

ROADS, JOBS AND THE ECONOMY

A report for
Greenpeace

by

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Introduction

New road construction is justified on economic development arguments. The European Union with its plan for 12000 km of new motorway has produced exactly the same arguments about jobs and international competitiveness as does the UK government in its road programme documents. At the local level county councils and district councils are convinced that new roads will attract industry and reduce their unemployment rate. Strathclyde Regional Council is determined to build a new generation of motorways through the centre of Glasgow to regenerate the urban economy. Lancashire County Council sees by passes and motorways as the key to prosperity and cites links to Europe and East coast ports as essential to job creation in Lancashire.

The rhetoric of government, international organisations and employee representative organisations has done a great deal to consolidate a generally accepted view that roads are good for the economy. There is no evidence whatsoever in support of this contention.

The evidence of road building and its consequences since the early 1960s shows very clearly that such a crude instrument cannot be expected to deliver improvements in employment, welfare and economic progress. Is it an accident that government has not carried out a detailed audit of a major item of public expenditure in order to verify the claims made for new road construction? The results would not support the next round of road construction.

This report reviews the evidence for "roads bring jobs" arguments and identifies a large number of studies that disprove this simplistic cause and effect link. Original empirical research is then undertaken to test the argument at a regional and sub regional level and concludes that there is no evidence whatsoever to support the myth that roads are good for the economy.

Road construction is self defeating. It generates further rounds of traffic growth that actually slow down commercial traffic and it stimulates organisational and locational change in the corporate sector to encourage centralisation and specialisation. This denies local economies and communities of opportunities to participate fully in economic development.

Road construction continues to have a privileged place in the firmament of transport policy options and public expenditure in support of economic progress and quality of life. It has failed to deliver its policy objectives and represents a major area of wasteful expenditure and bad value for money. Recognising this failure is the first step towards constructing a transport policy that can deliver results and can recognise the importance of sustainability and the aspirations of local communities to participate in rewarding and varied employment opportunities.

Conventional Wisdom

Economic prosperity is the result of a large number of processes spanning the whole range of human activity and government intervention including expenditure on health care, education, housing, public transport, innovation, environmental improvement, conservation, and social welfare. Traditionally transport, usually interpreted as road construction, has been accorded a special place in government expenditures with an explicit claim that investments in this area increase economic success:

"The objectives underlying trunk road building and improvement continue to be:

- *to assist economic growth by reducing transport costs*
- *to improve the environment by removing through traffic from unsuitable roads in towns and villages*
- *to enhance road safety"*

Trunk Roads, England into the 1990s, Department of Transport, 1990

Building roads, therefore, has been designated as a significant agent for economic growth and elevated to a position of prominence that outclasses other policy areas:

"The expanded programme will improve the inter-urban motorway and trunk road network by reducing journey times and increasing the reliability of road travel. It is a vital further boost for British industry. The measures proposed will provide the means to improve the country's economic geography, increasing opportunities for the less-favoured areas, assisting urban regeneration and helping the more prosperous areas to cope with growth"

Roads for Prosperity (HMSO, 1989)

An important component of economic growth is new firm formation. Small firms are important employers and the source of future employment growth. New firm formation is of greater significance to the national economy than firm relocation and there are considerable economic disbenefits resulting from a process of employment decline in regions and cities because that employment has migrated to out of town locations and suburban motorway locations.

The July 1994 issue of "Regional Studies" is given over to a detailed statistical analysis of new firm formation in seven advanced industrial countries. New firm formation is identified as a major source of innovation and new jobs as opposed to simply moving jobs around, and in each country there are large differences between regions in rates of new firm formation. The factors that determine this variability are central to an understanding of whether or not increasing accessibility through the provision of new and expanded roads is a stimulus to economic development and job creation.

None of the seven studies (France, Germany, Ireland, Italy, Sweden, the UK and the USA) identify road infrastructure as important in new firm formation.

The Swedish study is particularly clear about this finding and uses the variable "reachability" to describe the quality of access to other parts of Sweden:

"No unique effect of reachability is revealed. While formation rates (of new firms) tend to be higher than average in major cities and regional centres, this can be explained by the market size variables. Several regions in the periphery also show higher than average birth rates."

Davidsson, Lindmark and Olofsson (1994) page 400-401

The United States' study looked at a number of variables which were thought relevant to the explanation of new firm formation including local government spending on education, roads, police and fire protection. The author concluded:

"There is little evidence that the current variation in local government spending (on education, roads, police and fire protection) has much impact"

Reynolds (1994), page 438

The UK study concluded:

"For new firm formation the most important (influences) are previous local population growth, capital availability as indicated by housing wealth, occupational structures focussed on professional, managerial and non-manual expertise, firm size structures and geographically concentrated urban demand"

Keeble and Walker (1994), page 425

The results of these country studies should come as no surprise. The evidence that supports the link between increased accessibility, expanded road capacity and job creation is extremely thin and circumstantial. The evidence indicating the lack of such a simplistic cause and effect relationship is, on the other hand, large and based on a number of rigorous statistical analyses. Some of these are reviewed below.

WHAT ROADS DON'T DO

There are a large number of clear and authoritative studies that demonstrate the lack of a convincing association between road investment and economic gains.

The findings of these studies have been ignored for 25 years in the pursuit of road building policies that do not generate the economic benefits claimed for them. There are very few areas of public policy and public expenditure where so much evidence of policy failure has been dismissed by successive governments.

Where the general relationship between transport investment and the location of economic activities has been evaluated (ECMT, 1991) the conclusions are unequivocal:

"..when companies are deciding where to locate their activities, transport is a secondary criterion in company strategy. Infrastructure is an advantage to the entrepreneur who can use it to break into new markets. Otherwise location decisions are influenced less by the cost of transport than by other factors such as fixed costs, particularly labour costs. By and large businesses do not consider transport costs to be an important factor as they average only 3-5% of operating costs"

ECMT (1991) p 115

A House of Commons Estimates Committee inquiry into motorways and trunk roads expenditure in 1968/69 concluded:

"Little is at present known about the longer term development benefits likely to result from road building and investment decisions involving development considerations must therefore be taken on the basis of very imperfect information...(the committee) welcomes research efforts aimed at finding some objective quantifiable measures of the development benefits from road investment. They believe that any investment in roads giving a low rate of return by normal cost benefit measurements needs to be clearly justified by special arguments which are open to public appraisal: for example the more intangible benefits of preserving the existence of local communities in the Development Areas."

House of Commons Papers, 1968/69, 475, paragraph 25

The recommendations of the Estimates Committee have been ignored for 25 years during which time billions of pounds have been spent on the road programme justified by untested economic arguments.

The Leitch report (Leitch, 1977) and a Government Economic service report (Parkinson, 1981) provide official confirmation of the lack of evidence in favour of road construction serving job creation and increased output in the manufacturing sector.

The Leitch Report represents a very thorough review of a large literature and it could not have been clearer in its conclusion. It is remarkable that successive governments have felt able to endorse the economic gain argument when it was so soundly rejected by Leitch. For example:

"At the national and regional levels, therefore, all the evidence points to the conclusion that improvements to the trunk road system can only have a limited effect on industrial location and growth"

Leitch (1977) p207

Blonk (1979) in a review of transport and regional development evidence from 12 countries concludes:

"A new link between an area of concentration and an underdeveloped region improves the flow of traffic not in one direction but in two. This entails a risk of competition from outside and of a draining of resources from the underdeveloped region"

Blonk (1970) p335

An important study of one piece of transport infrastructure that produced a dramatic change in patterns of accessibility could find no impact on economic growth and regional development. Cleary and Thomas (1973) studied the impact of the Severn Bridge and its associated motorways. They conclude:

"..there has been no significant relocation of manufacturing establishments as a consequence of the Bridge"

Cleary and Thomas (1973) p98

Plassard in ECMT (1991) presents one of the few contemporary case studies of the impact of a major new transport investment on the spatial distribution of economic activities. His example is the French high speed train between Paris and Lyons, the TGV. Plassard quotes French Ministry of Transport research trying to quantify the benefits that would result from the construction of a motorway and summarises the findings:

"First, transport infrastructure does not automatically have positive effects on local development; second, the effects are themselves conditioned by the development measures implemented by the local actors"

ECMT (1991) p 50

He shows that a major investment producing considerable savings in time and money has not been reflected in a change in the pattern of economic activities ie that people, not activities, move. Whilst this does produce some advantages for firms in Lyons who wish to penetrate the Paris market Plassard goes to some lengths to point out that economic actors in the Paris region are starting to consider Lyons as a remote suburb and "in the long term the two economic areas may merge, increasing further the peripheral status of the Lyons area" (p59).

In a rare analysis of employment change resulting from transport investments Plassard shows that Nagoya in Japan, formerly an important regional centre, has lost 20% of its employment since the opening of the high speed railway line between Tokyo and Osaka (ECMT, 1991, p60).

Plassard's analysis is very significant indeed in the debate about transport investment, notwithstanding the fact that it is based on passenger rail investment. A new motorway, trunk road or bypass may be "justified" on the implicit assumption that its economic forcing effect is

through reductions in the costs/time associated with road freight. In practice road use will be dominated by passenger traffic and much of so-called manufacturing activity will be dominated by passenger transport in the management, sales, marketing and innovation process.

Plassard shows that transport investments are not the primary factor in determining changes in the spatial pattern of activities. This challenges the basis of all UK and European Union support of road building on economic grounds.

Buchan (1985) reviewed the evidence from GLC surveys about the importance of new roads to the freight industry and could find no support for the hypothesis that building roads and expanding road capacity generates local economic benefits. Gwilliam and Judge (1978) carried out detailed empirical work on the M62 and found that major increases in accessibility did not produce detectable increments in employment. They concluded: "As far as regional development is concerned we have seen little strong evidence to suggest that the motorway investment is a powerful influence on inter-regional location of activity".

Birmingham with its ample supply of motorway connections is not a conspicuous economic success and Edinburgh with far less motorway linkage than Glasgow has certainly not suffered economic decline in comparison with its traditional rival in Glasgow.

More recently a detailed sub-regional study has been carried out in Lancashire (Goodacre, 1993). This study analyses employment change over time in all the local authority districts (LADs) in Lancashire and finds that those LADs through which the M65 passes have not performed any better than those through which the road does not pass. The Fylde region (including Blackpool) through which the M55 provides high quality access to the M6 has fared worst of all.

The results for north east Lancashire are particularly interesting. Blackburn, Hyndburn, Burnley and Rossendale have all been afforded excellent access to the M66/M62 and national motorway system as a result of the construction of the M65. Rossendale has recorded an impressive increase in its economic fortunes and the other three (adjacent to Rossendale) have shown very little change.

The pattern of employment change in Lancashire in the period 1981-1991 shows no evidence at all of a "roads effect".

Goodacre (1993) followed this finding up with a questionnaire of firms in these areas. When asked to rank reasons that influenced locational choice, ease of access to the motorway system was ranked of least importance whereas the availability of grants or loans was ranked first. This information is consistent with the findings of Keeble and Walker (1994) who identify highly focussed aid packages such as those available via the Welsh Development Agency as explanations for higher than average new firm formation.

If economic growth is a high priority for government intervention the evidence from these studies clearly shows that these objectives can be achieved by direct support of firms themselves. Processing large amounts of money through the inefficient filter of a roads programme does not deliver the economic gains claimed for it, whereas direct assistance to firms does.

WHAT NEW ROADS HAVE ACHIEVED

A significant area of empirical evidence about the importance of transport investment in stimulating economic activity can be derived from studies of change over time in the spatial distribution of economic activity and the degree of concentration by sector. There is no argument that over the last 20 years, stimulated by the development of the UK motorway system there has been a great deal of rationalisation in the location and concentration of economic activity (McKinnon, 1989). This has been particularly well developed in retailing and associated activities and has been encouraged by developments in management and logistics. McKinnon and Woodburn (1993a) present valuable empirical evidence on developments in retailing that have led to centralised inventory at distribution centres. The clear implication of these developments is that over time a (relatively) dense pattern of economic activities providing local employment has been replaced by a much more concentrated pattern, ie fewer localities have a source of employment in these sectors.

McKinnon and Woodburn (1993b) describe the evidence on concentration of manufacturing activity in the Census of Production (see Table 1).

They summarise the trend:

"Data for the period 1980-1990 confirm that major manufacturing enterprises have been concentrating their operations... the total number of plants operated by the five largest manufacturers in sectors with annual sales in excess of £2 billion dropped from 1260 to 856 while the average value of plant output rose from £22 million to £35.8 million (at 1990 prices). Average output per plant rose significantly in all sectors except motor vehicle parts".

McKinnon and Woodburn (1993b) p3

The implication of these data is clear. Many local economies have lost jobs as large firms have rationalised their activities so that they are based at fewer locations and serve larger market areas. This process, no doubt stimulated by a number of factors, is made possible and encouraged by the increasing density of the UK and the European motorway/high quality road network.

McKinnon (1993) is very clear in his summary of the situation:

"Since the early 1960s, largely in response to the development of the motorway/autoroute networks, firms have been centralising their inventory within countries. The same process is now underway at a continental scale.....Not only distribution operations are being centralised. Manufacturing is also becoming more concentrated as firms move from a system of nationally-based factories to pan-European production"

McKinnon (1993) p1/2

This process was foreseen by the Ceccini report on the Costs of Non-Europe and is part of the economic development process to improve international competitiveness, innovation and market penetration.

A recent report published by the British Roads Federation (BRF, 1994) has presented a case for the economic benefits of road investment.

"Roads means jobs" appeared in June 1994 and concluded:

- "∞ Present plans for spending on roads and for road charging will still leave congestion 13% higher by 2010.*
- To stop congestion worsening using restrictive methods, the price of petrol would have to be raised to £15 a gallon at today's prices by 2010.*
- Higher spending on roads will cut congestion and have only a minor effect on road usage. A 50% increase (£1bn a year) would increase road usage by only 0.77%.*
- A 50% increase in road spending would cut the annual cost of road usage by £4bn by 2010.*
- Environmental costs of increased road expenditure amount to less than 2% of the direct benefits. The benefits of fewer accidents represent five times the environmental costs.*
- A 50% (£1bn a year) increase in road expenditure would lead to a 0.73% rise in GDP and increase employment by 91,770 by 2010.*
- Cutting road expenditure by a half would reduce traffic speeds in London by a further 14% in the period to 2010, lead to the loss of 22,490 jobs, and cut house prices by 5%"*

Source: *Roads and Jobs*, (1994) BRF

The report is based on seriously flawed assumptions. The report assumes that additional road capacity will free up road space and hence lead to a reduction in congestion and saving in journey time. Evidence available from academic sources and from SACTRA, the governments own advisory body, show that new road capacity generates new traffic. The degree to which the M25 is used for local trips is illustrative of the underlying process which incorporates new road

capacity in new patterns of local travel, thus negating the predicted economic advantages of reduced congestion.

Any expenditure on goods and services will create jobs. The BRF report misses completely the comparative element by focussing on roads and ignoring other modes. It is unlikely that any transport policy would have as its objective an increase in road capacity. Road capacity is a means to an end and not an end in itself. Firms need high quality infrastructure to enable them to compete in international markets. Equally they need high quality local transport facilities to enable their staff to make journeys to work easily and to use a variety of transport modes.

These objectives can be achieved by a variety of policies including rail, road, combined transport and public transport to reduce congestion in the immediate area of the firm. The BRF report deliberately ignores all the complexities of transport and land use planning and all the options available to government to manufacture an argument in favour of road building.

Expenditure on roads produces fewer jobs than on other modes of transport. Highway construction generates the fewest jobs of any public infrastructure investment (Renner, 1992). Spending DM 1 billion on highways yields 14000-19000 jobs, compared with 22000 jobs on railway projects and 23000 on light rail projects.

The report contains no evidence whatsoever to support the case that building roads will generate economic benefits. It is not based on any microeconomic analysis of new firm formation or behaviour nor on any assessment of the role of other factors in the equation such as direct government grants. It deliberately misinterprets environmental data and distorts environmental economics to justify environmental destruction and is completely unaware of the vast amount of German research (Teufel, 1989a and 1989b) which shows that on conservative assumptions cars pay only 25% and lorries only 15% of the costs they impose on society.

The report is unaware of the distinction between new firm formation and new jobs and relocation. A relocated firm produces job loss in one area and job gains in another whilst incurring costs in the removal itself. A move to better premises with new machinery/equipment and facilities etc will produce economic gains but these need to be balanced against economic losses which can be large if the process of relocation leads to the abandonment of inner city area and creates large social and economic problems in older city areas.

WHY ROADS ARE NOT THAT IMPORTANT TO A MODERN ECONOMY

The debate about road capacity and economic stimulus is firmly located within a completely outdated and inappropriate conceptualisation of economic activity and industrial location theory. Regional development theory and industrial location theory has its roots in a material intensive phase of industrial activity where transport costs were far more important than they now are and where manufacturing was the dominant economic activity. In the late 20th century this is no longer the case. Many local economies have ceased to be dependent on the flow of materials as a major component of their economic life support systems. Their locational decision making and their strategic thinking are dominated by the availability of skilled and/or professional labour, by the availability of good school and attractive housing and by a number of "feel-good" factors related to environmental quality and the availability of rich cultural, social and recreational opportunities. Dominant flows now consist of information, ideas, technology and innovation and a highly motivated and flexible labour force attracted by a high quality environment will be an important factor in economic success.

The implications of this are starkly simple. New roads justified by a logic based on reducing transport costs and improving access to markets are totally irrelevant. Just as transport costs are no barrier whatsoever to a highly organised Japanese manufacturer breaking into the UK market so are they irrelevant for a manufacturer in the Highlands of Scotland or West Wales seeking to break into a new market in Milan or Frankfurt.

These points which once again identify the exaggerated claims for a simplistic link between transport, particularly road, infrastructure and local economic gains are supported in a wide ranging study of European freight by the German consultancy organisation EURES (Hey et al, 1992).

Hey et al emphasise the importance of local linkages and short distance supply links in stimulating economic development:

"Modern location theories emphasise that spatial proximity and close co-operation between supply industries has become a determining factor in locational policy...the calculated construction and strategic reinforcement of such clusters and networks between industries in a region are thus strategic elements not only for the support of the regional economy but also for traffic demand reduction"

Hey et al (1992) p 137, translated from the original German

It is highly likely that current UK and EU emphases on infrastructure to support long distance movement are actually damaging economic activity through the neglect of local transport, local congestion and local multi-modal possibilities (in the case of freight). No matter how much we increase the capacity of inter-urban corridors the capacity of the urban transport systems at either end of the delivery chain will be unable to take the additional traffic. Inter-urban roads effectively operate as high capacity conveyor belts dumping large amounts of traffic on local roads in urban areas and contributing to the deterioration of local transport efficiency and local economic vitality. This is a major flaw in transport policy and requires a fundamental reallocation of transport expenditures away from inter-urban road capacity (including by-passes) and towards infrastructure in its widest sense of assistance to firms and particularly small and medium sized enterprises.

An investigation into the link between economic prosperity and high quality accessibility to the trunk road/motorway system.

If an expanded road programme is likely to improve the "opportunities for less favoured areas" and assist urban regeneration then it must be possible to identify the roads effect. A roads effect would produce a situation where areas better served by major roads would perform better than areas remote from such roads and therefore disadvantaged in their cost structures and access to materials and markets.

We shall test the hypothesis that high quality accessibility is associated with greater positive change in levels of job opportunity, business take up and a reduction in unemployment.

The investigation falls into 4 stages:

1. Defines a geographical basis for the investigation using 34 travel to work areas (TTWAs)
2. Defines accessibility using the AUTOROUTE software which produces estimates of journey time for different pairs of origins and destinations
3. Defines economic performance indicators using unemployed claimants and notified job vacancy data held on the National On-Line Manpower Information Service (NOMIS) database at Durham University for the period 1985-1992
4. Evaluates the correlation between accessibility indicators and economic performance indicators
5. Focuses in more detail on 4 regions: West Glamorgan, Humberside (including Doncaster), NE Lancashire and the East Midlands

1 Geographical basis

Travel to Work areas (TTWAs) are formal statistical regions defined by the Department of Employment. TTWAs attempt to define a "commutershed" and are the statistical basis for unemployment rates. TTWAs were redefined in 1984 and for this reason the data used in this study is from 1985 onwards.

2 Accessibility

Autoroute is a software package that is used for route selection between pairs of origins and destinations. It allows a preference to be set for motorways, A roads, B roads and for routes to be searched for to meet shortest/quickest/cheapest criteria. Motorways were selected wherever possible followed by A roads. B roads were avoided. The desired output was set at quickest and not shortest or cheapest. The analysis considered 3 options for each main urban area in the TTWA:

- travel time to motorway or dual carriageway
- travel time to Folkestone (ie Channel Tunnel)
- travel time to a selection of destinations

3 Economic Performance indicators

There are many different ways of measuring economic performance. A usual indicator is the seasonally adjusted unemployment rate, however this only shows the percentage of people claiming unemployment benefit and does not show if new businesses have started up or increased the number of people employed - although by definition a decrease in unemployment does imply that job opportunity has increased.

Over a longer time period a reduction in the seasonally adjusted rate could indicate that there has been migration of economically active people away from the area. A good example of this is clearly visible in the Blackburn LAD over the period 1981-1991 (Goodacre, 1993). Due to these possible errors the approach used here is based on the total number of unemployed people as one of the indicators of economic activity within a given TTWA.

The second indicator is the extent to which new businesses are being attracted to an area. There are several ways this can be determined. Data can be obtained from calculating the net change in the stock of VAT registrations occurring in an area. Unfortunately however these data are only held on the NOMIS database for Local Authority Districts and are not directly comparable with TTWAs. Accordingly, this approach uses data for the number of notified vacancies at the main Job Centre within the TTWA. The data is therefore directly comparable with those for total unemployed people.

These two parameters therefore make up the two sides of any equation trying to determine whether or not an area has performed better or worse than in the past. On the one side there is 'demand' in the form of unemployed people, and on the other there is 'supply' in the form of the number of vacancies available.

It is important to this analysis to have both variables represented in the indicator of economic performance. Unemployment data is susceptible to change as a result of government programmes designed to transfer the unemployed into other categories related to short term training programmes, enterprise schemes etc. Unemployment rates also decline if those in search of work move elsewhere because job opportunities are so poor in their local area. If there is a "roads effect" of the kind used to justify new road building then the improved economic conditions, inward investment and expansion of the local economy would manifest itself in an increase in the number of notified vacancies. For this reason notified vacancies are included in our indicator of economic performance.

To gauge how the TTWAs had performed over the period 1985 to 1992 the unemployment figures (U_e) were divided by the number of notified vacancies (V) to give a value for the number of unemployed persons per job vacancy. For each of the years being evaluated the monthly figures (September to August) were calculated and an average annual value for the ratio U_e/V found. This figure is a measure of job opportunity.

'Job opportunity' is a direct measure of the number of unemployed persons per notified vacancy. An increase in the 'job opportunity' value means that there are more unemployed persons "chasing" each vacancy, therefore representing a deterioration in the chances of finding a job. The value for job opportunity can increase or decrease as a result of changes in numbers of unemployed or as a result of changes in notified vacancies; ie a reduction in the numbers of unemployed or an increase in number of notified vacancies (ie positive changes) will produce a lower value for job opportunity. Conversely an increase in unemployment or decrease in notified vacancies (a negative change) will produce a higher value for job opportunity.

Because there is a considerable range for the Ue/V ratios direct comparisons were not possible. Accordingly, the data were converted into index values with 1985/86 being 100 for all TTWAs.

Index values for all areas are shown in Table 2. A typical graph is shown in Figure 1 with the index decreasing (showing greater job opportunity, i.e. Ue getting smaller or V getting bigger) in the 'boom' period up to 1989/90, followed by a period of declining job opportunity as the economy went into recession again.

Appendix 1 contains a fully worked example to show how the measure of job opportunity is calculated, compared over time, converted into an index value and used in Tables 2 and 3 to summarise economic performance over time. The measure of job opportunity using the same data as in the worked example is graphed in Figure 1.

To determine how well an area had performed the difference between the 1985/86 and the 1991/92 value was calculated. The index values were used for this as they are already, in effect, percentage values. For example, in the Okehampton TTWA during 1985/86 the average annual value for Ue/V was 13.15. In 1989/90 the figure had fallen to 3.45 (26% of its 1985/86 value). By 1991/92, however, this figure had crept back up to 8.54 (65% of its 1985/86 value). Therefore, over the whole period, the TTWA had experienced an increase in job opportunity of 35% (100-65). The percentage increase or decrease in job opportunity for all areas is shown in Table 3.

4 Evaluation

Percentage change in job opportunity has been plotted as a dependent variable against travel time (independent variable). The travel time for HGVs to motorways/dual carriageways from the main urban areas within the TTWAs is shown in Table 4 and figures 2 and 3 show the main scattergraph plots for all TTWAs in the analysis.

The scattergraphs show very clearly that there is no correlation between the two variables. Each scattergraph includes the value of the coefficient of determination (R^2) which identifies how much of the variation in the dependent variable (job opportunity) is accounted for by variation in the independent variable (time in minutes for an HGV to reach either the main road system or Folkestone). The coefficient of determination (R^2) is a standard statistical measure of the degree to which two variables are related. The R^2 statistic can be expressed as a percentage or as a decimal eg 10% = 0.1. An R^2 of above 60-70% (>0.6) would indicate the existence of a strong relationship as for example in the case of rainfall data and height above sea level. As height above sea level in Britain rises so does the annual rainfall total. With a R^2 value of less than 10-15% (<0.10-0.15) we can assume that there is no evidence of a relationship between the two variables.

Figure 2 plots data from all 34 TTWAs for time to the nearest trunk road against job opportunity. The number of minutes to the nearest motorway or dual carriageway trunk road has no influence on economic performance.

Figure 3 plots all data from 34 TTWAs for the time taken to travel to Folkestone and once again shows as near a complete absence of any relationship whatsoever as one is likely to find in statistical analysis.

5 Sub-regional analysis

Economic benefits from road accessibility are frequently claimed for the local level ie for geographical areas that are much smaller than TTWAs. This is the case in Strathclyde Region in Scotland which has an ambitious motorway construction plan designed to regenerate Glasgow's economy. Lancashire County Council has 33 road schemes in its "Greening the Red Rose County" draft structure plan, the majority of which are justified in terms of their economic benefits. In Lancaster £81 million is to be spent on a new 6 mile long Western Bypass specifically to stimulate the economy of Morecambe and Heysham. Since much of the impetus behind road construction comes from highway authorities and local economic

development departments it is important to look in a little more detail at the sub regional level.

Four areas were chosen for this analysis:

1. NE Lancashire
2. Humberside and Doncaster
3. East Midlands
4. West Glamorgan

NE Lancashire is particularly interesting for the emphasis given to the area in road building plans by Lancashire County Council and the progress of the M65 giving improved access to the national motorway system.

Humberside and Doncaster are motorway "rich" and relatively congestion free whilst the East Midlands represents a variety of accessibility conditions. Grantham and Newark are located on the A1 with very high accessibility characteristics whereas places such as Melton Mowbray, Horncastle, Gainsborough and Skegness are not as well endowed.

The West Glamorgan case study illustrates an important difference in economic performance between two areas with almost identical accessibility characteristics.

Accessibility out of the Humberside and Doncaster area was determined by calculating the travel time from the main urban areas of the TTWAs to junction 32 on the M1. This important nodal point was chosen because it connects the M1 with the M62, M180 and the A1(M) via the M18. It therefore represents a principle destination for many HGVs travelling south.

In the case of West Glamorgan both TTWAs are located less than 12 minutes driving time from the M4. Neath/Port Talbot and Swansea have been compared in accessibility terms to the M5/M4 junction and to Reading.

In the case of NE Lancashire TTWAs, junction 5 on the M62 was used as the final destination. This point was chosen because it is at the end of the A65 and M66 roads out of the area and represents the fastest route available.

Figure 4 shows a scattergraph of accessibility in NW and Northern England to Manchester Airport. With an R^2 of 0.040 there is a hardly any relationship at all between these two variables.

Figure 5 shows a scattergraph of accessibility in SW England and West Glamorgan to Reading. With an R^2 of 0.014 there is once again a very weak relationship indeed. TTWAs in SW England perform quite well or indifferently for reasons that have nothing whatsoever to do with the road system and indices of accessibility.

Figure 6 shows a scattergraph of accessibility in Humberside and the East Midlands to Manchester Airport. With an R^2 of 0.30 there is a weak relationship.

Figure 7 shows a scattergraph of accessibility in Humberside and the East Midlands to London Heathrow Airport. With an R^2 of 0.002 there is a very weak relationship indeed.

Figures 8 and 10 are shown without the R^2 statistic. With such a small number of points the statistic would be quite unreliable. Figures 8 and 10 can be inspected to show once again a pattern of points that shows no evidence of a relationship between the two variables.

Figure 8 (time to junction 32 on the M1 from the Humberside area) shows that all areas have achieved similar gains in job opportunity with the exception of Doncaster. This is surprising as this TTWA is more centrally located to the motorway network.

Figure 9 shows a scattergraph of accessibility in the East Midlands to the A1 dual carriageway trunk road. The R^2 statistic is very low showing a very weak relationship indeed between the two variables. As in the case of the SW England example the variability in economic performance between TTWAs can not be explained by the variation in accessibility. The results for Skegness and Horncastle are particularly interesting. Both are

more than 90 minutes away from the A1 and both did better in terms of job opportunity than Newark-on-Trent located on the A1.

Grantham's performance (figure 9) is interesting. Locational parameters are similar to those of Newark (ie within 6 minutes of the A1). Both are major junctions for a series of trunk and primary A roads yet Grantham has out-performed Newark by 20%.

Figure 10 shows that the TTWA furthest away from the M62, junction 5 achieved the greatest increase in job opportunity whereas Blackburn the second closest remained virtually stagnant with respect to changing job opportunity.

Figure 11 is interesting in spite of plotting only two points. The graph shows very clearly that Swansea and Port Talbot/Neath with almost identical accessibility characteristics (Swansea is 10 minutes travel time further away from the M4/M5 junction) have experienced very different economic fortunes with Neath and Port Talbot doing much better than Swansea. This cannot be explained by the few minutes travel time difference between the two locations. Swansea has experienced a significant decrease in job opportunity (-37%) whereas Port Talbot/Neath have experienced significant gains (+39%). This equates with a 76% difference between the two places in economic performance.

The analysis of economic performance and accessibility has produced results that could not be clearer. The R^2 statistic ranges from 0.010 to 0.30. Only in the case of Figure 6 and access to Manchester airport from Humberside and the East Midlands does the R^2 statistic rise above 0.04. There is no relationship between accessibility and economic performance.

Other variables

Well over 50 years of economic geography on both sides of the Atlantic have clarified exactly which factors encourage new firm formation, job creation, inward investment and the locational decisions of entrepreneurs. Transport costs are not a significant variable and rarely account for more than 2% of the value of sales (McKinnon, 1994). Most decision making is conducted with inadequate information about cost structures and a great deal of entrepreneurial activity is influenced by factors such as environmental quality, cost and variety of housing and perception of the quality of educational facilities in the area.

The national and EU obsession with roads and trans European networks at an enormous cost (£311 billion over the next 15 years for Trans European networks) is inexplicable given this knowledge base about all the factors that do encourage "Growth, competitiveness.....and.....employment" (Commission of the European Communities, 1993).

One factor that does figure largely in stimulating economic activity is the flow of grants directly to the firm itself.

In several of the areas selected for this study government grants are available in the form of Regional Enterprise Grants (REG), Regional Selective Assistance (RSA) and Regional Development Grants (RDG). Table 5 gives a breakdown of all payments under these schemes to 31 March 1992.

Details of which TTWAs received these grants were obtained from British Business (up to 1988) and Employment Gazette (1988 onwards). All RSA and RDG payments to a number of selected TTWAs in the period March 1984 - March 1991 were extracted from these publications and collated. The TTWAs were:

- Hull
- Scunthorpe
- Grimsby
- Doncaster
- Goole
- Blackburn
- Pendle
- Accrington and Rossendale
- Swansea
- Port Talbot and Neath

The cumulative totals are shown in Table 6.

A scattergraph of payments against job opportunity for the Humberside area (Figure 12) shows that the area that has received most money has achieved the best result in terms of job opportunity.

In West Glamorgan there is a very clear "grants effect". Figures 13 and 14 show time series information for job opportunity and the amount of RSA and RDG paid to these two areas. The graphs clearly show that the Neath and Port Talbot TTWA attracted significant amounts of grant income through the 1980s at a time when the area had development area status. Swansea with only intermediate area status has received erratic payments and far less in total.

Goodacre (1993) details the same effect in NE Lancashire where TTWAs with large RDG and RSA receipts systematically out-perform those without such receipts. Access to motorways or high quality roads is a poor predictor of economic success whereas direct payments to firms are a good predictor. In areas of equal or near equal accessibility grant receipts appear to be the main factor accounting for differentiation in economic performance.

Glasgow is both "road rich" and "grant rich". Glasgow's urban motorway system is one of the densest in Europe giving excellent intra-urban and inter-urban communication possibilities. Over the period 1983-1991 the Glasgow conurbation (TTWAs of Glasgow, Dumbarton, Greenock and Lanarkshire) have received over £300 million of RGD and RSA funds. Glasgow alone has received over £115 million. "Poverty in Strathclyde: key facts" (1993) estimates that 33% of the city's population is dependent on income support, a figure that rises to over 55% in parts of the inner East End. The poor performance of Glasgow particularly in comparison to Edinburgh which is "road poor" and "grant poor" should advise caution in the debate about road construction and economic benefits. Urban regeneration is difficult but is far more likely to be successful from investments in housing, education, environmental improvement, direct assistance to small firms and training programmes than through building roads.

Conclusion

The analysis of variation in economic performance and variation in accessibility has found no evidence of a positive relationship. Areas of poor accessibility out-perform areas of high accessibility and areas with very similar accessibility characteristics have very different economic performance characteristics.

This should not come as a surprise. The accumulated evidence from previous studies points unequivocally to the same conclusion. There is no basis in experience or empirical evidence for road investment stimulating economic development.

Economic development is a complex phenomenon and multi-factorial. A large number of factors have a bearing on job creation, new firm formation, growth and decline in local economies. One of these is direct government assistance to firms in the form of regional assistance and regional development grants. Where areas with similar accessibility characteristics have divergent economic performance characteristics these grants can form a large part of the explanation.

Large amounts of money are allocated to the national and local authority roads programme on economic development grounds. There is no evidence to support the deeply entrenched view that economic development is stimulated by new and expanded roads.

Road construction for economic development purposes has not been evaluated by government against a number of policy alternatives that are more likely to advance the same objectives. Not only does this produce a great deal of environmental destruction for very little gain, it actually distracts attention away from the urgent need to target public policy intervention and public expenditure very carefully to achieve agreed aims. If economic development is the target at the local level then road construction has failed to deliver.

Road construction is bad value for money as a way of creating jobs. Its rationale is seriously flawed, its performance rarely audited and such benefits as do materialise rarely maintained into the future as congestion builds up and eliminates the time savings at the centre of the flawed model of economic development.

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TABLE 1

Concentration of manufacturing Output (1980 and 1990)

Sector	Average Output per Plant for Top 5 Firms in Each Sector (£million) - 1990 prices		Number of Plants Operated by Top 5 Firms in Each Sector	
	1980	1990	1980	1990
(SIC classification in brackets)				
Iron and steel industry (221)	35.49	69.94	41	29
Basic industrial chems. (251)	58.07	70.17	45	27
Specialised chem. prods (256)	37.08	56.53	19	16
Pharmaceutical products (257)	169.11	226.29	7	10
Hand tools and metal goods (316)	7.75	9.33	67	42
Indust. plant & steelwork (320)	22.78	45.72	25	18
Mining machinery etc (325)	18.01	25.79	26	14
Misc. machinery etc (328)	7.81	15.72	108	40
Office machinery etc (330)	87.88	249.69	13	7
Basic electrical equipment (342)	16.08	20.92	75	40
Telecomm. equip. etc (344)	27.53	38.01	93	45
Motor vehicles & engines (351)	422.12	515.27	10	9
Motor vehicle parts (353)	28.67	19.13	34	31
Aerospace equip. etc (364)	168.14	227.16	19	21
Production of meat etc (412)	10.64	11.78	45	51
Bread, biscuits, flour etc (419)	9.14	13.92	153	86
Starch & misc. foods (423)	39.60	83.97	17	12
Clothing, hats & gloves (453)	3.43	8.45	100	53
Wooden furniture etc (467)	6.14	7.00	41	53
Conversion of paper/board (472)	8.00	10.17	103	59
Printing and publishing (475)	10.22	15.93	171	149
Processing of plastics (483)	7.42	9.57	48	44
All of above sectors	22.01	35.76	1,260	856

Source: Central Statistics Office, 'Business Monitor: Report on the Census of Production' HMSO, London (annual publication).

TABLE 2**Index Values for Job Opportunity**

	85/86	86/87	87/88	88/89	89/90	90/91	91/92
Plymouth	100	86	82	68	59	89	122
Okehampton	100	75	49	40	26	46	65
Newton Abbot	100	79	59	36	29	76	117
Dartmouth	100	79	57	33	31	91	130
Exeter	100	88	71	48	41	80	116
Torbay	100	90	81	49	41	70	84
Honiton	100	78	63	37	35	68	98
Taunton	100	72	57	47	56	101	84
Hull	100	81	50	41	33	55	74
Goole	100	86	73	49	33	51	73
Scunthorpe	100	78	63	35	33	53	69
Grimsby	100	77	75	56	52	79	70
Doncaster	100	106	109	67	47	65	98
Gainsborough	100	103	60	38	35	44	51
Newark	100	89	62	32	36	48	60
Melton	100	68	50	33	29	55	77
Sleaford	100	80	52	35	29	52	62
Lincoln	100	77	76	51	50	64	72
Horncastle	100	73	58	42	33	36	54
Skegness	100	87	64	42	51	53	55
Blackburn	100	83	66	50	49	65	87
Accrington	100	75	58	39	29	49	64
Burnley	100	85	60	39	34	51	68
Pendle	100	63	43	27	22	31	41
Carlisle	100	61	57	35	33	52	62
Penrith	100	86	50	27	17	34	45
Kendal	100	90	70	43	27	38	74
Barrow	100	86	62	39	32	48	80
Whitehaven	100	65	59	34	27	42	52
Workington	100	62	45	37	39	47	53
Keswick	100	73	64	36	28	29	53
Port Talbot & Neath	100	72	57	36	27	44	61
Swansea	100	148	153	94	68	96	137
Grantham	100	66	53	33	32	38	42

Source: NOMIS

TABLE 3

Percentage Change in Job Opportunity 1985/86 - 1991/92

Travel to Work Area	% change
Hull	26
Grantham	60
Newark	40
Scunthorpe	31
Taunton	6
Doncaster	2
Pendle	59
Sleaford	38
Accrington	36
Burnley	32
Grimsby	28
Lincoln	28
Blackburn	13
Exeter	-16
Okehampton	35
Goole	27
Melton	23
Port Talbot & Neath	39
Plymouth	-25
Swansea	-37
Gainsborough	49
Kendal	26
Honiton	2
Newton Abbot	-17
Penrith	55
Carlisle	38
Torbay	16
Keswick	47
Horncastle	46
Dartmouth	0
Barrow	20
Workington	48
Whitehaven	36
Skegness	45

TABLE 4**Travel time for HGVs to major roads and to Folkestone**

Urban Area	Journey time to major* road (minutes)	Distance to Folkestone (miles)	Journey time to Folkestone (minutes)
Nelson	1	344	384
Hull	1	320	355
Burnley	1	340	376
Okehampton	1	313	351
Penrith	2	397	428
Port Talbot	2	271	298
Exeter	3	289	317
Scunthorpe	3	300	329
Goole	3	293	322
Taunton	5	255	283
Grantham	6	195	243
Newark	6	203	258
Kendal	6	369	400
Newton Abbot	6	303	334
Carlisle	7	417	451
Doncaster	7	275	306
Plymouth	7	332	375
Grimsby	8	333	385
Accrington	11	338	370
Swansea	12	279	311
Blackburn	14	333	366
Honiton	19	284	317
Lincoln	28	259	304
Keswick	29	414	455
Torbay	31	308	344
Melton	35	187	246
Gainsborough	40	228	290
Barrow in Furness	48	394	446
Sleaford	54	201	257
Workington	65	436	491
Whitehaven	75	442	501
Dartmouth	81	322	388
Horncastle	95	296	377
Skegness	112	231	313

(*motorway or dual carriageway trunk road)

TABLE 5**Total Payments to March 1972/73 - 31 March 1992**

Figures are in £millions

	RDG	RSA	REG	Other REGs	TOTAL
Scotland	1927.1	408.8	20.3	41.2	2397.4
Wales	1214.3	284.7	27.8	11.7	1538.5
N. East	1751.2	234.2	6.8	23.7	2015.9
Yorks & Humb'	408.2	118.6	18.3	73.5	618.6
E. Mids	85.8	32.6	16.3	52.5	187.2
S. East			57.3	129.8	187.1
S. West	125.0	39.5	8.6	42.7	215.8
W. Mids	2.7	109.0	37.8	61.9	211.4
N. West	1167.3	215.1	32.1	87.0	1501.5
TOTAL	6681.6	1442.5	225.3	524.0	8873.4

Source: Industrial Development Act 1992 Annual Report 1991/92

TABLE 6

Payments of RSA and RDG to TTWAs (£000s)
1984/85 - 1990/91

	84/85	85/86	86/87	87/88	88/89	89/90	90/91	Total
RSA								
Hull	2099.0	458.0	342.0	8696.0	791.0	520.0	395.0	13301.0
Scunthorpe	1719.0	250.0	709.0	4174.0	12850.0	3077.0	725.0	23504.0
Grimsby	230.0	32.0	209.0	86.0	1393.0	150.0		2100.0
Doncaster	539.50	109.0	200.0	95.0	655.0	15.0	300.0	1913.5
Goole	23.5							23.5
Blackburn		385.0	325.0	1552.0	811.0	120.0	4324.0	7517.0
Accrington	102.5	347.5	647.0	660.5	957.0	532.5	649.0	3896.0
Swansea	1181.0	1643.3	455.0	3795.0	635.0	1605		9314.3
Port Talbot	375.0	1555.0	437.0	750.0	1668.0	432.5	5671.0	10888.5
RDG								
Port Talbot	16405.0	1098.0	3143.0	3626.0	2116.0	485.0	505.0	27378.0
Scunthorpe	5553.0	1996.0	16328.0	3960.0	7646.0	2962.0	2242.0	40687.0
Grimsby	1546.0	912.0	3569.0	445.0	143.0			6615.0
Hull	5590.0	2679.0	2756.0	1165.0	446.0			12636.0
Accrington	29.0	119.0	471.0	32.0				651.0
Total RSA & RDG								
Hull	7689.0	3137.0	3098.0	9861.0	1237.0	520.0	395.0	25937.0
Scunthorpe	7272.0	2246.0	17037.0	8134.0	20496.0	6039.0	2967.0	64191.0
Grimsby	1776.0	944.0	3778.0	531.0	1536.0	150.0		8715.0
Doncaster	539.50	109.0	200.0	95.0	655.0	15.0	300.0	55279.0
Goole	23.5							23.5
Blackburn		385.0	325.0	1552.0	811.0	120.0	4324.0	7517.0
Accrington	131.5	466.5	1118.0	692.5	957.0	532.5	649.0	4547.0
Swansea	1181.0	1643.3	455.0	3795.0	635.0	1605.0		9314.3
Port Talbot	16780.0	2653.0	3580.0	4376.0	3784.0	917.5	6176.0	38266.5

Work Example of Job Opportunity Calculation

The table below details values of Ue , V and ratio Ue/V for Doncaster over the period 85-92. It can be seen that as values of Ue and V change so too does the ratio Ue/V . For example, between 85/86 and 86/87 the number of unemployed dropped from 22542 to 21626 but over the same period the number of job vacancies also dropped (605-551). The effect of this being to increase the ratio value from 37.26 to 39.32.

This, in effect, shows that there has been an increase in the number of unemployed per job vacancy, i.e. a decrease in job opportunity.

	Ue	V	Ue/V
85/86	22542	605	37.26
86/87	21626	551	39.32
87/88	18107	445	40.69
88/89	14669	592	24.78
89/90	12062	685	17.61
90/91	13763	565	24.36
91/92	16168	442	36.58

The ratio values were then converted into index values for direct comparison with 85/86 = 100.

	Ue/V	Index Value
85/86	37.26	100
86/87	39.32	106
87/88	40.69	109
88/89	24.78	67
89/90	17.61	47
90/91	24.36	65
91/92	36.58	98

These are the values plotted in Figure 1 and show that over the period 85/88 job opportunity in Doncaster decreased (increase in Ue/V ratio). Followed by a period of increasing job opportunity (88-90), followed by another period of decreasing job opportunity (90-92).

The cumulative result of this being that over the period 85-92 job opportunity in Doncaster has slightly improved (a 2% decrease in index value).