any facilities at Ashford would have to be examined in detail. It is possible that the local highway network together with the proposed Ashford southern orbital could cope with likely traffic flows, but that a passenger interchange in the town centre would require multi-storey car parking near Ashford station. Careful consideration needs to be given to the manner in which the British Rail proposal might develop in the long term. The M25 and M20 will provide good highway accessibility to any passenger station, which could prove a more attractive destination for such traffic than the proposed facilities in central London. Similarly, the road/rail interchange facility could prove attractive to road freight from beyond the immediate Kent area. The local access and environmental problems which might be created by such changes in operation need to be adequtely considered at the planning stage.
>
> It is not felt that the single bore tunnel proposal would remove the need for the all purpose dual carriageway road proposed between Folkestone and Dover, but would in view of its high cost make its economic justification more difficult. The road would be requred to carry local traffic and rol-on/roll-off port traffic."

While no detailed study has been made of passenger traffic which might join trains at Ashford, Newington or Stanford, the British consultants do not expect that more than a small proportion would do so, particularly if there were a station also at or near the M25 - a possibility which was investigated last time. Neither would we expect much freight to go straight to the tunnel unless it origins were local, since it would generally be cheaper if freight went by road to the nearest depot for trucking by rail.

The Council's officers also considered that the project has the least impact of the alternative fixed link schemes, although there would be a strong preference for confining terminal facilities to the urban area of Ashford and the safeguarded site at Cheriton. The tunnel has capacity for an extra 120 trains per day on the existing rail network and this could create additional noise problems along the route. The County Council would wish to ensure that adequate protection measures were taken.

Bearing in mind also their view on the consequences for employment which are to be discussed in section 12, it is important that on 9th October, 1979 the County Council's Planning and Transportation Committee agreed that on the information available the County Council would be unlikely to oppose on any issue of principle the tunnel project as now conceived, but before reaching a formal view it would require considerably more information as to the facilities and services to be provided and the impact of these on Kent's environment and economy. Strong objection would be likely to the use of Stanford in particular for terminal facilities, and there would be considerable advantage if it were possible to locate at least some facilities at Ashford in view of the town's growth status in the Structure Plan.

11.3.3 London

The effects on the built environment in London are more difficult to predict since no firm decision has yet been taken on where either the passenger or goods terminals should be placed. Strong possibilities for the passenger terminal are Victoria or Olympia or both. Possibilities for a freight terminal include Willesden, sites in South London and in or near Docklands.

The view put to us by officers of the G.L.C.[1] - which does not commit the Council - is that no matter what the decision on terminals, their siting would not be a major issue becuase of their limited scale. If, for example, the business traffic were mostly to go to Victoria, the view is that the problems of access will not be of a different order of magnitude from that of present and planned ferry services. Indeed, the effect on traffic flows is largely self-regulating. If there is congestion, fewer will use cars and taxis, and more will use public transport with which Victoria is well served. The extra loadings on it could easily be accommodated. Neither should there be any adverse planning implications there.

The G.L.C. have also looked at the consequences of siting terminals at Olympia and Docklands. Special roadworks should not be needed except for immediate access to terminals though there may be some need to give priority to roadworks already planned within half-a-mile.

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1 Communications by the Transportation Branch, GLC December 1979 without commitment by the Council.

Such local access schemes are unlikely to cost more than £10million. Olympia can have good Underground access, but the practicality of a Docklands terminal, in the officers' judgement, would depend on prior provision of major public transport links to the centre, undertaken for other reasons.

The Council, the Boroughs and BR safeguard certain sites for vast depots and believe that one or more of them should be the new freight depot if hey are required. In particular they point to Neasden, Nine Elms and the expansion of Stratford for international traffic.

As existing tracks will be used, the officers note that Channel services will only represent an increase on existing flows, though there could be considerable night operation. However, the use of lines in London is already intensive and many freight trains run at night in the Southern Region. Therefore they doubt that the additional Channel services will raise a critical problem.

11.4 The Double-Track Tunnel

The effects of this are different because of the substantial number of vehicles that will drive to the portals to entrain there for the crossing; and to a much more limited extent because of the possibility of providing depots for Motorail services elsewhere.

11.4.1 The Effect on the Continent

The consultations of the French Consultants suggest that the additional flows of traffic on the Continent are not likely to impose any particular problems, given the improvements in the road network that are already being planned.

11.4.2 Kent : The Views of the County Council's Officers

The officers note that there is no intention to revive the High Speed Link of the 1973 scheme. That involved taking land at certain points and the likelihood of considerable disruption. The scheme as at present envisaged would use the same track as now, just as the single-track tunnel would; and indeed the traffic going to London along it could be not much more. The 1973 plans assumed many more trains going to London. At present there are about 160 movements each week between Ashford and Folkestone. The single-track tunnel proposals would mean another 120 movements a day while the double-track tunnel in its previous form would have meant 60 further daily movements rising to perhaps 120 in time. The officers comment that in 1974 the proposal for a high speed rail link to London was the subject of considerable public objection, and although such a link is not regarded as part of the double-track tunnel project for the purposes of this evaluation, the substantial increase in rail traffic will inevitably cause problems of noise at some points along the route.

The officers used the Coopers & Lybrand forecasts of the early 1970s to note that a double-track tunnel would mean 9000 more vehicles a day in the summer on the M20 in 1990. Access to the tunnel facilities at Cheriton would be via the interchange currently under construction, and there would be sufficient capacity along the M20 except at the Maidstone Bypass, the widening of which would need to be brought forward by 7-10 years from the 1990s as a necessary part of the whole project. Although the tunnel removes a considerable volume of traffic from Dover, an improved A20 Folkestone/Dover link is still necessary in view of the high traffic flows expected in any event. It should be noted that the

consultants would now regard a figure of 5000 extra vehicles per day, the figure suggested by the 2000 high growth forecast, as being a high estimate of the extra traffic.

If the scheme were revived, it should be noted that the location of tunnel facilities preferred by the County and the Ministry of Transport in 1969 meant the construction of a ferry terminal of 138 hectares at Cheriton, a possible passenger station near Saltwood and a freight yard of 40 hectares at Sevington or Stanford, as well as emergency parks at Dibgate Camp.

The officers note that the terminal facilities required to serve the previous Channel tunnel would constitute major development in a rural areas which would normally be regarded as contrary to the County Council's policies for the conservation of productive agricultural land and good landscape. The project also involves a net increase in road traffic in Kent, compared to the situation without a tunnel, and there is therefore no environmental benefit to Kent from the diversion of road traffic to rail.

In conclusion, and bearing in mind the employment effect to be considered in section 12, the officers comment that this scheme in their judgement would have a significant impact on an attractive part of South East Kent, in terms of visual amenity, loss of farmland, and disturbance to residents. The County Council felt that normal planning policies could be overriden only if the project were in the national interest. In August 1974 the Department of the Environment was informed that the County Council policy should be to facilitate the most favourable solution to the problems of accommodating the Cheriton terminal, the high speed rail link and the necessary road works within the County of Kent. However, the County Council intended to resist the promotion of any Parliamentary Bill by British Rail until it was satisfied that all reasonable and practical steps had been taken to achieve a number of objectives, including minimising the impact upon the environment and re-establishing the economy of the Channel ports and adjacent areas.

11.4.3 London : The G.L.C. Officers' Views

The G.L.C. note that there would be significant problems posed by a double-track tunnel, though this does depend in part on how many extra trains come into London termini. No major motorail facility would be accepted in London though one might be acceptable on the M25. These objections may relate more to the 1973 version than to a variant which expects much the same rail traffic into London as the single-track tunnel; and which in particular does not mean taking any land for additional track, raising bridges or other major infrastructure improvements.

11.5 The Bridge

The difference between the problems posed by a bridge and double-track tunnel are several:-

(a) there will have to be different connections to the road and possibly to the rail systems;

(b) there will be less corresponding requirement for yards though some inspection and storage facilities will probably be necessary;

(c) the flows of road traffic will be greater;

(d) obviously there will be no need for London termini; and

(e) there will be impacts on the Channel itself.

11.5.1 The Continent

The French Consultants do not expect that a bridge would pose any considerable environmental effects in France.

11.5.2 Kent

The County's officers directed much of their observations at a bridge plus single-track rail facilitity, chiefly a tunnel.

The officers note that the preferred route for the bridge is between the South Foreland three or four kilometres east of Dover and Sangatte but the landfall could be immediately west of Dover harbour.

The officers noted that there would be much more road traffic if there were a bridge than if there were a double-track tunnel, and took a provisional view that very substantial road improvements would be needed throughout the South-East, in particular the main East-West road through Kent and the South coast road from Brighton to Dover should be improved to motorway standards. If there were a landfall at the South Foreland, a new motorway standard road round the north of Dover would be required to connect with the A2; and so as not to overload that road, it should continue as a high standard connection to the M20 at Folkestone, possibly along the route "A" between Dover and Folkestone currently being considered in consultation. However, if the landfall were to be to the west of Dover, the Folkestone-Dover road would need to be of motorway standard; and there might need to be better links with the A2.

The officers suggest that the cost of all these works might be of the order of £200 million. They also add that strategic road network considerations suggest that the landfall should preferably be west of Dover, if geological considerations rule out a landfall west of Folkestone. This is because a landfall at South Foreland is oriented towards the unsuitable A2/M2 corridor, whereas capacity will be much more available on the M20/A20 route. In any event the project clearly has implications for the current consultation on the improvement of the A20 route from the M20 to Dover. It is very important that associated inland road improvements required by this scheme are clearly identified, agreed and the additional cost attributed to the fixed-link scheme.

They are also concerned with the environmental effects of a bridge. The visual and environmental impact at the landfall of a bridge would have by far the greatest impact of the alternatives considered. Even if it were possible to avoid a substantial cutting in the chalk cliffs by the construction of a tunnel, the scale of the work involved would destory the landscape quality of the most critical part of the White Cliffs at Dover. This would be likely to be unacceptable in a locality designated as an Area of Outstanding Natural Beauty and Heritage Coast.

Similarly the impact of the bridge project inland in terms of the new motorway standard roads required, which would cross ridge-and-valley topograph of great landscape value, including a service area at some point, is by far the worst of the alternative projects. The motorways required linking either landfall with the A2 and M20 routes would cause severe damage to the Area of Outstanding Natural Beauty, and related major improvements to the A259 coast route west of Folkestone would also have a considerable environmental impact.

11.5.3 London

By the time road traffic reached London it is likely that it would be sufficiently dispersed not to add appreciably to the volume that any one road would otherwise carry.

11.5.4 The Bridge Itself

The beauty or otherwise of the bridge is largely a matter of design. Since there are many designs and several variants of each design, in some cases using very different materials, no conclusion can be reached - even if it lay within the Consultants' competence - whether an actual bridge would be an eyesore or of majestic beauty.

Similarly the extent to which it can be used in all weathers may be a matter of design but prima facie it would seem less feasible for it to be used in thick fog or heavy storms (while such conditions would not affect the use of a tunnel).

A difficult question of engineering - and therefore outside the terms of reference of this study - is the extent to which it is true - as scheme proponents have suggested - that if there were a collision between even the largest ship and a pier, it would be the ship that would suffer. On the face of it, the risk of oil pollution must increase, thought it is only fair to report the view of scheme proponents that with wide spans, the risk of collision is extremely slight. Ships have far greater navigational problems elsewhere in the world than would be posed by a bridge - the piers of which would be easy to protect with lights and fog-horns. Moreover, it has been put to us that the divisions of a bridge might make it easier to achieve lane discipline among ships and so reduce collision that way. The reduction in the number of ferries - this would be true too of the double-track tunnel - would itself reduce the risk of collision.

A related point is that we understand that if there were to be a bridge - or for that matter a submerged rather than a subterranean tube - there would need to be an international treaty not only between France and the UK but also all nations whose ships use the Channel. It can be assumed that its negotiation would not be easy given the variety of the interests and issues involved.

11.6 A Submerged Tube Project

11.6.1 Kent: The County Council Officers' Views

While generally the problems of a submerged tube would be similar to those of a bridge, the Kent County Council officers also gave a view on the issues it would raise in the vicinity of its portals. The submerged tube would contain a two-lane road and a single-track railway. Its landfall in Kent would be immediately west of the Admiralty pier in Dover on a reclaimed terminal site of 44 hectares. Direct access to the M20 would be needed for motor vehicles while the rail track would enter the single bore tunnel between (Heriton and Shakespeare Cliff proposed by British Rail as the inland section of their current project.

The officers suggest that the road traffic attracted by the Tube would probably require the construction of a dual three-lans extension to the M20 from Folkestone to Dover. It would also be necessary to adopt a route which provides direct access to the terminal area. There could, however, be considerable difficulties in accommodating roadworks on this scale on the 'red' or 'blue' routes at the western entrance to the town. The alternatives currently being considered for a two lane all purpose road between Folkestone and Dover would clearly need to be reconsidered, and it may be that the tunnel route 'E' is the only practicable solution. Additional costs would attach to the Tube scheme. As with the previous Channel Tunnel scheme it would be necessary to bring forward improvements to the Maidstone Bypass, and further highway works might be required to improve the A259 south coast route.

In environmental terms, difficulties would arise; the reclamation of an area to the west of Admiralty Pier at Dover, although not desirable, would be acceptable. More serious and harmful would be the likely impact upon both the chalk cliffs and the urban environment of Dover caused by linking a high standard extension to the M20 to the terminal facilities and the local road network. An acceptable solution might not be possible without placing the M20 extension in a tunnel to remove traffic from the Tube inland.

Even so, the dual three-lane motorway required by this scheme would have a much greater impact upon the Area of Outstanding Natural Beauty between Folkestone and Dover than the current proposal for a dual two lane all-purpose road. The increased impact would in particular attach to the roadworks necessary to climb the North Downs scarp in the vicinity of Holywell. Again, this may require tunnel route 'B', and if so, the additional costs would be attributed to the Tube scheme.

11.6.2 The British Consultants' Views

Except for the possibility - recognised by the scheme proponents - that a higher proportion of would-be users might be deterred psychologically from driving along a submerged tunnel by comparison with a bridge, there should be no real difference between its environmental impacts inland from those of a bridge.

11.7 The British Consultants' View

11.7.1 Road Noise

We have considered the implications for the environment of differences in the levels of road traffic caused by the link for four road corridors, which we consider to be those most affected. These corridors are:-

(a) the A2/M2 and A20/M20 roads from the Kent ports to London;

(b) the A259 South Coast road west from the Kent ports to Brighton;

(c) the A45 and A604 access roads from Colchester and Ipswich to Harwich and Felixstowe; and

(d) the roads giving access to Harwich and Felixstowe from the Midlands and the North; that is, the A45, the A120 and the A604.

The likely differences in traffic resulting from the presence of the link have been assessed for the year 2000 in the high growth scenario. This is because this is where the impact will be largest. In the low growth scenario, the number of vehicles carried by the link is roughly half that in the high growth case; we will therefore assume that any impact on road use will be roughly halved.

The effect of the various links on traffic on these corridors is summarised in Table 11.7.1. Unfortunately, estimates of the base level of non-port traffic were only available for the London-Kent ports corridor. As can be seen, the impacts of the link schemes differ from one another. The double-track tunnel and, more strongly, the bridge scheme result in an appreciable increase in the number of cars and lorries along the roads to the Kent ports. Averaged over the year, the bridge results in a 9% higher level of cars and a 35% increase in the number of lorries on the Dover end of the London-Dover corridor. Large though these increases seem, they are nowhere near the proportions required to produce a change in noise levels greater than 3 dB(A) L_{10}, and would thus be ignored by current UK DTp criteria. The same would be even more true of the low growth scenario.

The extra traffic on the roads to the Kent ports has mostly been diverted from other roads, although some is generated traffic. The diversion will be from roads serving Southampton, Portsmouth, Newhaven, and the Haven ports. The diverted traffic from the roads seving these ports will, with the exception of the Haven, be a very small fraction of the total traffic, since Southampton, Portsmouth and Brighton are large population centres. The roads to Harwich and Felixstowe merit attention, however, since some of them are at present subject to severe overloading. Planned improvements to the A45 will largely remove this problem for Felixstowe traffic, and traffic from the ports for London and the South-East can use the high-standard A12. Problems arise with traffic from Harwich for the Midlands and the North. The most direct route for this traffic is the A604 from Colchester to Cambridge, a road highly unsuitable for heavy traffic. While the responsible highway authorities would rather the Harwich traffic use the less direct routes via the A45, or the A120, which is planned to bypass all settlements in the near future, any reduction in traffic on the sensitive A604 would be welcomed. Otherwise, the savings in traffic on roads in East Anglia and Essex are considered environmentally beneficial but not of great significance in terms of noise or pollution.

The increased levels of traffic predicted for the A259 Kent coast road may be of some significance given the present low standard of this road, but again are unlikely to result in changes in noise levels of the level regarded as significant by the DTp criteria.

The effect of the single-track tunnel is to reduce levels of traffic on all the roads considered by relatively small amounts. Thus the comments of Kent Council officers on possible necessary road improvements are unlikely to be applicable.

Table 11.7.1 Impact of the Links on Selected Roads

(thousands of vehicles per year: 2000, high growth scenario)

	Non-port traffic		Port traffic (no link)		Impact of single-track	Impact of double-track		Impact of road bridge		Impact of bridge & rail	
	Cars	Lorries	Cars	Lorries	Lorries	Cars	Lorries	Cars	Lorries	Cars	Lorries
A2/M2 & A20/M20 (Dover/Folkestone end)	11950	1328	3996	873	-166	671	364	1405	780	1405	604
A259 Kent coast	n.a.		419	82	-9	54	26	151	41	151	33
Haven port access roads	n.a.		1015	1326	-76	-280	-196	-483	-232	-483	-321
A604 & A45 inland	n.a.		559	762	-46	-106	-105	-253	-98	-253	-157

11.7.2 Aircraft Noise

We have illustrated the evaluation of the impact of aircraft noise for the year 2000 in the low growth case, as it is here that the diversion from air to the link is greatest. We believe that any effect on Continental airports will be negligible, since the traffic is spread so thinly. We have therefore concentrated on UK airports.

A problem arises in that the French consultants have not distinguished in their route choice between London and other UK airports. we have assumed that 90% of their traffic goes to London airports, and 60% of this to Heathrow. The same proportion, 60%, of the British consultants' forecasts of "London" air traffic, is assumed to use Heathrow. The resulting changes in passenger movements are shown in Table 11.7.2.

Table 11.7.2 Changes in Passenger Movements at UK Airports

(thousands of movements; 2000, low growth scenario)

	Heathrow	Other UK Airports
Single-track	-1570	-1484
Double-track	-1940	-1800
Bridge	-370	-300

Following through the analysis described in section 11.2.4, we obtain the following monetary values for the benefit to residents near UK airports arising from the link:-

single-track:	£4.24m
double-track:	£5.22m
road bridge:	£0.98m

It should be noted that this is a once-for-all benefit, not an annual flow.

11.7.3 Air Pollution

The existence of the links will make a difference to levels of air pollution caused by road vehicles, with the double-track tunnel and the bridge increasing levels and the single-track tunnel decreasing levels. To assess the importance of this effect we need to estimate the levels of pollutants existing in the absence of a link. No information was available for Continental Europe, but for the UK, published figures were available for the vehicle-kilometres travelled in 1977. Figures from the UK Department of Transport National Traffic Forecasts suggest an elasticity of road transport to GDP of about 0.75; using this figure for our high growth scenario gives the following estimates for vehicle-kilometres in the UK in the year 2000:

Petrol vehicles:	375 thousand million
Diesel vehicles:	38 thousand million

This assumes that methods of propulsion will remain as at present, although it is likely that there will be a move towards less polluting technologies.

The estimated changes over the whole UK as a result of the links are shown in Table 11.7.3.

Table 11.7.3 Changes in UK Vehicle-Kilometres as a Result of the Link

(millions; 2000, high growth scenario)

	Petrol vehicles	Diesel vehicles	% change petrol	% change diesel
Single-track	-	-62	-	-0.16%
Double-track	83	82	0.02%	0.21%
Road bridge	243	172	0.06%	0.45%
Bridge with rail	243	103	0.06%	0.27%

It can readily be seen that any changes in the overall pollutant level will be negligible. Use of the figures in Table 11.2.2 show that the largest percentage increase in pollutant levels will be a 0.15% increase in oxides of nitrogen in the presence of the road bridge. For the low growth scenario, changes will be even lower.

Of course, the real importance of air pollution is at a local level. The changes in traffic that result from the presence of the link are heavily concentrated in the areas discussed in the previous section. Here we note that the increased traffic levels at the Dover/Folkestone end of the London-Kent corridor will imply an increase of 5-15% in pollutant levels for the double-track tunnel, and 10-30% for the road bridge, in the year 2000, in the high growth scenario. in proportion to the increase in traffic.

Although we have no information on base levels of pollutants on the Continent, all indications are that the effect of the link will be proportionately smaller than in the UK.

11.7.4 Road Accidents

The changes in vehicle-kilometres which result from the presence of the links are summarised in Table 11.7.4. The year 2000 in the high growth scenario is chosen as it is here that the effect will be greatest.

Table 11.7.4 Changes in Vehicle-Kilometres as a Result of the Link

(millions of vehicle-km: 2000, high growth scenario)

	UK	Continent
Single-track	-82	-221
Double-track	165	331
Road bridge	415	1009
Bridge & rail	346	752

Using the figures given in section 11.2.6, and assuming that the appropriate factor is approximately 0.2, intermediate between those for motorways and dual carriageways, we obtain the figures shown in Table 11.7.5 for the change in accidents involving personal injury. At the current costs used for evaluation of road accidents, the cost of these extra accidents is very small. We have used the cost figure appropriate for rural roads, and have applied UK value to the Continental figures, where information is not available.

Table 11.7.5 Changes in Road Accident Rates as a result of the Links

(accidents per year: 2000, high growth scenario)

	UK		Continent		Total	
	Accidents	Costs	Accidents	Costs	Accidents	Costs
Single-track	-2	-0.017	-4	-0.046	-6	0.063
Double-track	3	0.034	7	0.068	10	0.102
Road bridge	8	0.085	20	0.208	28	0.293
Bridge & rail	7	0.071	15	0.155	23	0.226

(Costs are in millions of £ per year, 1979 prices).

The impact of the links on accident levels will be even smaller in the low growth scenarios by approximately half.

The accident rates for other modes of transport are assumed to be negligible.

11.7.5 Summary

The environmental impacts of the links are summarised in Table 11.7.6. In this table, a plus sign signifies a favourable environmental impact, a minus sign an unfavourable one. A blank indicates a negligible impact.

According to most environmental criteria, the tunnels have a much more favourable impact than the bridge. The bridge increases road traffic and thereby road noise, accidents and air pollution, and does not reduce aircraft noise to the extent that the tunnels do. In addition, its impact on the visual environment, landscape, etc, is likely to be very great. Of the tunnels, the additional terminal facilities required for the double-track tunnel will have an environmental impact, and this tunnel will also increase road traffic, though not nearly so much as the bridge. The single-track tunnel, on the other hand, reduces road traffic.

While all the environmental impacts examined in this section have been very small, it should be borne in mind that the greater the unfavourable environmental impact of a scheme, the more it is likely to be subject to long and damaging delays for planning inquiries and other difficulties. This would appear to be a point in the favour of the single-track tunnel, with its favourable environmental impact.

Table 11.7.6 Environmental Impact of the Fixed Link Schemes

	Visual Environment		Road noise	Air pollution	Aircraft noise	Accidents	Legal & international difficulties
	UK	Continent					
Single-track tunnel			+	+	++	+	
Double-track tunnel	-		-	-	++	-	
Road bridge	--		--	--	+	--	-
Bridge with rail	-		-	-	+	-	-

12

DISTRIBUTIONAL IMPACTS

12.1 Approach

It is inevitable that a fixed Channel crossing will confer net benefits on some groups and individuals, but impose net costs on others. As such it could never be possible to say that a crossing would result in what economists call a Pareto improvement in welfare, that is an outcome which leaves some better off, but nobody worse off. The returns to a fixed link that have been calculated already do not take account of such distributional issues.

Four issues seem of particular importance. There will be different gains and losses for different:-

(a) transport interests;

(b) regions within countries;

(c) industries. This last is often considered more one of economic efficiency than of distribution but reasons are given for its treatment as the second in this study; and

(d) member-states of the European Communities and other countries. This will be considered in Section 13 where Community Benefit is discussed.

12.2 The Distribution of Costs and Benefits Among Transport Interests

12.2.1 The Approach

In the first stage of our cost-benefit study, the geographical area used for the evaluation has been the world as a whole. However, the distributional aspects between countries may affect a decision to proceed with the project.

We have already identified above the groups who may be affected by a fixed Channel crossing, as follows:-

The Crossing Operating Authority
Ferry operators (including hovercraft)
Airlines
Ports
Airports
Railway undertakers
Road authorities
Transport users,

and have calculated as far as possible the costs and benefits accruing to these groups in the event of a crossing being constructed. Here we break those figures down according to the country in which the loser or beneficiary was located.

12.2.2 The Distributional Impact of the Transport-Cost Benefit Study

To go through the distributional implications of all the combinations of discount rates, growth-scenarios and projects would be laborious. Therefore Table 12.2.1 shows them only for the 3% and 10% discount rates.

Table 12.2.1 The Distribution of Benefits and Costs Among Transport Users and Producers

£m, January 1979 prices, NPVs discounted to 1979

Project	Single Track Tunnel				Double Track Tunnel				Bridge				Bridge and Rail Facility			
Discount rates	3%		10%		3%		10%		3%		10%		3%		10%	
Growth Scenarios	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H
The Link	2162	2265	213	223	4214	6631	280	612	1725	5201	-739	-283	2999	6512	-696	-245
User Benefit: Passengers	1193	1512	250	304	2950	4974	551	812	2785	5573	448	798	3180	5702	518	868
Freight	342	414	69	81	776	1167	141	198	512	1007	83	155	1415	1315	199	199
Ferry Lo-Lo	-51	-80	-11	-17	-112	-233	-23	-41	-56	-125	-9	-18	-116	-262	-21	-41
Operators Ro-Ro	-1191	-1148	-196	-145	-2122	-3452	-277	-329	-1579	-3151	-262	-228	-2164	-3595	-236	-106
Sea Ports	-132	-116	-29	-20	-194	-351	-47	-60	-115	-329	-25	-46	-206	-438	-43	-63
Airlines	-504	-674	-118	-150	-521	-711	-132	-165	-397	-697	-65	-101	-442	-636	-95	-125
Airports	-22	-23	-10	-10	-28	-31	-13	-14	-1	1	0	0	-18	-19	-7	-8
Railways	849	942	163	177	935	956	165	162	-74	-345	-12	-49	634	590	107	98
Roads: Authorities	0	0	0	0	-2	-2	-3	-3	-157	-157	-91	-91	-157	-157	-91	-91
Operators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2645	3092	330	443	5898	8948	643	1171	2642	6977	-573	135	5125	9013	-345	405

12.3 The Distribution of Benefit Between Regions

12.3.1 Approach

E.E.C. Regional Policy is designed to supplement national policies with regard to the structural adaptation of areas specified as Development Areas, Conversion Zones or other names for areas requiring special developmental assistance. Currently such areas in the UK include all of Scotland, Wales and Northern Ireland, all of the Northern Region and parts of the North West and South West regions of England. The areas closest to the proposed fixed cross-Channel link in the UK, namely the South East, East Anglia, West Midlands, are not designated for special assistance.

In France, the other country where the impact of the fixed link will be most felt, a large part of Western, Central and Northern regions are eligible for special aid. The French end of the link would be located within one of the special areas - the Pas de Calais.

In the analyses which follow we explore the question of the regional incidence of the costs and the benefits of building and operating a fixed link. Thus, if it can be shown that a fixed crossing causes net costs to the regions designated as requiring development assistance, then this should be drawn attention to as a conflict between Community Regional Policy and those policy objectives which would be furthered by the construction of a link. A more likely situation would be where the benefits arising from the link were concentrated in areas not so designated. We have illustrated our methodology for regions in the UK on the grounds that such conflicts are most likely there, whereas in France it is likely that construction of a link would further the objectives of regional policy, especially for the Pas de Calais. However, the methodology employed here could also be used to estimate impacts on French regions.

12.3.2 Potential Impacts

The regional impact of a fixed link can be considered under five distinct, though related, headings. There is first the possibility that public funds used to create and operate a fixed crossing are, in effect, diverted from more pressing socio-economic needs in Development Areas. The question of whether the use of private funds in a fixed link removes this potential conflict, is a related issue. Secondly, if a link is built, the construction phase will result in a creation of jobs and of demands for

semi-finished and finished goods and services. The regional incidence of the benefits from these new demands, including positive regional multiplier effects, is liable to vary. Similarly, the construction phase is likely to result in some jobs and demands for other inputs being destroyed as investment decisions relating to existing cross-Channel links are cancelled. This phase is also likely to cause environmental costs to those directly or indirectly affected by construction operations. Thirdly, the link will have an impact on patterns of leisure and business journeys, and on the costs incurred by making these journeys; this impact is likely to be greater for regions closer to the link. Thus, for example, South-East residents may be stimulated by the presence of a link to make more leisure trips abroad, to a greater extent than those in the North. Additionally, the reduced costs might make the South-East an even more greatly preferred destination for Continental tourists. A fourth potential area of impact is the effect of a link on trading relations, both for U.K. producers region by region selling to the Continent and for U.K. regional products buying from each other. Thus the creation of an added link may affect the propensity of a South-East producer to buy from the Continent rather than another British region. The regional origin of imports from the Continent and the U.K. regional destination of such imports may also be affected by the fixed link. Finally, the net effect of a fixed link may be to increase the locational advantages of the South East for those industries particularly sensitive to the need for rapid and always available personal or freight links to and from the Continent. If such effects occur they are likely to affect the location of investment decisions in specific sectors, so adding to the agglomeration economies of the South East.

These potential impacts can be presented diagrammatically as follows:-

U.K. Regional Impact of a Fixed Channel Link

Construction Phase →

Jobs created, inputs required, by region + Positive multiplier effects, by region

minus

→

Jobs destroyed; other inputs not required, by region. Negative multiplier effects, by region

minus

→

Negative environmental effects

Operating Phase →

Distribution of user-benefits: passengers and freight

→

Trading relations (net effects): U.K. regions to Continent U.K. regions to U.K. regions Continent to U.K. regions

→

Investment decisions: specific sectors, locational impact

The methodology set out below specifies the key issues to be considered, the method of considering these issues and the sources of data to be used in a conclusion.

One consideration is the extent to which the Development Areas should not be regarded as a set. A fixed crossing will be a national asset open to all willing to pay whatever charges are levied. Benefits will be generated for all regions, though total benefits, region-by-region, are likely to be affected by distance from the portals. Thus Wales (as a Development Area) may benefit more than Scotland (another Development Area). It follows that a realistic assessment of the impact of a cross-Channel link on regional policy objectives must take account of these potential differential effects on different Development Areas.

12.3.4 Diversion of Funds

If the fixed crossing is built and operated with public funds, therefore affecting the Public Sector Borrowing Requirement, an obvious question is whether this represents a diversion of funds away from regional policy objectives. In a simple sense this must be the case. Any funds invested outside the Development Areas entail, as an opportunity cost, the impossibility of investing them in a Development Area. However, this cannot be used as a criterion for political judgement, for pushed to its logical extreme it would imply that no public resources should ever be spent outside the Development Areas. The more realistic way to formulate the question is to ask whether the marginally higher public expenditure allocations, per capita, made to Development Areas, are jeopardised by investment in a fixed link.

In seeking to answer this question the following factors may be relevant. Government may not wish to regard those objectives furthered by the presence of a link as alternatives to regional objectives. Thus both may be regarded as equally high priorities with economies being made in other areas of public expenditure. Secondly, a commitment to a fixed link need not necessarily entail an increased public investment in Channel crossings as a whole. Thus if investment in a fixed link replaces investment which would have been made in other methods of crossing, then there is a marginal increase in resources used only if that substitute is more costly than the alternatives. If that substitute is cheaper, then there is a net public expenditure saving. However, for this comparison the time dimension; must be considered; the savings in investment (and operating costs) in alternative means will tend to accrue after the construction of the fixed link.

Many of the same issues arise if private funds rather than public funds are used. Regional policy has always sought to divert private funds to the Development Areas by a combination of subsidies the restraints on investment elsewhere. Private investment in a fixed channel link could be seen as a diversion of private funds away from regional objectives. Once again the key question is whether the fixed link investment substitutes for private investment which would have been made anyway and whether such a substitution requires additional resources.

12.3.5 Construction Phase Effects

Estimates have been made of the sectoral breakdown of the capital expenditure of a fixed link (see section 12.5). They include the direct construction inputs required in situ. In addition, for the multiplier exercise an estimate has been made of the source of these input requirements at a country level e.g. the extent to which the steel will be produced in the U.K. Given the knowledge of the existing regional production facilities, the likely regional production can be estimated. Where production facilities are ubiquitous, no special regional allocation will be made.

Similar estimates have also been made of the net investments "saved" in existing cross-Channel facilities. As with the investment in the link itself, the regional impact of this reduced investment will be estimated.

In addition to the direct effects described above, there will in turn be induced multiplier effects. The multiplier analysis will indicate the overal GDP impact by sector by country, and comparison with the direct effects will yield estimates of the 'second and later round' impacts for each sector. Where regional production facilities for a sector are not ubiquitous, it will be possible to indicate the regional impact based upon the existing regional facilities.

The limitations of this analysis are imposed by the limitations of the multiplier analysis, in particular the sectoral classification. The two most important, and in general the most localised, sectors we would wish to consider are steel and ship-building. As we have seen, with the harmonised data available, these two industries are each subsumed into a broader sectoral classification: "ferrous and non-ferrous ores and metals" in the case of the steel industry, and "transport equipment" in the case of the ship-building industry. Thus, though it may be possible to know, for example, the elements

of the differential final demands on the 'transport equipment' sector that relate to ship-building, it is not possible to have the same knowledge of the induced impact on the same sector as indicated by the multiplier analysis output.

The application of this methodology is illustrated with respect to only one fixed link scheme.

12.3.6 Operating Phase Effects

Distribution of User Benefits

User benefits will accrue from the existence of a fixed channel link due to:-

(a) the time savings on the link itself; and
(b) the lower tariffs on the link itself and also the lower tariffs on other routes and modes caused by the competitive reactions of operators.

This applies both to passengers and freight.

As it is assumed that the competitive responses will be greatest for routes close to the fixed link, traffic already using such routes, and to a lesser extent traffic diverted to such routes, including the fixed link itself, will share in the user benefits. It is unlikely therefore that the regional distribution of benefits will be equal to the regional distribution of the overall traffic. For example, traffic originating in Kent, which without a fixed link would use the French and Belgian Straits sea routes, will have a higher user benefit, per unit of traffic, than traffic from the North which would use Hull as its major U.K. port.

Given the methodology of the route choice models, the level of user benefits can be readily identified. We intend therefore to examine the differential between their incidence with respect to three U.K. areas: Scotland, a Development Area remote from the portals of a fixed link; Wales, another Development area, but the U.K. Development Area closest to the portals; and Kent. The analysis will be carried out for:-

(a) U.K. leisure travellers:-
  (i) accompanied car;
  (ii) independent non-car;
  (iii) package non-car;
(b) freight:-
  (i) imports to the U.K
  (ii) exports.

In the case of leisure traffic, it is clear to whom the user benefits accrue - the passengers themselves. In the case of freight, our analysis will indicate the level of user benefits available, separated by imports and exports, without specifying whether they accrue to the importer, to the exporter, or are split between them. This area is being examined by SETEC under the title "Distribution of Costs and Benefits".

12.3.7 Impact on the Pattern of Trade and Passenger Journeys

The effect of the reduction in the generalised costs of freight transport will give rise to a generation of trade between the U.K. and the Continent. Insofar as the distribution of user benefits will be unequal between regions, then the distribution of this generated trade between regions will reflect this. SETEC are examining this question. We shall not consider the extent to which this increased UK-Continent trade is likely to affect the intra-U.K. trade flow.

Similarly, the existence of a link will tend to generate increased passenger journeys, both leisure and business, and the pattern of this inward traffic is, as with increased trade, likely to be different to the base traffic in the no-link case.

12.3.8 Investment Decisions

The best methods of indicating whether certain industries or activities are likely to shape their location investment decisions differently because of the fixed link, are to:-

(a) estimate cost/time/flexibility savings to them of a link;
(b) question them directly in the light of their future investment strategy.

12.3.9 Evaluation of Regional Impact

Diversion of Funds

In terms of UK capital costs and leaving aside the question of whether the sources of funds are private or public, there is unequivocal evidence that the building of any one of the alternative forms of fixed link would result in lower capital and maintenance costs than the development and maintenance of existing methods of crossing, all for a given volume of traffic. These savings in capital investment are most pronounced when the comparison is with likely capital expenditure streams for Ro-Ro ships and hovercraft. But there would be substantial savings to be gained in the limitation of Ro-Ro port and Lo-Lo port expenditures. Thus even if we take both a low growth scenario and the type of fixed link which will divert least traffic of all kinds from existing facilities (the single-track), the capital savings up to the year 2000 would be £447 million made up as follows.

Savings in Capital Expenditure

	£ million
UK Ro-Ro port	11
UK Lo-Lo ports	4
Ro-Ro ships	432
	447

In addition to the reduction in future capital expenditure, the operating costs of the fixed link are considerably below the reduction in operating costs of alternative modes (in the low growth, the saving is £60 m in the year 2000 considering only ferry operators).

The implication is clear. For a given volume of UK-Continental traffic, the capital and operating costs will be lower if a fixed link is built than they would be if no fixed link is built. Since some of these potential savings would accrue to the public sector, then there is no *a priori* case why regional policy spending would be impaired. Indeed, logically, the freeing of capital resources would enable government, should it so desire, to add to regional policy spending. The critical question then becomes the precise effects of a fixed link upon the well-being of the problem regions, a question we turn to next.

Construction Phase Effects

In the methodology specified in the previous section it was suggested that we could distinguish between construction phase effects and impacts during the operation of a fixed link. In the construction phase we suggested that the link would create demands for inputs including labour in particular regions and these demands would generate income to companies and individuals with consequent income and employment multiplier effects locally when these incomes were spent. Offset against these positive effects would be negative regional effects as demands were reduced for inputs, which would have been required had existing UK-Continental methods of linkage been maintained. We stressed that only if these positive effects had the same locational incidence as the negative impacts could we choose to ignore spatial effects flowing from a fixed link.

The principal materials which would be used in any of the fixed link are concrete and steel. Given the low monetary value of concrete for unit weight (i.e. transport costs high relative to value) and the marked economies of scale in concrete production, there is a very high probability that all concrete production will be located as close to the portals as is feasible. The problem regions of the UK will not benefit directly or indirectly.

With regard to steel the picture is more complicated. Probably the only fixed link which will require large quantities of steel is the bridge. For the rail tunnels, no final decision has been made as to whether the tunnels are steel-lined or concrete-lined. In the previous Channel Tunnel studies, the decision was that for the most part the double-track tunnel would not be steel-lined on considerations of cost and speed of construction.

For the bridge, the estimates suggest that 460 thousand tonnes of steel would be required at a value (1979 prices) of £456 m as shown below in Table 12.3.1. All of the steel to be used could be produced in the EEC, though the scale of demand for wires and possibly cables is so great relative to existing capacity, that overseas imports would be necessary. Indeed, the likely demand for wire is equivalent to one third of world capacity.

Table 12.3.1 Bridge - Steel Requirements

		Quantity (000 tonnes)	£m
Suspended structure:	main cables	130	130
	: wire strand hangers	4	6
	: steel deck	130	130
Towers	: high tensile steelwork	70	70
Piers	: steel reinforcement	20	5
Approach spans	: steel deck	100	100
Piers to Approach spans	: high tensile steelwork	6	15
		460	456

In the case of the bridge there is little doubt that the scale of the demand for steel is very large and that the bulk of any demand placed in the UK could be satisfied in three of the principal areas designated for regional assistance namely Scotland, the Northern Region and Wales. Collectively these three areas have about 60 per cent of British steel industry capacity and accordingly there is little reason to doubt that they could all benefit directly and in a major way from the construction of the bridge.

Even if their contribution was limited to fulfilling part of the demand for steel decks (£230 m total value) then the value of work ordered might well reach £70 million.[1]

With the other forms of fixed link, the likely scale of demand for steel is much more conjectural. In the single-track tunnel it has been estimated that 1.5 million tonnes would be required if it was steel-lined (£150 million in value). But a more likely outcome is a demand for steel mainly limited to rail track and rolling stock (£110 million total cost). With the double-track scheme the additional rolling stock estimated cost would be £85 million for ferry trains.

Now if the demand is mainly for rail track, the problem regions are liable to benefit markedly. By contrast rolling stock capacity is spread much more evenly throughout problem and non-problem areas, so that the direct benefits to the problem areas are likely to be relatively limited.

1 £230 million value; 50% French share = £115
50% UK share £115
Problem regions share = $\frac{\text{£115 million}}{60}$ = £69 million

Offset against these potential gains to the problem areas are potential losses especially in terms of reduced ordering for Ro-Ro and Lo-Lo vessels not built as traffic is diverted to the fixed link. To obtain some idea of the magnitude of these potential reductions in demand we scrutinised the nation of building and the year of entry of 89 vessels currently operating on UK-Continental sea routes.[1] The UK builders accounted for almost one quarter of all vessels built, with West Germany and France providing the biggest national proportions of the residue. (Table 12.3.2) However, the critical point is that unlike every other nation the British fleet did not contain a mixture of older and newer vessels.

Table 12.3.2 Operational Vessels - UK/Continental Routes

Country of Construction	Number Built	Percentage of All Vessels	Number Built After 1969	Percentage of post 1969 Vessels
United Kingdom	22	24.7	2	5.4
West Germany	17	19.1	11	29.7
France	15	16.9	7	18.9
Belgium	10	11.2	4	10.8
Norway	8	9.0	4	10.8
Denmark	7	7.9	4	10.8
Netherlands	7	7.9	3	8.1
Italy	1	1.1	1	2.7
Ireland	1	1.1	1	2.7
Sweden	1	1.1	0	0.0
	89	100.0	37	99.9

Indeed nearly all of the British vessels were at least ten years old and recent growth in the British fleet has been concentrated on hovercraft. If we assume that British operators wished to maintain their share of the market by modernising their fleet and that they would be biased to buying in the main from British shipyards because of government subsidy policies then the advent of a fixed link would stifle this replacement demand. In 1980, five new vessels will be added to the ro-ro fleet on the French Straits routes - two of these were constructed in the UK, and three in West Germany.

1. This does not account for all vessels as some could not be classified by nation of building and/or year of entry.

In a detailed analysis of a series of factors relating to traffic growth, traffic diversion to the fixed link, use of existing vessel capacity, replacement policies, competitive strength of UK operators, the scale of real subsidies to order from British yards, we have calculated the effects of a fixed link on vessel demand. This analysis suggests that for a single-track £432 m would be saved by the year 2000, for a double-track £924, £807 for a road bridge and £1086 for road and rail (low growth scenario). In turn this translates into a reduction in demand for vessels from British yards. The magnitude of this reduction depends of course on where such orders would have been placed. If the UK share were equal to the current share of the existing fleet, namely 25%, then the effects on the problem areas of Merseyside, the North East, West and East Scotland and Northern Ireland would be very large. Together these areas contain over 80 per cent of British shipbuilding capacity and reductions in demand for vessels of this magnitude unless offset by demands from other shipping users would markedly swamp any increased demands generated by the steel and other requirements of the fixed link.

Operating Phase Effects

Our results indicate that distance from the portals is the main impediment to fixed crossing use and this impediment has both resource cost and psychological components. It was also established that travellers from Northern Britain when travelling to or through destinations other than France would generally use routes other than the French Straits. It was also shown that for travellers from these regions a high proportion of leisure journeys were by air. Accordingly it is not surprising that user benefits flowing from a fixed link to all leisure travellers fall off sharply with increased distance from the portals. Whether measured in terms of total benefits, benefit per trip or benefit per head of population, our examples show that Kent receives a far higher benefit than either Scotland or Wales. Not surprisingly, given the distances involved and the existing pattern of route journeys, leisure travellers in Wales are more likely to benefit than travellers from Scotland but this does not affect the overall conclusion of the largest benefits accruing to Kent leisure travellers (Table 12.3.3)

Table 12.3.3 Summary of Regional User Benefits - UK Leisure Traffic 2000: Low Scenario

	Region	Single-Track	Double-Track	Bridge	Bridge and Single-Track
Benefit (000 £)	Scotland	224	411	205	357
	Wales	260	393	138	321
	Kent	709	1034	353	901
Benefit Per Trip (£)	Scotland	0.23	0.41	0.21	0.36
	Wales	0.64	0.97	0.35	0.79
	Kent	1.29	1.86	0.70	1.63
Benefit Per Head of Population (£)	Scotland	0.04	0.08	0.04	0.07
	Wales	0.08	0.13	0.04	0.10
	Kent	0.40	0.58	0.20	0.51

Freight Effects

A similar picture emerges with respect to freight traffic, when expressed on a benefit per tonne basis. The one exception to this is the single-track rail link, which attracts traffic that has long on-land haulage distance and is therefore relatively unattractive to traffic originating or destined for Kent itself. The overall benefits depend on the total volume of trade and Table 12.3.4 below shows the depressed areas considered, particularly Wales, receive considerable benefits. Expressed in terms of benefit per head of population, the picture that emerges is closer to that of the leisure benefits.

In the case of leisure traffic, it is clear to whom the benefit accrues. This is not true for freight traffic, but clearly the existence of such benefits indicates the potential benefits that could accrue to each region.

Table 12.3.4 Regional User Benefits - Freight Traffic 2000: Low Scenario

	Region	Single-Track	Double-Track	Bridge	Bridge and Single-Track
Imports					
Benefit (000 £)	Scotland	442	744	410	625
	Wales	465	813	508	838
	Kent	220	742	731	835
Benefit Per Tonne (£)	Scotland	0.41	0.69	0.38	0.58
	Wales	0.55	0.96	0.60	0.99
	Kent	0.38	1.28	1.26	1.44
Benefit Per Head (£)	Scotland	0.08	0.14	0.08	0.12
	Wales	0.15	0.26	0.16	0.27
	Kent	0.12	0.41	0.40	0.46
Exports					
Benefit (000 £)	Scotland	347	618	356	483
	Wales	764	1435	977	1527
	Kent	434	381	431	462
Benefit Per Tonne (£)	Scotland	0.41	0.73	0.42	0.57
	Wales	0.50	0.94	0.64	1.00
	Kent	0.47	1.13	1.28	1.37
Benefit Per Head (£)	Scotland	0.06	0.11	0.07	0.09
	Wales	0.25	0.46	0.32	0.49
	Kent	0.24	0.80	0.24	0.26

Effects on Location Decisions

There can be little doubt that a cheaper cross-Channel linkage and one less subject to weather conditions will enhance the attractions of the South-East for those types of activity in which rapid and reliable contacts by surface with the Continent are an important element of competitive survival. Whilst there may be a growth in the pressure for distribution centres around the portals, the more general effect will be to widen the areas within the South-East in which these transport/communications

sensitive industries may operate efficiently though in the end the precise location of any such activities will depend on many other factors than time or distance from the portals.

However, the central question is whether a fixed link will make it harder to attract and generate economic activity in the problem regions. A priori and apart from the transport sensitive activities which would not contemplate development in relatively distance locations anyway, there seems no logical reason why a fixed link of itself will change the spatial distribution of comparative advantage. In this sense a fixed link is not associated with a fixed trading area but is open to all users regardless of location.

This is not to argue that the problem regions do not have relative disadvantages including distance from major European markets. These disadvantages will require continuous efforts by governments and others to change net disadvantages into a position where private activities freely choose, without subsidy, to operate there. But the fixed link will not increase governments' difficulties in avoiding politically unacceptable imbalances in regional growth rates and regional welfare. Equally a fixed link will do nothing to ease these difficulties of government.

Other Spatial Effects

Up to this point we have looked at the possible disadvantages to the problem areas of the UK. But a detailed analysis of the effects of the link on port-related employment on the Kent coast has suggested that during the operating phase there could be marked reductions in employment. The effects would be most modest with a single-track tunnel (some 15% reduction in Dover employment) and even here this loss might be compensated by a strong growth in traffic continuing to use non-fixed link crossings. With a double-track tunnel or road bridge the loss to port employment especially in Dover but also in Folkestone and Ramsgate, could be of major magnitude, and would not be offset by fixed link related employment, even on optimistic assumptions of traffic growth. Similar effects, but smaller in magnitude might result in Harwich, Felixstowe, and Newhaven.

Conclusions

Reaching any definitive conclusion on the regional policy effects of the construction of a fixed link is fraught with difficulty but the following pointers suggest the most important considerations:-

(a) The fixed link would save fixed and operating costs for a given volume of UK-Continental traffic. In this way there is no direct conflict between regional policy spending and fixed link spending.

(b) The bridge development would generate larger demands for steel which would almost certainly be mainly provided from problem region plants.

(c) There is no agreement as yet as to the demands for steel on other schemes for the fixed link but if the demand is for rails the Development Areas would benefit whereas if the demand is mainly in the form of rolling stock, then demand would be spread throughout the UK.

(d) The reduction in demand for vessels following the creation of a fixed link would have very marked negative employment effects on the Development Areas and almost certainly greater employment/income reducing effects than the growth effects of fixed link steel demand.

(e) Leisure benefits are likely to accrue in the main to those living close to the portals. Though some problem area users would benefit, the magnitude of the benefits falls off sharply with increased distance from the portals.

(f) A similar conclusion though less pronounced to (e) can be reached for freight users.

(g) Certain kinds of transport/communications sensitive activities already located in the South-East are likely to benefit from the opening of a fixed link but there is no logical reason why regional policy should be more difficult to operate as the result of the fixed link. This does not mean that regional policy efforts to ameliorate regional net disadvantage should be relaxed but simply that the fixed link will not, of itself, add to regional net disadvantage.

(h) The employment depressing effects upon Kent ports especially in the schemes other than the single-track, would be of a fairly major magnitude.

We have confined this analysis of the regional impact to the UK where the depressed areas are in general those areas most distant from the fixed link. This is not true on the Continent, where the Pas de Calais is designated a Development Area.

12.4 The Distribution of Benefits between Sectors

12.4.1 Approach

The traditional cost benefit analysis considers the initial investment in a fixed link, the investment saved in later years in other modes, for example construction of new ferries, and the revenue and operating cost implications for the affected parties during the years of operation. What this fails to capture is the 'multiplier' effects. An increased demand on the sector in one country will induce changes in output and employment in other sectors in the same country and sectors in other countries, through:-

(a) linkages between sectors i.e. as illustrated the standard input - output technical coefficients;

(b) the consumption 'feedback' linkage i.e. increased output gives rise to increased employment and hence increased consumption expenditure;

(c) the trade linkages between countries.

To demonstrate the impact of the multiplier, we have developed a methodology which will attempt to quantify the magnitude and the geographical location of the full effects, including these secondary or induced effects.

There are several ways in which such effects may be held relevant. Except in very rare circumstances which are not thought to be relevant here, their elucidation will not alter the calculation of returns already completed in the Transport Cost-Benefit Study. It is often argued as if discovering such multiplier effects would bring in new benefits and costs; but this is to mistake the methodology of transport studies. Changes in the value of time are themselves assumed to capture the benefits of such second and subsequent effects. While they are measured as they affect the user directly, they may be transmitted, that is redistributed, to others depending upon practical bargaining power. Therefore to count them in as well would be double-counting.

However, the effect in construction and use of a fixed link on various sectors is worth knowing in its own right; and may be relevant to decision-making. As the next section indicates, the distribution is relevant for regional policy, but it may also be relevant for industrial policy.

12.4.2 The Multiplier Analysis

Four aspects of the multiplier analysis are considered. The first part will briefly discuss the concept and relevance of multipliers for this study. Secondly, since the methodology for analysing multiplier effects involves the construction of an economic model, the next part will describe it in general terms and defend the particular choice of model. A formal derivation of the model is included as Appendix J. The third part deals with the requirements and availability of data for the model. Finally, the fourth part considers the proposed methodology for the multiplier subsystem as a whole. Thus, although the multiplier model is the core, the system is shown also to embrace peripheral facilities and these are described in the final part.

12.4.3 The Concept of Multipliers

Any large perturbation of an economic system is likely to have significant secondary (or multiplier) effects. They will be transmitted through the many (and complex) behavioural linkages that exist within any economic system, and will result in real and monetary (price) changes in many parts of the economy. Whatever form the initial perturbation takes, the repercussions may continue for several years and may not be confined to the single country in which the initial perturbation occurred. The purpose of the multiplier subsystem is to account for the most significant of the repercussions of the fixed link investment programme. The repercussions are confined to real effects on EEC member countries.

The standard Keynesian multiplier analysis has frequently been used to ascertain the likely impact on aggregate income levels which would result from an injection of investment expenditure into the economic system. The analysis is based on assumptions about the behavioural response of consumers when faced with additional receipts of income. Its main appeal is that it is simple and captures some (endogenous) reaction to the (exogenous) investment impulse, through the fairly well-defined behavioural reaction of consumers. Nevertheless, the response if incomplete and hence the multiplier analysis is only partial, since other potential reactions within the system are omitted. Of course, to capture the full effects would require the specification of a complete macroeconomic model, of which the Keynesian multiplier would only be one component.

Apart from this criticism of the Keynesian multiplier other criticisms are possibly of even greater significance in the present context. Principal among them is that the typical Keynesian multiplier analysis deals only with broad macroeconomic aggregates. Since one objective is to determine differential impacts on various sectors and geographical areas within the EEC, an aggregate analysis is inappropriate for present purposes.

A technique related to the Keynesian multiplier analysis is the (open, static) Leontief input-output model. This model can embrace a Keynesian-type multiplier by closing the system with respect to household behaviour. In essence the Leontief model is a multi-sectoral model which determines the direct and indirect (secondary) effects of a change in final demand on the output of production sectors. Final demands are defined to be requirements for products other than those required for use within the production processes. New projects' constructional demands (i.e. investment expenditure) would constitute a typical final demand component.

In essence, the input-output model assumes a fairly simple production function for each sector, namely, that the ratios of inputs to outputs are fixed in real terms. Thus a stimulus to final demands for the sectoral products will lead to further input requirements, the levels of which will be determined by the input-output ratios. These (direct) input requirements will act as a further stimulus to sectoral outputs which, in turn, will lead to still further (indirect) input requirements. The process repeats itself, eventually converges, and ultimately leads to a multiplier effect of the initial injection of investment demands on sectoral output levels.

These production multipliers are important because it is well-known that both the scale and the distribution of the final (overall) sectoral impact may well substantially differ from the initial impact. The Leontief input-output model provides a basic methodology for ascertaining the size of the differential sectoral output effects.

Both the Keynesian multiplier (in so far as it endogenises consumption behaviour) and the Leontief input-output multipliers (which account for interindustry linkage) are relevant techniques for analysing the fixed-link project. They may be used in tandem to calculate both the order of magnitude and directions of effect of the project on the economic system after accounting for (i.e. endogenising) certain consumer and producer behaviour. Even though it is a relatively simple conceptual step to combine the Keynesian and Leontief multipliers, the model requires modification and extension before it is applicable to this study.

The principal modification is to recognise the EEC as a multiregional economic system with substantial linkages existing between member countries, particularly through commodity trade.

In the present analysis the EEC is considered as an eight-country economic system, Belgium and Luxembourg being combined as a single country. The model therefore attempts to capture not only linkages between production sectors and linkages between household income and expenditure behaviour, but also the trade linkages between member countries. The result will be to generate a set of output and income multipliers differentiated by sector and by member country, consistent one with another.

12.4.4 General Description of the Multiregional Multiplier Model

Several standard forms of multiregional input-output model have been proposed in the technical literature, although few operational models currently exist. At a detailed sectoral level no such model currently exists for the European Economic Community. The model proposed here has been designed to use readily available data and to have general regard for the latest views on multiregional model construction, so as to help implement a demonstration model quickly.

A formal statement of the model is included in Appendix J, where three operational features are highlighted, namely:-

(a) the separation of commodity demand and supply influences;
(b) the endogenisation of household expenditure and income generation; and
(c) the method of modelling intra-EEC trade flows.

Each of these features is now discussed and the section will conclude with:-

(d) a summary.

12.4.5 Demand for and Supply of Commodities

Sectoral commodity demands are determined on a country by country basis according to the conventional assumptions of the Leontief model. Thus, total intermediate commodity demands for each EEC country are determined by multiplying technical requirements per unit of output by the output levels of the various sectors. To these intermediate commodity demands are added the

corresponding country final demands for commodities. These final demands include, of course, not only household consumption, government consumption and exports to the Rest of the World (non-EEC) but also investment demands and increases in stocks. The result is a set of total commodity demands for each member country.

The supply of commodities necessary to meet the demands in each country are met either by domestic (i.e. own-country) output, or by imports from other EEC members, or by imports from the Rest of the World. One feature of the model is immediately obvious, that an increased demand for commodities met either by domestic supply or by intra-EEC imports will create further commodity demand within the EEC system. The model is deemed to account for interdependencies within the EEC through commodity trade. The consequences of this demand on the two sources of supply are as follows.

The domestic supply response to domestic demand will create further commodity demands through the individual sectoral needs for further inputs. This mechanism is part of the standard Leontief model.

The supply response emanating from another EEC country will also create further country demands, but this time the response will be in that other country. This 'external' response will occur because production behaviour of all countries of the EEC are endogenised within the model. Thus, if country q is the importing country and its EEC imports are traced to a supplier in country p, then as a result of sectoral interdependence the increased output of the appropriate sectors in country p will trigger further intermediate demands, and hence a further production multiplier response.

At each stage of the multiplier mechanism in both the domestic country, and exporting EEC country there is likely to be a further need to break down the supply response into 'domestic',' EEC import', and 'Rest of the World import' components. This is the beginning of a complex intra-EEC interaction, whereupon imports from country p to country q may stimulate further requirements, and indeed, may involve feed-back effects such that there is a further demand for goods by country p from country q. Thus in every sense the model is attempting to capture the inter-country multiplier mechanism as well as the sectoral multipliers.

The multiregional model is not, however, a 'World model'. Hence, a leakage from the system by way of imports from the Rest of the World (i.e. non-EEC countries) is not allowed to feed-back and restimulate demand within the EEC. The grounds for ignoring possible feed-backs is simply one of relative orders of magnitude. It is assumed that multilateral trade linkage

between EEC member countries is more significant than the linkage between the EEC and the Rest of the World. One-way trade between an EEC and a non-EEC country might, of course, be quite significant, but the linkage only has a bearing on the model operation if there is a two-way (or de facto two-way) linkage which would lead to a feed-back effect on the EEC from an impulse arising within it. It is assumed for present purposes that these effects are relatively small.

12.4.6 Household Consumption and Income Generation

It is proposed to endogenise household income generation and consumption behaviour within the model so that it would accommodate a form of Keynesian income multiplier. Such a model is referred to as a closed-loop Leontief model. Because of the standard nature of this part of the model, brief details only will be given.

The income-expenditure loop between households and the sectors of production is formally closed by augmenting the matrix of input-output coefficients by a row and column of coefficients relating to households.

Households are assumed to spend fixed proportions of any marginal increase in disposable income on commodities. This is analogous to the assumption that production sectors require fixed proportions of material inputs for any increase in their outputs.

Similarly, as well as requiring extra material inputs to supply extra output, production sectors will also require labour services. Thus, each production sector will generate additional amounts of household income for any expansion of their outputs, and to capture this, a set of household income/output coefficients are defined within the model.

The income-expenditure loop is now closed within the model by allowing any increase in household income, arising say, from the expansion of sectoral output, to be spent subsequently according to the assumption of household expenditure patternsn. The round by round reactions will have a multiplier effect on household incomes.

Household income multipliers are embodied within the model for each member country, but will incorporate only a limited amount of reaction and feed-back between countries since no inter-country (i.e. intra-EEC) income transfers will be accounted for. Information on these transfers is not readily available, and, in any case, it is conjectured that such transfers would be relatively small. Thus, all household income generated by production activities within a member country will be assumed to be received (and spent) by households resident in that country. No inter-country multipliers and feed-back effects will arise on account of household income payments alone. Nevertheless, there could be some spillover effects and even feed-back effects through the linkage between the household and production sectors within country, and the subsequent linkage through commodity trade between countries.

Household income generation by each sector of production will be incomplete, since information is only available on the amount of wages and salaries generated. The model will assume that the relationship between wages and salaries and distributed profits will in future be the same as in the base year.

12.4.7 Modelling Intra-EEC Trade Flows

Commodity trade between EEC member countries will be modelled simply. This is a strengh not as a weakness, as it will permit some exogenous control over simply-defined parameter values in the operation of the model under alternative scenarios. Moreover, the trade assumptions employed compare favourable with those embodied within the Leontief world model . No country-specific trade flows were included in the latter.

The data sources permit country of origin and country of destination of all commodities to be formalised within the model. However, data are not available to identify the sector of destination of these trade flows. In any case, it is considered that detailed trade flow patterns based on both country and sectoral specifically are unlikely to be sufficiently stable for modelling purposes.

The trade model operates as follows. Total requirements of each commodity in each member country are specified according to the demand assumptions. These requirements are drawn from a commodity pool specific to that country . The supplies for this commodity pool originate from three sources: domestic (i.e. own-country) origin, other EEC countries, and the Rest of the World. The model assumes that supply patterns are fixed. The patterns have been estimated according to trade flows observed in 1976, but variations in these patterns can be incorporated to allow for expected future trade and capacity constraints.

12.4.8 A Summary of the Multiplier Model

The multiregional, multisectoral multiplier model has been designed so as to determine the impact on (country-specific) sectoral outputs of changes in final demands brought about by the investment in various fixed-link schemes. The specification of the model as derived in Appendix J results in a final expression of the form:-

$$g = (I - \theta A)^{-1} \theta f \qquad (1)$$

where the symbols are matrices and vectors defined as follows:-

- g represents the resultant change in output and household income levels in each of the EEC member countries;
- f represents the final demand changes (or differential final demand changes) implied by investment in the fixed-link facilities;
- A represents the technology of the system, including the structure of household income generation and household expenditure patterns;
- θ represents the structure of trade patterns between member countries in the EEC system.

Expression (1) is multidimensional because it shows the effects on individual sector within each of the eight member countries. Although it is a matrix equation, it has a very simple intuitive interpretation. The premultiplying term in (1) shown as $(I - \theta A)^{-1}$ is a multidimensional multiplier. It captures both the inter-industry and inter-country effects discussed in earlier paragraphs within a single set of multipliers. The post-multiplying term of θf is simply the result of multiplying country final demands by trade coefficients. It therefore recomputes the final demands in terms of the initial country and sectoral impact, before the consequential indirect effect of that impact are established.

In using the multiplier model within the whole multiplier subsystem, it is intended to distinguish two types of final demand impact. The first, f_1, will relate to final demands which have already been adjusted to the country of origin source of supply. This is particularly important in the case of the investment in the link itself. Some assumptions will have to be made as to where the contacts for the orders are placed. The alternative would be to assume the demand arose say on a 50:50 basis in the U.K. and France and the source of supply (domestic production, imports from EEC, imports from Rest of World) would be as any other demands on the same sectors in each country. The second set of final demands, f_2, will relate to the remainder i.e. the demand arises in a known EEC member, and the model itself determines the initial sources of supply on the standard coefficient basis. This simply means that the trade coefficients θ no longer need to be applied to f_1, although they still need to be applied to f_2 as before. With this adjustment, expression (1) becomes:-

$$g = (I - \theta A)^{-1} (f_1 + \theta f_2) \qquad (2)$$

The reason for distinguishing f_1 and f_2 in this way is that although the application of 0 within the model is a useful way of handling the general incidence of trade and alternative supply sources, specific knowledge of the origin of certain investment expenditures may be known in so far as they relate to the various fixed-link schemes.

Part of the investment demands of the fixed-link schemes will result in a direct use of labour services. This means that f_1 will contain elements of direct increases in household income in various countries. One feature of the model is that expression (2) will derive estimates of the multiplier consequences of that direct income generation within the system as a whole.

The model is a static impact model. It represents the total impact of the perturbation, which will take place over a period of time, but makes no attempt to represent the time variation explicitly. To do so would require a much more complex model, which incorporated assumptions about delayed or gradual responses to changes in demand.

12.4.9 Data Requirements and Detailed Model Specification

The objectives of this section are twofold. First, since the theoretical formulation of any model is inevitably inextricably bound up with the availability of data, a general review of the main data sources is required to demonstrate the feasibility of model construction. Its second objective is to determine the strategy for constructing the model given the data available, while drawing attention to those areas where prticular difficulties remain.

Current Data Availability

The principal basic data requirement is largely satisfied by the existence of a set of harmonised input-output tables for the member countries of the EEC, published by EUROSTAT[1]. The latest set of harmonised tables currently available relate to the year 1970. Although 1970 was before a number of major events in the World economy, including structural changes within the EEC arising from the membership of the United Kingdom, Ireland and Denmark, there is little alternative but to resort to these tables for determining economic structure within the Community.

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1 Statistical Office of the European Communities (EUROSTAT), Input-Output Tables - 1970, Volumes 1 - 9, Luxembourg, 1979.

The tables are harmonised in two respects. First, they are drawn up in common units of account (EUR units[1]) and according to common valuation procedures. In fact, all tables are valued in approximate factor prices; which means that flows are measured when the relevant commodity leaves the producer unit or enters the country in question (i.e. imports are in c.i.f. values). Taxes and distribution margins levied on all purchases are shown as separate debits. Secondly, the harmonisation means that all classifications of transactions within the member countries are standardised. The classification is referred to as NACE - CLIO (R44). This is the maximum common disaggregation that can be achieved from an alignment of the individual country input-output tables.

The harmonised input-output tables are the basic input for specifying the technology matrices previously depicted by A. The matrices are specific to each of the member countries, and it may be noted that a comparison of structures of production for the member countries has already been carried out by C. Dewaleyne and J.M. Seyler[2]. There is no comprehensive and readily accessible information on the extent to which technological change has taken place between 1970 and the present day. Therefore, the A matrices will essentially be left unadjusted.

A second data set of prime importance to the present study, also published by EUROSTAT, is the harmonised set of foreign trade statistics. These data are conveniently classified by NACE - CLIO as well as by the SITC classification. The common currency unit is again employed, but the exchange rates vary from year to year. The main trade series commence in 1975 and have been produced annually from 1975 - 1978.

The set of trade coefficients for the model, θ, is based on trade data for 1976. Substantial changes in trade patterns will have taken place during the last decade and it is important to capture the most recent picture in the model. Average trade coefficients are used although strictly, marginal coefficients would be more appropriate for the impact analysis. Several variants of the base case will be included for model runs. The model system incorporates the facility to amend trade coefficients in line with the trade models that have been developed as part of the overall study.

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1 In 1970, 1 EUR = 1 US dollar; other currencies convert at official exchange rates to it.

2 C. Dewaleyne and J.M. Seyler, 'The Harmonised Input-Output Tables for the EEC Countries - and their use to compare the economic structures of the EEC Member Countries', Paper to the Seventh International Conference on Input-Output Techniques, Innsbruck, Austria, April, 1979.

A formidable problem with many international trade statistics is the identification of 'entrepot' trade. This is particularly prevalent within the EEC where a considerable volume of shipments are routed through the ports of London and Rotterdam. For any analytical work, the recording of trade data in terms of observed shipments (i.e. inclusive of 'entrepot' trade) creates severe difficulties. If, as in the present model, imports are geared to the level of demand, then imports for re-export could be overestimated if entrepot trade is not excluded. Consultations with Mr. Klaus Lonig (Head of the Trade Statistics Division, EUROSTAT) have established that the data have largely been purged of the entrepot problem. Some problems inevitably remain, regarding the treatment of bonded goods, timing differences between invoice and despatch, as well as the distinction between general and special trade referred to above. The trade data cannot be improved any further for use within the present modelling exercise and they would appear to be well-suited for sound analytical work.

Although data are available on both import and export bases, there are inevitable problems of consistency and comparability. Not all are due to differences in timing and general errors of measurement. Some are due to differences in valuation; imports are generally valued c.i.f. and exports are valued f.o.b. However, all trade data utilised in the study are based on import series. This is because it would seem more logical to use the import data for calculating import shares in a demand-oriented model.

The third major data source, also assembled by EUROSTAT, is the set of harmonised National Accounts data[1], currently published for the period 1960-1977, but supplemented by unpublished data made available by EUROSTAT. The harmonisation again means the accounts are standardised as well as having all monetary aggregates converted into a common currency. As with the trade data, the common unit of currency (EUA) varies from year to year, according to current market exchange rates. for 1970 1 EUA = 1.002 US $, which is slightly at variance with the units of account used in the 1970 input-output tables[2].

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1 EUROSTAT. National Accounts (ESA) 1960 - 1977, Luxembourg, 1978.

2 See EUROSTAT, National Accounts (ESA) 1960 - 1977, p.89 for the tabulation of exchange rates used in calculating EUA values.

Generally, the principal use of the harmonised National Accounts series has been to update the flows prescribed by the input-output tables for 1970 so as to approximate to the position prevailing in a more recent year.

12.4.10 Strategy for Model Construction

The basic data requirements for the implementation of some form of multiregional model are reasonably good. Ideally, it would be desirable to have the input-output data consistent with a set of trade data for some recent year. Since these are not available it has been necessary to update the input-output flow tables and to indirectly estimate the level of demand for each commodity in each member country for one of the years in which trade data exist. These demands are crucial elements in the calculation of trade coefficients (O's) in the multiregional model.

Classification of Sectors

The harmonised input-output tables distinguish 44 sectors (or branches) under the NACE-CLIO (R44) classification. Although the trade data will adequately sustain this detail, the national accounts data are classified according to (at most) a 25-sector aggregation of the 44 sectors. This is referred to as NACE-CLIO (R25). There is a further aggregation of the 25 sectors (and hence the 44) to 6 sectors. The R6 classification, as it is called, is frequently used in the national accounts tables. Since the national accounts are likely to be an integral part of data base construction, the model sectors cannot be disaggregated further than R25, and even this order may create problems. For purpose of demonstrating the model performance and assessing its capabilities, a 10-sector classification of product groups has been devised. This is an aggregation of the R25 branch scheme but, unlike the R6 classification, it includes some detail on certain broad categories of manufactured products. The 10-sector classification for the multiplier is set out in Appendix K.

Household Accounts

In order that the household income-expenditure loop is adequately specified in the multiplier model, it is desirable that we determine the total household income generated for a unit output expansion of each sector. The input-output tables show only the wage and salary components of this income generation. Although some information is obtainable from the national accounts on the size of income transfers to households for some member countries, the

information is not sector-specific and is therefore of little use for modelling purposes. It has been assumed that total household income generated is a constant scale factor above wage and salary income generated in each sector, and expenditure coefficients derived accordingly.

12.4.11 Calculation of Model Parameters

The year 1976 was chosen since it represents the most recent year for which complete and detailed National Accounts data are readily available. The derivation of the model parameters was carried out in the following manner.

The I-O coefficients for 1970 were used as estimates for A for 1976 without any adjustments. This implies we are assuming constant coefficients in value terms or that input quantities adjust for any change in relative prices to maintain the same value share. This assumption is made for convenience and yet empirical evidence on other country studies does not show it to be less preferred to the strict Leontief assumption.

Total demands for each of five final demand categories, namely:-

(a) private consumption;
(b) government consumption;
(c) gross domestic fixed capital formation;
(d) changes in stocks;
(e) exports to non-EEC countries;

for each member country are published in the National Accounts for 1970 and 1976. The 1970 values were scaled up according to the index calculated from the National Accounts, assuming no change in the sectoral breakdown of these demands in value terms. This yielded an estimate of the vector of final demands for each country in 1976, f_{76}. Similarly, an initial set of estimates for the 1976 values of gross outputs could only be obtained by indexing according to sectoral gross domestic products, to yield a vector g^*_{76}. Thus, inserting these estimates into equation (1) in Appendix J, we arrived at an estimated vector of total country commodity demands:-

$$d_{76} = A_{70}\, g^*_{76} + f_{76} \qquad (3)$$

With import flows known for 1976, estimated domestic supplies can be calculated as the difference between demands and total imports (including non-EEC imports) and hence:-

$$\theta_{76} = T_{76}\, d^{-1}{}_{76} \qquad (4)$$

where T_{76} is the matrix of trade and total internal domestic flows.

Next, reexpressing equation (1) in terms of commodity balances for 1976, we obtain:-

$$g^{**}{}_{76} = \theta_{76}\,(A_{70}\, g^{*}{}_{76} + f_{76}) \qquad (5)$$

With import flows known for 1976, estimated domestic supplies can be calculated as the difference between demands and total imports (including non-EEC imports) and hence:-

$$\theta_{76} = T_{76}\, d^{-1}{}_{76} \qquad (4)$$

where T_{76} is the matrix of trade and total internal domestic flows.

Next, reexpressing equation (1) in terms of commodity balances for 1976, we obtain:-

$$g^{**}{}_{76} = \theta_{76}\,(A_{70}\, g^{*}{}_{76} + f_{76}) \qquad (5)$$

A final stage in the estimation procedure was to effect a balance in the 1976 flows estimated so far. To do so, equation (5) has to be solved for an assumed equality between gross outputs, given the coefficient estimates θ_{76}, A_{70}, and the final demands f_{76}. Thus,

$$g_{76} = (I - \theta_{76}\, A)^{-1}\, \theta_{76}\, f_{76} \qquad (6)$$

Solving the system in this way ensures complete consistency between gross outputs, final demands and the coefficient structure estimated during earlier stages. It is of interest to note that g_{76} will not be independent of the choice of $g^{*}{}_{76}$ because θ_{76} was derived from it. However, once $g^{*}{}_{76}$ is fixed, θ_{76} is fixed and g_{76} will be unique.

12.4.12 Final Demand indices

The indices for each final demand category were mostly obtained from the National Accounts series (Eurostat (1978c). The series are in current prices so that at this stage we have made no adjustments for changes in the rate of exchange with the European Unit of Account. This will be discussed in a later section. The indices for Belgium and Luxembourg were wholly based on the accounts for Belgium owing to gaps in the Luxembourg series for 1976.

Although information was not available to distinguish exports to the EEC from those to outside the EEC, indices were obtained from the published trade statistics. These are presented in current values in EUA, so the indices were corrected back to own-currency values to avoid double counting these adjustments at a later stage. Table 12.4.1. shows the resulting indices.

Table 12.4.1 : 1976 Indices of Final Demands in Current Values (1970 = 100)

Country	Private Consumption	Government Consumption	Gross Domestic Fixed Capital Formation	Change in Stocks	Exports to non-EEC
Germany	173.3	118.9	134.1	61.0	203.0
France	218.9	232.3	208.9	86.3	284.9
Italy	248.4	265.0	233.5	418.1	369.6
Netherlands	205.9	232.0	158.4	116.6	233.6
Belgium & Luxembourg	208.2	244.2	196.2	44.2	211.0
United Kingdom	234.5	296.2	247.3	86.5	288.2
Ireland	243.7	358.6	298.5	103.5	361.8
Denmark	193.3	243.7	197.6	75.0	208.0

Two observations are important. First, the indices for changes in stocks are understandably variable since stock changes have a tendency to fluctuate quite widely over time. Secondly, in many instances the use of global indices to scale each commodity demand for each category of final demand could be substantially improved by using some of the detailed published information on various types of final demand (Eurostat (1978b)).

12.4.13 Gross Output Indices

The source for these indices are again the national accounts statistics, although as mentioned earlier, it was necessary to use indices based on gross value added at market prices by branch. In some instances, data were not available and some approximation had to be used[1]. The indices are shown in Table 12.4.2.

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1 The most serious difficulty was for the United Kingdom where information was only available from 1973 onwards at the R6 branch classification.

Table 12.4.2 1976 Indices of Gross Outputs in Current values (1970 = 100)

Country	Sector									
	1	2	3	4	5	6	7	8	9	10
Germany	138.8	179.8	156.2	148.1	140.1	148.0	127.9	219.3	134.4	183.9
France	156.5	175.8	138.3	193.1	292.3	219.3	180.1	210.4	220.3	221.6
Italy	220.3	205.2	259.3	257.5	304.4	203.5	287.5	284.8	222.6	250.8
Netherlands	164.9	319.9	194.8	151.4	157.4	149.0	125.8	190.8	182.0	229.2
Belgium & Luxembourg	162.7	239.3	117.6	176.9	113.2	187.1	152.4	191.7	215.5	226.5
United Kingdom	251.2	304.0	213.5	213.5	213.5	213.5	213.5	213.5	272.0	270.7
Ireland	286.5	335.6	334.7	342.8	271.6	382.4	234.0	180.4	348.6	329.9
Denmark	182.7	192.5	76.7	167.4	236.9	176.9	142.4	194.5	186.7	220.3

12.4.14 Change in the Exchange Rate and the EUA

All of the scaling factors applied to the components of final and intermediate demands discussed so far are based upon current value indices calculated in terms of currencies of member countries. The multicountry input-output tables pose a new problem, not encountered in subnational regional studies, whereby the exchange rates between members vary through time. The EUA equivalent on which the 1970 harmonised tables are based have changed between 1970 and 1976, and it is necessary to reflect these changes by applying a final set of scaling factors to all flows before calculating total estimated demands in EUA units. The scaling factors are shown in Table 12.4.3.

Table 12.4.3: Scaling Factors for Revaluation of Flows in 1976 EUA Units

Country		Index
Germany	(D)	1.33
France	(F)	1.06
Italy	(I)	0.69
Netherlands	(NL)	1.25
Belgium & Luxembourg	(B-L)	1.18
United Kingdom	(UK)	0.68
Ireland	(IRL)	0.68
Denmark	(DK)	1.13

Source: Eurostat (1978c) p.89.

Combining the methodology outlined above a set of EEC inter-country tables have been estimated for 1976. These are shown at Appendix L. This sets out the estimated values for θ (excluding non-EEC imports which can be obtained by subtracting column totals from unity).

What is perhaps of some interest with regard to the estimation methodology is the extent of the differences between the three stages of calculation of the sectoral gross outputs : g^*, g^{**} and g. Appendix M therefore shows these in full. It reveals marked variations in the gross output levels in moving towards the final, consistent set we have determined as the vector g. One can only conclude that in some instances the assumptions are too crude to account for the movements which must have taken place in the early 1970's. Although, countering this, it is certainly the case that some sectors fare worse than others and possibly more detailed work on those sectors (e.g. agriculture, energy, servies) could well lead to significant improvements.

The attempt to both update the 1970 EEC input-output tables and to show inter-country interactions, has been reasonably successful. A set of tables have been produced entirely with the aid of published sources. However, there is scope for improvement and further refinements. They fall into two categories. First, trade flows can be formally accommodated to allow for f.o.b./c.i.f. discrepancies, and secondly, there is a good deal of detailed information already available to improve the indexing procedures and to avoid recourse to global scale factors. Of the two, the latter is clearly of greatest numerical importance. Nevertheless, this is likely to be quite time-consuming, so the present attempt represents about the best which can be done without investing a great deal of time and resources.

12.5 The Evaluation of Sectoral Impact of the Link

12.5.1 The Multiplier Impact of Link Construction

To provide the inputs to the multiplier model, we must break the costs of the fixed link down by the type of product they are used to purchase. We distinguish ten production sectors, but the direct costs only involve five of these. We must also specify the country (UK or France) where the demand originates, and whether it may be met from imports, or must be met in situ (e.g., construction). The demands arising from complementary infrastructure are also included. We have, initially, assumed that the tunnels are concrete-lined; if they were to be steel-lined, the initial impact would be different, and thence the subsequent repercussions. The input requirements are summarised in Table 12.5.1.

Table 12.5.1 Direct Inputs for Link Construction
(million £, 1979 prices)

	French Demands				UK Demands			
Sector	Single-Track	Double-Track	Bridge	Bridge & rail	Single-Track	Double-Track	Bridge	Bridge & Rail
3	-	-	228.0	228.0	-	-	228.0	228.0
5	57.2	83.9	-	57.2	57.2	76.1	-	57.2
8	-	22.1	-	-	-	15.1	-	-
9	294.8	493.8	635.0	929.8	305.8	402.4	835.0	1140.8
10	-	94.8	252.5	252.5	-	39.2	252.5	252.5

Sector definitions:

3 - Metals
5 - Transport equipment
8 - Manufacturing n.e.s.
9 - Building & construction
10 - Services

Demands for the products of sectors 3, 5 and 8 may be met from normal sources; demands for those of sectors 9 and 10 must be met in situ.

Table 12.5.2 sets out the total multiplier effects, broken down by sector and by EEC country, arising from the investment demands for the four alternative links. Although in all cases the major impact is on French and UK sectors, there are varying degrees of repercussion on other EEC countries. For all the links, the strongest subsidiary effects are in West German sectors, and the weakest in Ireland and Denmark.

Table 12.5.2 : Sectoral impacts of link construction (million £, 1979 prices)

SCHEME	SECTOR	West Germany	France	Italy	Netherlands	Belgium & Luxembourg	UK	Irish Republic	Denmark
Single-track tunnel (total cost £715m)	1.	8	63	7	5	3	21	3	2
	2.	10	37	3	7	3	50	0	0
	3.	22	33	4	3	7	32	0	0
	4.	5	37	2	1	2	45	0	0
	5.	17	75	5	2	4	57	0	0
	6.	16	84	7	9	5	74	4	4
	7.	9	37	8	2	3	28	1	0
	8.	53	144	16	12	9	150	2	2
	9.	2	308	1	1	0	319	0	0
	10.	47	386	21	12	12	267	2	3
Double-track tunnel (total cost £1227m)	1.	14	124	12	9	5	32	5	3
	2.	18	72	6	12	4	74	1	0
	3.	37	59	7	5	13	47	0	0
	4.	8	64	4	1	3	61	1	0
	5.	26	120	8	3	6	79	1	0
	6.	27	168	12	16	9	111	6	6
	7.	16	71	14	3	6	42	2	0
	8.	93	289	28	21	17	231	3	4
	9.	3	521	1	1	1	422	0	0
	10.	81	859	36	20	20	436	4	5
Bridge (total cost £2431m)	1.	25	199	20	18	9	75	11	1
	2.	34	125	11	26	10	184	1	1
	3.	117	303	21	22	59	303	1	1
	4.	14	87	6	3	5	131	1	1
	5.	20	66	6	3	4	47	1	0
	6.	48	268	21	31	18	264	14	14
	7.	27	110	25	6	10	99	4	1
	8.	152	389	44	37	28	482	7	7
	9.	6	678	2	3	2	882	0	1
	10.	147	1459	61	42	46	1220	9	11
Bridge plus Single-track (total cost £3146m)	1.	32	262	27	23	12	96	14	10
	2.	44	162	14	33	13	234	2	1
	3.	139	336	25	25	66	334	2	1
	4.	19	124	9	4	7	177	2	1
	5.	37	141	11	4	8	104	1	0
	6.	64	352	28	40	23	338	18	18
	7.	36	146	33	8	13	128	5	1
	8.	205	533	60	49	37	632	9	9
	9.	8	986	2	4	2	1201	0	1
	10.	193	1845	82	54	57	1487	11	14

Sector definitions :

1. Agriculture
2. Energy
3. Metals
4. Non-metallic minerals
5. Transport equipment
6. Food
7. Textiles
8. Other manufacturing
9. Building and construction
10. Services

Table 12.5.3 shows the multiplier effect on GDP generation. The generated accumulated GDP is expressed as a proportion of the total construction cost. Thus, for example, the generated GDP in France would ultimately reach 80-100% of the total (UK + France) construction outlay. For all the links, France appears to be the country most favourably affected by the multiplier effects. The table also reveals how GDP generation could occur in countries other than the UK and France. But more importantly, the table allows a standardised comparison to be made between the links in their effects on different countries. It is noteworthy, for example, that the double-track tunnel has the largest estimated overall effect on cumulative GDP (195.8), closely followed by the single-track tunnel (192.6). However, the double-track tunnel is more favourable in its impact on France relative to the UK. The effect on other countries is similar for all the links.

12.5.2 The Total Multiplier Impact

The approach to analysis of the sectoral distribution of the impact of a fixed Channel crossing is illustrated above for the construction inputs only. A full analysis of the multiplier impact of the link should also include:-

(a) the effect of reduced investment in alternative modes, such as ferries; and

(b) any changes in demand patterns resulting from the use of the link.

This full analysis has not yet been performed, since it requires the bringing together of results which have only become available at a late stage.

12.5.3 The Impact of Link Construction on Energy Use

The increase in energy costs resulting both directly and indirectly from the construction of the link are outputs of the multiplier model. These costs are summarised in Table 12.5.4. The table also shows those energy costs which will be met from outside the EEC. The final two columns show the total energy costs, and those met from outside the EEC, expressed as a percentages of total construction costs. It is interesting to see that these proportions are very similar for the different link options.

12.5.4 The Total Impact on Energy Use

As with the general sectoral breakdown, a full analysis of the energy use impact would require examination of the implications of the saved investment elsewhere, and those of changed demand in the use of the link,

Table 12.5.3 Multiplier Impact of Link Construction on Cumulative GDP

(as a percentage of total construction cost)

	West Germany	France	Italy	Netherlands	Belgium & Luxembourg	UK	Irish Republic	Denmark	Total
Single-track tunnel	11.7	90.6	5.2	3.4	3.0	77.0	0.9	0.8	197.6
Double-track tunnel	11.8	104.3	5.3	3.4	3.1	66.4	0.8	0.7	195.8
Road bridge	10.5	82.4	4.6	3.6	3.4	80.0	0.9	0.8	186.2
Bridge & rail	10.7	84.3	4.7	3.5	3.4	79.3	0.9	0.8	187.6

Table 12.5.4 Energy Costs of Link Construction

(millions of £, 1979 prices)

	West Germany	France	Italy	Netherlands	Belgium & Luxembourg	UK	Irish Republic	Denmark	Total	From outside EEC	% of total costs	
											Total	Outside EEC
Single-track tunnel	11.4	63.0	4.7	5.3	3.5	73.3	0.6	0.5	162.3	51.4	22.8	7.2
Double-track tunnel	19.7	123.1	8.2	9.0	6.0	107.5	1.0	0.8	275.3	88.6	22.4	7.2
Road bridge	38.6	210.9	14.8	20.0	15.8	268.5	2.2	1.6	572.4	180.4	23.5	7.4
Bridge & rail	50.0	274.0	19.5	25.2	19.3	341.8	2.9	2.1	734.8	231.7	23.4	7.4

The French consultants have examined the energy impact of the use of the link, but here confined their attention to direct energy inputs. No attempt has yet been made to perform a full energy impact analysis.

13

THE BENEFIT TO THE COMMUNITY

13.1 Approach

The Terms of Reference for the study required the Consultants to consider the nature of the benefits the European Community might derive from a fixed link. As was explained in section 8, the discharge of the remit has been undertaken in three ways. First, it has been the aim of the Consultants to provide as much data as possible, and that seemed relevant, as might best inform Community policy makers so that they could judge what solution was in the best interest of the Community. Indeed, that has been an objective of the whole report.

Secondly, the Consultants would consider how in their judgment, the provision of a fixed link or the development of existing services might meet the policies adopted by the Community. Those which seemed most pertinent covered:-

economic policy
steel policy
competition policy
regional policy
the environment policy
transport policy and
energy policy.

The Consultants do not presume to be expert on these policies, but they have taken what material they have had describing them and interpreted their relevance in this context as seemed fit.

Thirdly, the Consultants would consider the distributional implications for the Community of providing a fixed link as far as this was possible, given that no decisions have been taken on the form of funding.

13.2 Relevance of the Community's Policies

13.2.1 Economic Policies

Article 2 of the Treaty of Rome requires the Community "to promote throughout the Community a harmonious development of economic activities, a continuous and balanced expansion, an increase in stability, an accelerated raising of the standard of living and closer relations between the States belonging to it".

Arguably the article has a threefold implication for developments such as a fixed link across the Channel:-

(a) Inasmuch as such a fixed link promises a positive economic return, it could be seen as making its contribution to development of economic activities, to economic expansion and to an increase in the standard of living; and thus as benefitting the Community;

(b) As the discussion on environmental policy later in this section supports, recent developments in Community policy have recently stressed the importance of environmental aspects of the standard of living. Therefore they must be considered in establishing the benefits of a fixed link to the Community; and

(c) a fixed link which reduces transport costs in the movement of persons and in trade, brings States closer together not only in time but also economically. Moreover, the successful establishment and operation of such a link would seem to require closer co-operation between the member states concerned.

In a broader sense fixed links such as those across the Channel can be seen as acting as a factor generally increasing economic growth and trade within the Community. This issue has been discussed in detail by the French Consultants.

13.2.2 The Community's Steel Policy

The Treaty of Paris that set up the European Coal and Steel Community in 1971 preceded the Community itself (with which it was merged in 1967). Steel is of major interest to the Community because its production is important in every member state except Denmark and Ireland. A major concern of the Community has been to take measures to counteract the problems caused by worldwise excess capacity. The main objective has been to rationalise steel production capacity and to prevent dumping and prices below cost. The Davignon Plan which the Council of Members approved in principle in December 1978 prefers such policies to any that would increase the subsidisation of steel.

"Public aid can only be permitted by the Community for a limited period and only as long as it modernises plant and improves the competitiveness of the steel industry".[1] While the idea of a code to regulate state

1 "A Steel Policy for Europe" European File, EEC June 1979, p.6.

subsidies to steel was first raised in May 1978, there was debate on the extent to which the Commission should investigate the practices of member-tates, until a code was finally adopted by Ministers in Brussels in December 1979 to come into force on the 1st January 1980. This may relate to the choice of materials used for the construction of a link.

13.2.3 Competition Policy

On the 18th October 1978 the Commission sent a letter[1] outlining various policies to help promote Community policies on the free movement of goods. Of particular importance was the development of the Community's thinking on the types of barriers and practices that in its judgment were equivalent to barriers to trade.

While the letter was mostly concerned with alleged infringements by member-states, a wider view on what constitutes a barrier to trade may have some relevance to a fixed link across the Channel. Such a link may help make it possible to simplify movement across the French and UK frontiers, but also by reducing the cost of movements of persons and goods, it will have an effect equivalent to reducing tariff barriers at national frontiers - as in principle would any lowering of transport costs between member-states - so realising benefits to the Community.

A further implication of the Community's competition policy would seem to be that fares and charges on a fixed link should be carefully considered to establish that they are not themselves set at levels which might be held to constitute a set of tariffs in restraint of trade. Arguably, this might be held to be implied by Article 16 of the Treaty of Rome which states that:-

"Member states shall abolish between themselves customs duties on exports, and charges having equivalent effect ...";

as well as by the wider approach to the definition of restrictions on the free movement of goods set out in the Commission's letter of 10th October 1978.

Thus it might be held that the benefit to the Community under this head was conditional in part on the pricing policy adopted in respect of the fixed link; and certainly that it could well be a matter of Community interest to consider what that pricing policy should be.

1 Bull EC10 - 1978 point 2.1.14.

13.2.4 Regional Policy

The regional implications of a fixed link have been discussed in the last section. While it is an objective of the Community's regional policies to help correct imbalances between poorer and richer regions, this is to be done mainly by aids to those regions and investments in them, rather than by avoidance of good economic investments elsewhere. Though a fixed link will achieve benefits in the poorer regions of the UK which would be distant from it, the greater benefits would be bound to be concentrated on the areas nearer to it (including some French poorer areas). This is a fact of geography.

13.2.5 The Community's Environmental Policy

The 1970s have witnessed a massive growth of interest in the environment, in ways in which it may be damaged, and in methods of preventing such damage taking place. In all countries of the EEC, policies have been adopted to prevent and control pollution, and an environment policy has been adopted at Community level,[1] with the following objectives:-

> The aim of a Community environment policy is to improve the setting and quality of life, and the surroundings and living conditions of the peoples of the Community. It must help to bring expansion into the service of man by procuring for him an environment providing the best conditions of life, and reconcile this expansion with the increasingly imperative need to preserve the natural environment.
>
> It should:-
>
> (i) prevent, reduce and as far as possible eliminate pollution and nuisances;
>
> (ii) maintain a satisfactory ecological balance and ensure the protection of the biosphere;
>
> (iii) ensure the sound management of and avoid any exploitation of resources or of nature which cause significant damage to the ecological balance;
>
> (iv) guide development in accordance with quality requirements, especially by improving working conditions and the settings of life;
>
> (v) ensure that more account is taken of environmental aspects in town planning and land use;

1 Adopted by the Council of Ministers, 22/11/73.

(vi) seek common solutions to environmental problems with States outside the Community, particularly in international organisations.

Though individual countries express their objectives for environmental policy in somewhat different terms, their aims are basically similar to those of the Community as a whole. From this it can be seen that policy objectives are highly diverse covering both the man-made and the natural environment in all their aspects.

In its discussion paper on its environmental policy[1] the Commission gave four reasons for a Community policy:-

(a) The need to tackle problems on an international basis.
The examples given included problems posed by the pollution of the Rhine; the blame Norway places on the Community for sulphur dioxide poisoning from its industrial regions; and the need for international co-operation in wild-life protection. The choice of a fixed link is important for the Community since a bridge in particular could affect the probability of oil and other pollution on the coasts of Community members on the Channel. It is possible also that a reduction in the number of cross-Channel ferries could have a similar effect;

(b) Reconciling economic growth with environmental protection
Economic growth has always been a Community objective, but to maintain the standard of living - also a Community policy - the environment must be protected. Therefore the Community has an interest in ensuring that the economic policies of its members are not offset by environmental deterioration. It has the interest and locus, therefore, to ensure that a major international investment as in a Channel crossing which promises a high economic return does not do this at the expense of the environment;

(c) The avoidance of distortion in competitiveness by differences in environmental policies. If one member-state adopts less stringent environmental policies than another, the extra costs could reduce its competitiveness. As an objective of this study was to develop a notion of Community benefit which might apply also to the evaluation of other improvements in transport infrastructure, this seems particularly relevant. Comparable environmental standards

1 The European Community's Environmental Policy. Office for Official Publications of the European Community, May 1977.

need to be applied in different instances if transport costs and therefore competitiveness are not to be distorted;

(d) The ability of the EEC to take a long-term view.

The EEC has an ability to take views further ahead than national governments find easy given their pre-occupation with the short run. A possible implication of this is that the Commission should consider carefully whether the right weight is being given to environmental considerations in reaching a decision.

Among the principles adopted by the Council of Ministers at the same time as the objectives set out above are two of perhaps special relevance:-

Sixth Principle "the cost of preventing and eliminating nuisances must in principle be borne by the polluter";[1] and

Eleventh Principle "in each different category of pollution it is necessary to establish the level of action that befits the type of pollution".[1]

Also worth noting is the greater attention the Commission has given the problems of marine pollution by hydro-carbons discharged at sea since the Amoco Cadiz disaster off the coast of Brittany.[2] The Community has also shown several recent initiatives in its campaign against pollution from exhaust gases and against noise from motor-cycles.[3]

In conclusion, it is Community policy to protect and enhance the environment, and in particular to ensure that economic benefits such as those predicted for those fixed links with positive economic returns are not offset by adverse environmental consequences. While it would be presumptuous to attempt to define an interpretation of the implications for a fixed link of the Community's environmental policies, prima facie and on the evidence at present available it would seem:-

(a) that the single-track tunnel is most likely to have a positive effect on the environment;

(b) that while the double-track tunnel will also have substantial positive effects and arguably somewhat greater benefits than a single-track tunnel, it will have some adverse effects, principally through increased road traffic, though probably only to a limited extent;

1 Adopted by the Nine in 1975 following a Commission recommendation to the Council of Ministers.

2 See the references given in Twelfth General Report on the Activities of the European Communities, Ref 1979 p. 149.

3 Ibid, pp. 150,1.

(c) that the bridge will have greater adverse environmental effects inland and smaller positive benefits, while the bridge itself poses much greater environmental issues to be resolved than do either those two tunnels or the submerged tunnel.

Therefore in line with the conclusions of section 11, given the schemes as presented, and the evidence as currently available, there is a prima facie case for arguing that the Community's environmental policy ends would be best served by the single or double-track tunnel; though as was argued in section 11, in no case do adverse inland environmental consequences appear likely to be very considerable.

13.2.6 Transport Policy

The Community has a clear interest in a fixed link joining member-states inasmuch as Article 75, and the policies that have flowed from it, have required the Council to lay down:-

"common rules applicable to international transport to or from the territory of a Member State or passing across the territory of one or more Member States"

as well as interest under Article 79 in so far as the possibility of discrimination might arise, and under Article 81 which requires that:-

"Charges or dues in respect of the crossing of frontiers which are charged by a carrier in addition to the transport rates shall not exceed a reasonable level after taking the costs actually incurred thereby into account".

In recent years the Commission has devoted greater attention to problems of infrastructure especially after a Committee on Transport Infrastructure was instituted by a Council Decision of 20th February 1978.[1] At its meeting on 23rd November 1978 the Council asked the Commission to prepare a report on bottlenecks in transport infrastructure.

In addition, the importance of the benefits the Community may derive from improvements in transport infrastructure has been increasingly recognised. Of the greatest importance has been the publication on 14th November 1979 of the Memorandum of the Commission on the Role of the Community in the Development of Transport Infrastructure,[2] which reported the Commission's conclusion that the Common Transport Policy will not

1 OJL of 25.2.1978

achieve the objectives defined for it in the Treaty and play its part in the economy as a whole unless it relates more and more to transport infrastructure. The reasons for this new impetus, which originates largely in recent economic developments, are clear. The following important points can be noted:-

- international traffic between Member States has developed faster than national traffic; on some major links it plays a significant role in the formation of bottlenecks;
- the growing interdependence of networks makes it inconceivable to consider one state as an isolated planning entity;
- infrastructure will play a crucial role in future transport operations;
- the increased difficulties faced by the national administrations with the financing of infrastructure projects which, in some cases, can justify action at the Community level.

Moreover, the Commission concluded that in general, over and above the field of transport planning, infrastructure decisions have consequences on economic, social and regional development, which must also be taken into account. An approach which combines the various criteria is needed to appreciate the Community's role.

Infrastructures which are essentially the responsibility of the public sector, and have a decisive effect on the future of transport, are particularly appropriate for joint planning and application of a Common Policy. It is such recognition of the implications of the improvement of major transport infrastructure for other policies that underlies the argument for considering the Community benefit as a whole from them, rather than looking at their benefits purely in transport terms.

The Commission in that paper further observes that:-

(a) existing networks have generally been conceived nationally and without concern enough for international links;

(b) in general terms, though this cannot apply to the Channel, more attention has been given to roads than to other modes of transport;

(c) diverse criteria have been used. This is of special importance in this study and one of its hopes is that an approach out of it may come that could be accepted as common ground for exercises of this sort.

The Memorandum further recognises the importance of forecasting given the scale and longevity of such investments, as well as the need to detect weak links in the Community's transport network which impede movement through shortage of capacity.

It outlined the circumstances in which Community financial aid might be appropriate:-

- projects to be undertaken in the territory of a Member State or another country which will allow a bottleneck affecting Community traffic to be removed;
- cross-frontier projects which do not have sufficient priority at national level to be included in the national budgets but which are very important to the Community due to the stimulation they could bring to the development of economic links between regions situated on either side of frontiers;
- projects which do not have sufficient priority at the national level to be included in even the long term programme but which have greater importance from the Community viewpoint if specific Community objectives are taken into consideration;
- projects which facilitate the standardisation of equipment and the co-ordination of work on the Community network and which would also increase the profitability of complementary infrastructure situated in other Member States.

The second of these is clearly as relevant to the projects considered here as the first is not. The third clearly depends on the views taken by the relevant Member-States; while arguably the first element in the fourth is involved in so far as difficult decisions are needed to enable trains even more than road vehicles to operate on both sides of the Channel. It would seem a benefit to the Community, for example, if a solution is adopted which achieves efficient inter-running between the Continental and UK railway systems.

Annex 2 in the Memorandum provides a statement about the nature of 'Community interest' which has been drawn upon in the last stages of preparing this report. A distinction is drawn between the direct interest related to flows of traffic and therefore the designation and improvement of routes between Member-States; and an indirect interest where the Community has an

interest in relatively national objectives at the Community level. Thus the reconciliation of economic scenarios that has been undertaken for the projects could be seen as such a benefit.

The Annex concludes with two paragraphs which have been useful in guiding the development of the concepts practised in this study.

A distinction has been drawn between the Community interest of a direct nature and the broader macro-economic interest. In the case of direct interest the problems of evaluation are being approached through a policy of extending the methodology already applied by the Member-States. Study of the possibility of widening the coverage of national evaluation to include Community factors has already shown that the approach should be feasible. The objective is to produce an assessment of projects which includes both Community and national factors, in a single evaluation, although both elements should be separately identified. This approach is aided by the fact that all Member-States employ cost-benefit methods or some variant for their national planning. The practical objective is to extend the traffic forecasts and the traffic impact study to a wider network outside the Member-State. More general factors such as the impact on trade generation, regional policy etc. will be also considered, although clearly such factors are more difficult to quantify.

The macro-economic interest of the Community, like the evaluation of direct interest, should be considered at an early planning stage. This will pose difficult problems of giving due weight to policies which each have their own objectives. The minimum objective is to provide guidance for the decision maker on the size of the quantifiable traffic benefits to the Community. This is required in support of the 'compensation' principle that lies behind the proposed financial regulation: the aim being to quantify the amount by which the Community would benefit from a project and hence give a guide to the amount of aid from Community sources. Research in this field is progressing and it is hoped to be able to develop a trial approach in the near future.

13.2.7 The Community's Energy Policy

In 1978 and 1979 the Community has taken several steps towards a common energy policy. At the Council of Energy Ministers on 27th March 1979, a new approach was agreed to limit oil consumption and develop alternative energy sources; while the Commission was asked to report on the efforts made by national governments to achieve the 5% energy savings agreed by the

European Council in Paris when it decided to limit oil consumption to 500 million tonnes in 1979.

While it would appear that there is no current intention to alter the level or pattern of energy consumption by subsidisation or taxation, but to recommend that fuel prices should be based on their economic cost, there would seem to be a prima facie argument for saying that fixed cross-Channel links with a rail facility will lead to net energy savings especially insofar as they draw passengers from air; but the net savings need further examination and experience and investigation elsewhere suggests they should not be exaggerated.

The energy inputs and savings have been included as part of the cost-benefit analysis.

In addition, the energy implications have been examined in detail in section 12.5.

13.3 European Cost-Benefit Study

The adjustments required to produce a cost-benefit study, where impacts are limited to nationals of Member-States is the responsibility of SETEC who will report on it.

14

TESTING THE ROBUSTNESS OF THE RESULTS

14.1 Recommendations on Further Work

As has been made clear throughout the report the strength of its conclusions is conditional. It depends on statements made by the scheme proponents which it has not been the duty of the Consultants to investigate; on the assumptions underlying the demand forecasts, the indications given of the probable direction and order of magnitude of the external effects; and the attribution of the distributional consequences.

To test the soundness of the conclusions reached, the British consultants believe that it would be useful if some or all of the following tests and other inquiries were undertaken.

14.1.1 Sensitivity Tests

As pointed out earlier, the tariff assumptions made are plausible in the Consultants' judgment, but not necessarily those that would maximise profits or the economic return as calculated in section 10. The robustness of the results might be tested to:-

(1) lower tariffs on the fixed links, but most especially on the bridge; and

(2) raised tariffs on the fixed links;

(3) The partial test performed in section 9 of the effect of substantially lower ferry charges should be carried through to a complete cost-benefit analysis and assessment of profitability;

(4) The effect of higher energy costs should be considered. Two possibilities are:-

(a) that the higher rate of growth of energy costs should be assumed to carry on to the end of fifty years; and

(b) that the consequences of a higher growth path of energy costs should be investigated, for example one that would result in a 200% increase in its real cost by the end of the century;

(5) The scenarios provided by SNCF foresee a decline in the real cost of rail freight charges on the Continent. The implication of a less optimistic assumption should be considered - possibly one that real freight charges remain constant;

(6) There may be some need to review the values of time implied by the study. While they seem plausible, the compatability of the figures for user benefits reached for the Continental and the UK travel should be confirmed;

(7) The sensitivity of the results to a time saving on the link routes of half an hour should be evaluated -- not that there is necessarily an immediate prospect of this but it would provide a useful measure of what gains might be involved if such a saving could be realised, for example through quicker handling at terminals, Customs and Immigration examination on trains, the provision of more London terminals, quicker processing facilities at the bridge ends, etc;

(8) The peak capacity problem should be modelled and the effect of peak charging and other methods of peak-spreading should be considered;

(9) Reactions to a cut in air times and sea crossing times need to be investigated.

14.1.2 The Schemes

In the judgment of the British Consultants the cost and feasibility of the schemes needs to be tested or confirmed:-

(1) Some of the schemes to be worked up and costed in more detail as their proponents recognise and as is indicated in section 4;

(2) An independent engineering evaluation would appear to be required to check the technical feasibility and the cost of what is proposed;

(3) The capital cost of each scheme needs to be checked, in particular to make sure that similar provisions have been made for contingencies, and that the approaches are consistent;

(4) Maintenance and other operational costs need to be reviewed to check the plausibility and adequacy of what is proposed in each case;

(5) The operational feasibility of what is proposed needs confirming. For the railway operation this may entail satisfying the general public that with either a single or double-track tunnel there would be no or a negligible effect on commuter traffic even in the peak, and that the trackside environmental impact would be negligible;

(6) Though the rail schemes are more definite in their requirements near the portals, decisions need to be made on location and then their environmental and other implications reviewed. A clearer view is needed of the landward implications of the bridges. More detailed costings are also required;

(7) While the British consultants believe that the road improvement costs assumed for the schemes are of the right order of magnitude, more detailed inquiries may be needed, especially at the local level. In some cases it might be useful to consider more carefully the actual loading on some of the roads in the vicinity of the tunnel other than the M20;

(8) The properties and prospects for jetfoil may well reward more careful study;

(9) The use of alternative materials needs to be studied. For example, the tunnels could be lined with either cast iron or concrete and some of the bridge at least could be built of steel or concrete. Various implications of the choice need to be considered - technical, cost and social;

(10) Though the sensitivity of returns on the fixed link to ferry charges will have been tested, further inquiries may be needed to decide the cuts in charges over the long run that the ferry operators may reasonably be expected to achieve.

14.1.3 Scheme Variants

(1) The most important issue is to consider what would be involved and what lost or gained by building a single-track tunnel first and then later either a second tunnel or bridge. The implications should be explored for:-

demand
capital costs
operations and operational costs
associated infrastructure requirements.

A study should also consider the dynamic programming problem involved in helping decide when it would be best to build a second tunnel or bridge, if at all. This should draw upon the study of peak capacity already advised;

(2) If the tunnel were to be phased it would seem to follow that it should be built to a 7 metre diameter but there may be a case for reconsidering the feasibility of vehicle-carrying trains using a tunnel of 6 metres diameter;

(3) If there should be a rail facility the siting of one or more London terminals has to be decided. In addition to the operational and planning issues already considered, there would appear a case for considering how the choice of site would affect the convenience of travellers. A survey would be needed to establish in finer detail where the journeys of cross-Channel passengers originate at present in London and the Outer Metropolitan area in order to help establish how many terminals might be justified and where they would be. While there are costs and operational difficulties in establishing two or more terminals, it could increase substantially the volume of traffic overall if it were feasible, for example, to site a terminal suitable for travellers from East and North-East London. Such a study might be relevant to the case for trains stopping at a station on or near the M25, a question which was considered in the last round of Channel studies.

External Effects

(1) While the Consultants believe that the inland environmental effects are unlikely to be of a different order of magnitude, there will be more localised issues which need further examination;

(2) The choice of bridge design would require careful consideration as would the environmental issues posed by connections between a bridge or a submersed tube and the rest of the transport network;

(3) Technical research is needed on the maritime problems posed by a bridge and conceivably by the problems of laying a submersed tube.

Financial and Institutional Arrangements

(1) Various problems of funding need to be considered and decided. If the schemes do promise to be profitable as here suggested, there is should be no difficulty in raising funds, but the terms will require careful consideration;

(2) In particular issues of pricing policy need to be decided which strike a balance between the user and the producer, and bear in mind the potential monopolistic characterisatics of a fixed link as well as the need to assure investors that their interests are not in jeopardy;

(3) The institutional arrangements for constructing and operating a link would need to be considered.

14.2. Conclusions

In the Introduction to this Report (section 0.2) three questions were posed which it was intended it should aim to answer. They were:-

(a) Is there a prima facie case for any fixed link across the Channel?

(b) Is any one scheme found to be the most promising? and

(c) Are there any schemes which prima facie, and on the evidence available, do not seem worth pursuing?

It has always been realised that the conclusions would be conditional and indeed the first part of this section has set out many tests which it is felt are necessary to test the strength of the conclusions reached.

Any conclusions must therefore be treated as provisional and unreliable until some of that work at least is completed. Moreover, the conclusions are based upon criteria which we believe relevant to deciding the benefit the Community might derive from a fixed link, but which cannot logically reflect the varying weights the Community might give to the issues raised, or to the various distributional implications.

That said:-

(a) Prima facie all forms of fixed link considered - the Single-Track Tunnel, the Double-Track Tunnel, a Bridge or a Bridge with Rail facility (whether on the bridge or in a tunnel) would appear likely to be profitable and to show a positive economic return in the transport cost-benefit analysis. The measured external effect would not seem to affect those returns substantially.

Therefore subject to the caveats set out, there is a prima facie case for a fixed link.

(b) Subject to the same caveats, the Double-Track Tunnel would appear to be the most profitable and to promise the highest economic return in the transport cost-benefit analysis in the high growth case. This conclusion is not affected by the inclusion of the measured external effects. In the low growth case, it remains the most profitable. While the Single-Tunnel promises the highest return in the transport cost-benefit analysis, the Double-Track Tunnel

shows higher Net Present Values at discount rates of less than 10%. In that the rational aim of investment is not to achieve the highest rate of return as such, but to achieve the largest return obtainable, given the privately or socially determined discount rate, whichever is applicable, and given also the case made in section 10 for choosing a social rate of under 10% unless it is thought that additional weight is to be given for uncertainty above that allowed for in the estimates of costs and benefits, the case for the Double-Track Tunnel would appear the strongest and is not affected if measured external effects are included.

However, as explained in sections 9 and 10, the Single and Double-Track Tunnels are not independent alternatives. The real issue is as follows. The conditional case for building a Single Tunnel is very strong, though it may well be most sensible to build it of 7 metre diameter. Whether a second tunnel should be built at the same time, or sequentially (and if so, when) or not for the foreseeable future if a peak pricing study shows that it would be efficient to increase the effective capacity of a single tunnel through measures to spread the peak, requires further investigation. It should be realised that the larger the facility, the greater the planning, environmental and distributional issues raised.

Therefore prima facie the case for building a Single-Track Tunnel would appear the strongest, in the first instance, but it could be as part of a development that resulted in a second tunnel at the same time or subsequently or even a bridge.

(c) While the bridge schemes show lower returns and do not look as promising in the short run, they do show positive returns over the fifty year period. Much depends on the view taken on the uncertainty of the project. However, it is clear that they do raise more difficult planning, environmental and distributional issues than the tunnels. It may be premature, however, to exclude them until there has been further sensitivity analysis, particularly on tariffs and energy costs.