APPENDIX A

SUPPLEMENTARY NOTES ON THE SELECTION OF ROUTES FOR DEVELOPMENT

The section of the survey on the selection of routes for development mentions the broad considerations taken into account in reaching conclusions. Much detailed work was undertaken during the process of selection and this appendix deals with some specific examples which illustrate the depth of the survey. It is convenient to deal with these examples under the following headings:—

(1) General considerations:
Areas linked by the routes considered.
The future traffic flows between these areas together with the intermediate centres served.

(2) Physical characteristics:
Data concerning the numbers of bridges and tunnels, ruling gradients, and features restricting running speeds.

(3) Traffic levels:
Levels of traffic at present passing over the routes.

(4) Alternative routes:
Summaries of the salient features, the range and mix of speeds expected, and calculated route capacities.

(5) 'Network' considerations:
The way in which the routes selected fit into the future railway trunk network.

Example 1 Trans-Pennine Routes

The routes considered in this example are: —

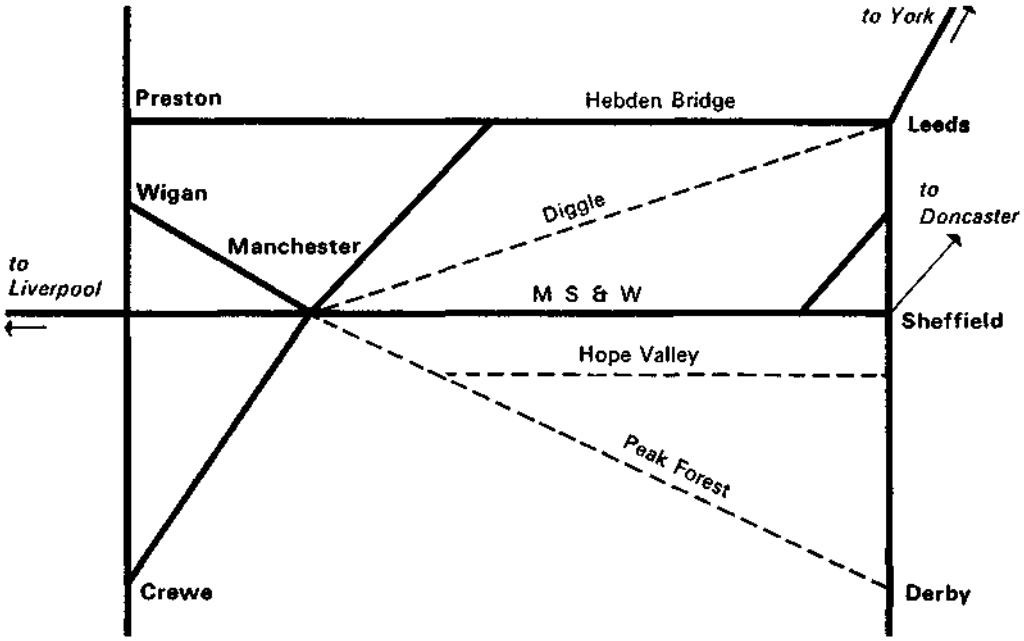
(a) Leeds to Manchester via Hebden Bridge,

(b) Leeds to Manchester via Diggle,

(c) Sheffield to Manchester via the Woodhead Tunnel,

(d) Sheffield to Manchester via the Hope Valley,

(e) Derby to Manchester via Peak Forest.



(1) General Considerations.

(a) Hebden Bridge route.

This route between Leeds and Manchester links South Yorkshire and the Tyne/Tees and Humber areas with Lancashire. Reference to Maps Nos. 8 and 18 will show that it is well aligned in relation to the present and forecast flows of freight traffic.

Intermediate areas served along the line of this route are: —

Bradford,
Halifax,
Sowerby Bridge,
Todmorden,
Rochdale.

Its most important feature is its ability to fulfil the dual functions of carrying the traffic flows from the East side of the Pennines to the North Manchester area and Lancashire, and that of providing a through link between the West Riding and the main Anglo-Scottish West Coast route at Preston.

(b) The Diggle route.

This route, which also connects South Yorkshire and the traffic areas to the East with Manchester, divides near Standedge into two separate lines which rejoin at Stalybridge. It was opened some 8 years later than the Hebden Bridge route, with which it was designed to compete, and now provides a duplicate link for the principal East-West traffic flows. It does not provide a connection between the West Riding and the North, except by a circuitous journey involving greater mileage than the Hebden Bridge route.

The intermediate centres which it serves are Dewsbury, Huddersfield, and a C.E.G.B. power station near Stalybridge.

(c) *The Woodhead route (M. S&W).*

This route provides a link for the principal traffic flows between the southern part of the South Yorkshire area, the East Midlands, and the Manchester/Liverpool industrial complex. At its eastern end, the connecting lines provide a natural 'funnel' for westbound coal from the South Yorkshire/East Midlands coalfields, and they also gather traffic from a very much larger catchment area extending eastwards to the Humber ports.

A particularly important feature of the Woodhead route is that 10 years ago it was electrified, equipped with modern signalling, and re- aligned through a newly bored tunnel between Woodhead and Dunford. This electric system is now being extended to connect with a new mechanised marshalling yard to be opened shortly at Tinsley, north of Sheffield.

At its western end, the route is well located to handle future traffic flows to the Manchester South area. It also provides a through con- nection, via Godley, with Liverpool and serves important intermediate centres.

(d) *The Hope Valley route.*

This was the last of the trans-Pennine routes to be built in the days of competition, in the hope of attracting some of the traffic passing between Sheffield and Manchester. It covers approximately the same route- mileage as the Woodhead route and provides for the same traffic flows between South Yorkshire, the East Midlands, and the Manchester area. The only intermediate traffic of any importance is provided by a cement works situated midway between Dore and Chinley.

(e) *The Peak Forest route.*

This route connects the traffic centres of the East Midlands with the Manchester area. At its southern end, connecting lines serve the south part of the East Midlands coalfield and the Nottingham area, whilst its northern connections provide links with Stockport and Manchester South. By a branch at Cheadle Heath, a through link is provided to Liverpool, both via Warrington and via the former Cheshire Lines route.

(2) *Physical Characteristics*.

A survey of the five routes under review has revealed that no large items of maintenance expenditure are likely to be incurred during the next 10 years. Although they all embody substantial engineering structures, those on the Woodhead route, in particular, have been renewed in recent years with a consequent reduction in the level of maintenance costs.

The table which follows summarises the main physical features of each route:—

PHYSICAL CHARACTERISTICS OF ROUTES

Route	Route Mileage	Maximum permitted speed mph	Permanent Speed Restrictions* (Distance)				Total cases	Gradients		Tunnels		Bridges		Viaducts	
			0- ½ miles	½ - 2 miles	2-5 miles	over 5 miles		Ruling	Next severest	No. of separate bores	Aggregate length in miles	Over bridge	Under bridge	No.	Aggregate length in miles
Hebden Bridge	49	75	3 cases	1 case											
			1 x 35 mph	1 x 45 mph			4	1/47	1/59	19	4.4	72	127	14	1-2
			1 x 45 mph									i			
			1 x 60 mph												
Diggle	43	75	4 cases	1 case		2 cases	*_								
			1 x 15 mph	1 x 20 mph		1 x 50 mph	7	1/47	1/59	13	10.5	91	144	23	1.6
			1 x30 mph			1 x 55 mph									
			I x 35 mph												
			1 x 45 mph												
			| 2 cases	2 cases											
			2 x 35 mph	2 x 40 mph				1/77	1/97	3	3.7	76	71	8	0-7
Woodhead	41	60	5 cases	1 case		2 cases	4								
			1 x 20 mph	1 x 45 mph		1 x 50 mph		1/70	1/100	6	8-0	43	195	4	0-3
Hope Valley	45	80	2 x 35 mph			1 x 60 mph	8								
			1 x 50 mph												
			1 x 60 mph												
			8 cases	6 cases	1 case	1 case									
			1 x15 mph	1 x 20 mph	1 x 60 mph	1 x 60 mph		1/90	1/100	23	7	153	220	13	i-o
Peak Forest	61	80	2 x 25 mph	3 x 50 mph			16								
			1 x 40 mph	1 x 55 mph											
			1 x 45 mph	1 x 60 mph											
			2 x 50 mph												
			I x 55 mph												
* Restrictions below 65 mph!															

Attention is drawn to the following points of particular interest:—

(i) Apart from the 1/47 incline at Miles Platting, which is common to both of the 'northern' trans-Pennine routes, in general the gradients via Hebden Bridge are less severe than via Diggle.

On the 'southern' route, all heavy freight trains via Peak Forest require an assisting locomotive for 15 miles between Rowsley and Peak Forest.

(ii) The small number of permanent restrictions on speed over the Woodhead route compares favourably with the large number of such restrictions via Peak Forest.

(iii) The large number of tunnels on the Peak Forest route—23 in all—which affect the maintenance costs for the route.

(3) Present Traffic Densities.

It is of interest to note the levels of freight traffic of all classes passing over each of the five routes today, and the following table sets out the present situation:—

Freight traffic carried by tram-Pennine routes: 1964

Route	'ooo Tons per Week
Hebden Bridge	70
Diggle	40
Woodhead	170
Hope Valley	45
Peak Forest	85

This shows that the Woodhead route carries twice as much freight traffic as any other trans-Pennine route and reference is made later to the scope for increasing its freight train payloads.

(4) Routes selected for development.

The conversion of future traffic flows, shown in Maps 18 and 20, into train- loads per day in each direction, using the forecast of future payloads set out in Table 10 of the main report, produces a total demand of rather less than 200 westbound trunk trains (passenger and freight). The volume of eastbound traffic is smaller, as the predominating traffic is the flow of coal from Yorkshire and the East Midlands into Lancashire. These 200 westbound trains per day will just about saturate the future maximum workable capacity of one trans-Pennine route.

The object of the study is to select for development a trunk system which provides for the foreseeable traffic, with an adequate margin of spare capacity. So much the better if this can be provided without route duplication, but, in the case of trans-Pennine traffic, chiefly because of the extra train mileages involved if only one route were selected, it is prudent to select two routes for long-term development. These are one 'northern' route via Hebden Bridge and one 'southern' route via Woodhead.

An important consideration taken into account in selecting the Hebden Bridge route was that of its dual function (mentioned in i (a) above) of giving access between the West Riding and Manchester, and providing a through connection with the main Anglo-Scottish West Coast route at Preston. The alternative 'northern' route via Diggle is unable adequately to fulfil both these requirements.

Further advantages in favour of the Hebden Bridge route are that in general it has less severe gradients and, moreover, the total population of the intermediate centres served is double that covered by the Diggle route.

Turning now to the 'southern' routes (via Woodhead, Hope Valley and Peak Forest), the most important considerations concerning the route via Woodhead are:—

(i) Its directness for traffic flowing from the East Midlands, and centres to the east and south, to the Merseyside area.

(ii) The favourable rail connections at each end of this route.

(iii) The post-war modernisation of the route, providing electric traction, colour-light signalling, and a new tunnel.

(iv) The scope for increasing the payload of freight trains from 750 tons up to the limit of present coupling strength—about 1,100 tons. The additional power can be provided by adapting the existing electric locomotives to enable two locomotives to operate as one tractive unit.

(v) It was necessary to calculate, in respect of each route, the maximum work- able capacity in relation to the total estimated demand for train-load movements. An important feature of this calculation was the way in which trains are expected to operate within the speed bands discussed in the main report (Table 8).

Over the Hebden Bridge route some 30% of the trains are expected to run at an average speed of 35 mph, with the bulk of the remaining 70% averaging 50 mph. Inter-city express passenger services, running at average speeds of 70 mph, will account for about 10% of the total movement. On the Woodhead route the majority of the future trains are expected to be in the heavy freight class, running at an average speed of 35 mph.

The calculations of potential route capacity in the future are summarised below:—

		Woodhead (trunk trains per day /each way)		Hebden Bridge (trunk trains per day/each way)	
Theoretical Capacity			320		370
Deductions for: —					
(i)	Mixed speeds.	50		100	
(ii)	Junction/Terminal confliction	35		50	
(iii)	Maintenance & contingencies	35		35	
		—	120	-	185
	Workable capacity		200		185

As noted previously, the total traffic demand represents rather less than 200 trunk trains per day in the direction of the heavier flow, so that the selections would provide a substantial margin of spare capacity.

It will be noted (from the table on Page 84) that the effect of selecting two routes for

development would be to reduce the trunk route mileage of the trans-Pennine routes from 239 to 90.

The concentration of trunk flows over two routes is likely to give rise to a limited increase in train mileage. This would, however, be compensated by improved utilisation of locomotives and train crews operating over a simplified trunk system. The overall effect of this concentration would be a substantial reduction in the route unit cost (in terms of the cost levels shown in Table 4 of the main report) for trunk traffic compared to the costs which would arise if all five routes were to be retained for trunk movement.

(5) Network Considerations.

As in all cases under review, it was necessary to consider the way in which the selected routes would fit into the trunk system as a whole. The main points taken into account in this connection were:—

Hebden Bridge

East End—at Leeds the route feeds in three directions:—

(i) to the north—via the selected Leeds—Church Fenton—York route,

(ii) to the east—via Selby to Hull,

(iii) to the south—via the selected link with the East Coast route at Doncaster.

West End

West of the Pennines the route feeds in three directions:—

(i) to the North—via Preston to the Anglo-Scottish West Coast route,

(ii) to the West—via the selected route to Liverpool,

(iii) to the South—via the newly electrified route to Crewe.

Woodhead

East End

(iv) to the North—via the selected Sheffield to Doncaster link on to the East Coast,

(v) to the East—particularly to Immingham (the port selected for export coal shipment) and the steel centre at Scunthorpe,

(vi) to the South—

a) via the Sheffield—Retford link on to the East Coast route,

b) via Sheffield to the selected route serving the East Midlands coalfield area.

West End

The ex-Cheshire Lines route between Manchester and Liverpool has been proposed for development, and this is reached by branching at Godley to provide a through link

to the docks at Liverpool, which would also serve the important intermediate industrial centres. This through route by-passes the Manchester complex on its south side and secures many operational advantages by so doing.

A further feature influencing the selection of the Woodhead route is the fact that scope exists for the westward projection of the trans-Pennine electrified system via the Cheshire Lines route to Liverpool; a step which would improve the utilisation of the existing electric locomotives.

Example II Manchester—Liverpool routes

(a) Wigan and Kirkby,

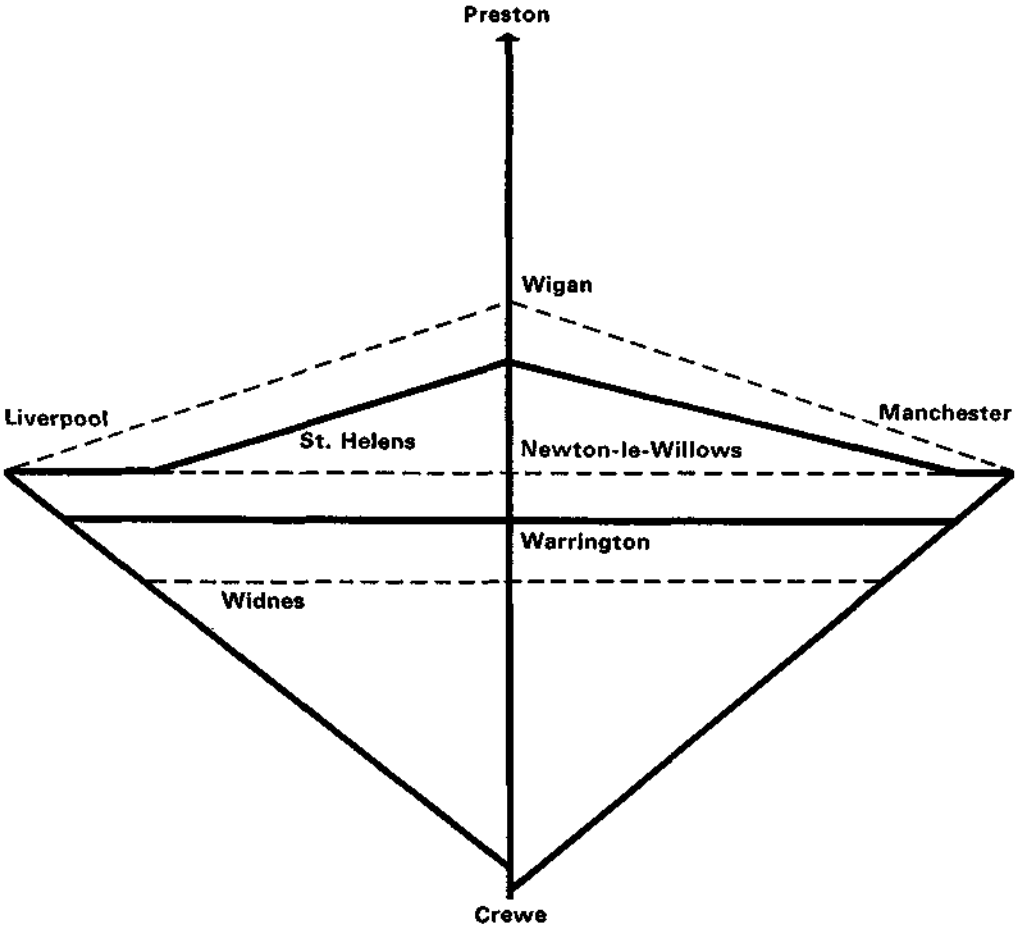
(b) Tyldesley and St. Helens,

(c) Newton-le-Willows and Earlestown,

(d) Irlam and Warrington,

(e) Lymm and Widnes.

The routes are shewn diagrammatically in the figure below. The extent of the through route mileage which exists between Manchester and Liverpool reflects the independent and competitive development in the past on the part of the former London & North Western Railway, the Lancashire & Yorkshire Railway, the Cheshire Lines Committee and, to a smaller extent, the Great Central Railway.



(1) General Considerations

(a) Route via Wigan

This route, constructed by the Lancashire & Yorkshire Railway, is one of the less direct of the links between Manchester and Liverpool.

Between Manchester and Liverpool the significant centre of population and industry is Wigan, which can be served by alternative routes.

(b) Route via Newton-le-Willows

This line has very few industries situated on it. Where they do exist, industrial locations, traffic concentration centres, and the long-life collieries can be conveniently served from other lines.

Junctions to the North provide through links between Manchester and Liverpool and the main Anglo-Scottish trunk route.

(c) Route via St. Helens

A particular feature of the route is the large number of collieries either located on it or served from it. Many of these collieries have a long life expectancy. The main centre of industry served is St. Helens.

The route is some three miles longer than that via Newton-le-Willows. It also provides a through link with the main Anglo-Scottish West Coast route from the Manchester and Liverpool directions.

(d) Route via Warrington

This is the former Cheshire Lines route which is two miles longer than the route via Newton-le-Willows. There are several freight centres throughout the length of the route, the most important being at Trafford Park, Irlam, Glazebrook, Warrington and the docks at Herculaneum and Huskisson.

(e) (e) Route via Widnes

This route, five miles longer than the line via Newton-le-Willows, is less a through link between Manchester and Liverpool than a means of pro- viding a by-pass for Manchester.

Important centres which the route serves are at Arpley (near Warring- ton), the new C.E.G.B. Power Station at Fiddler's Ferry, Widnes, and the docks at Garston.

Near Widnes the route is joined by the electrified London-Liverpool line.

(2) Physical Characteristics

A survey of the five routes under review revealed no large items of maintenance expenditure as likely to be incurred over the next 10 years. The table which follows overleaf summarises the main physical features of each route.

(3) Present Traffic Densities

As mentioned in the previous example, whilst selection of routes for development must take account of capacity required for future traffic flows, it is of interest to note the levels of freight traffic passing over each of the routes under review today. The following table sets out the present situation:—

Freight traffic carried over Manchester-Liverpool routes: 1964

Route	*'000 Tons per week*
Via Wigan	25
Via St. Helens	20
Via Newton-le-Willows	20
Via Warrington	30
Via Widnes	35

PHYSICAL CHARACTERISTICS OF ROUTES															
Route	Route Mileage	Maximum permitted speed mph	Permanent Speed Restrictions* (Distance]				Total cases	Gradients		Tunnels		Bridges		Viaducts	
								Ruling	Next Severest	No. of separate bores	Aggregate length in miles	Over Bridge	Under Bridge	No.	Aggregate length in miles
			0 – ½ miles	½ - 2 miles	2-5miles	over 5 miles									
Manchester – Liverpool via Wigan	36	75	1 case	1 case	2 cases	-	4	1/45	1/55	9	1.5	99	93	4	2.5
			1 x 55 mph	1 x 35 mph	1 x 40 mph										
					1 x 50 mph										
Manchester - Liverpool via St. Helens	35	60	3 cases	3 cases	—	—	6	1/67	1/100	11	1.6	114	97	3	0.1
			1 x 20 mph	1 x 15 mph											
			1 x 40 mph	1 x 25 mph											
			1 x 45 mph	1 x 30 mph											
Manchester - Liverpool via Newton-le- Willows	32	75	2 cases	1 case	—	—	3	1/69	1/83	11	0.75	81	37	3	1.0
			1 x 25 mph	1 x 45 mph											
			1 x 60 mph												
Manchester - Liverpool via Warrington	34	75	3 cases	1 case	—	—	4	1/70	1/100	10	1.75	90	71	8	1.75
			1 x 25 mph	1 x 30 mph											
			1 x 40 mph												
			1 x 50 mph												
						'									
Manchester - Liverpool via Widnes	37	40	1 case	2 cases	—		3	1/83	1/93	11	0-75	104	75	6	0.25
			1 x 35 mph	1 x 20 mph											
				1 x 25 mph											
*Restrictions below 65 mph															

(4) Routes selected for development

The conversion of future traffic flows into train loads per day in each direction, produces a total demand of some 100 trunk trains (passenger and freight) each way.

The future traffic flows in the area may be grouped as under:—

(i) flows between Manchester and Liverpool,

(ii) flows from Manchester to the north, Liverpool to the north,

(iii) flows from Manchester to the south, Liverpool to the south.

It is the first two groups with which we are concerned in considering the routes between Manchester and Liverpool. Flows in category (iii) have already been legislated for, and will pass on to the main Anglo-Scottish route at Crewe or, in the case of Manchester, may pass also via Stoke.

Ideally, it would be preferable if one route could combine the features of:—

(i) serving the majority of important centres of population and industry,

(ii) serving the long-life collieries in the area,

(iii) providing a connecting link from Manchester and Liverpool to the north.

No one route, however, fulfils all requirements. Thus whilst the total trunk flows could be accommodated on one route, it is considered prudent that two routes should be developed:—

(i) a route which serves the majority of the important intermediate centres,

(ii) a route which can provide connections with the collieries in the area and through links to the north.

The two routes which together best fulfil these requirements are the route via Warrington and that via St. Helens.

Further advantages of the route via Warrington are:—

(i) the favourable arrangement of connecting lines at the west end of the route permitting the serving of the docks areas,

(ii) the fact that it lends itself to the diversion of the 'trans-Pennine' diesel service would add to the density of the Warrington route,

(iii) it provides a through route from Liverpool to Sheffield, by connecting with the Woodhead electrified route at Godley.

There are no capacity difficulties for trunk services on the two selected routes. The Warrington route would cover services between Manchester and Liverpool—the route via Wigan would be adequate to cover services to and from the North.

In the case of the route via Warrington, 75% of the services are expected to run at an overall average speed of 50 mph, the remaining 25% are expected to be fairly evenly divided between inter-city passenger expresses and 'heavy' freight services.

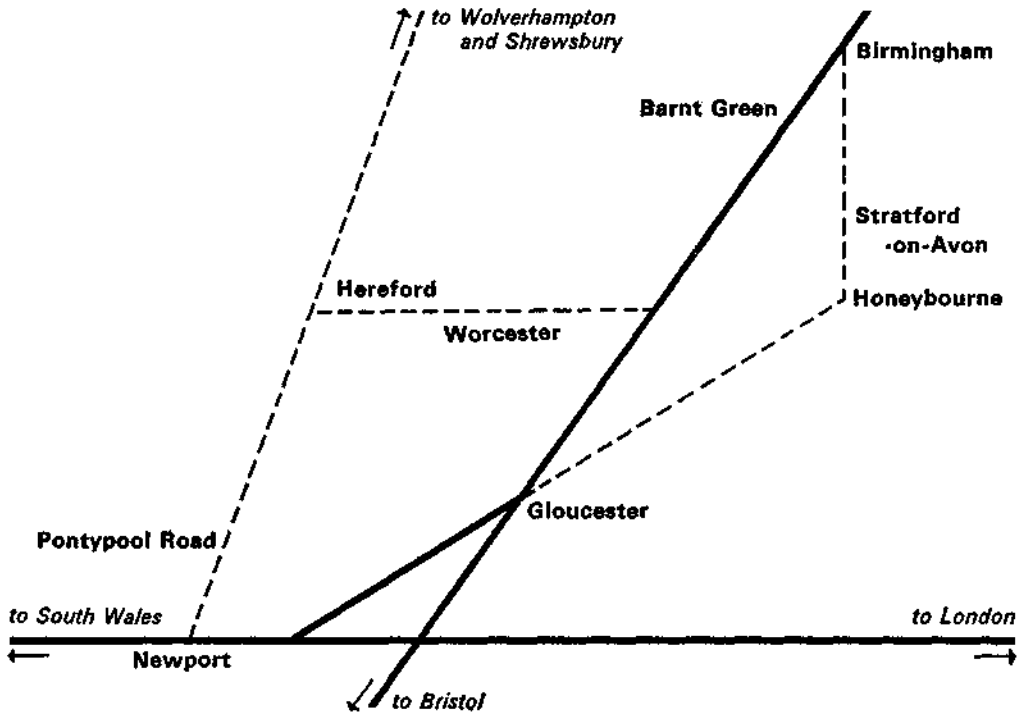
The effect of selecting two routes would be to reduce the route mileage over which trunk traffic is carried from 174 to 69.

Example III Routes between the West Midlands and South Wales/the South West

(a) Birmingham to Newport and Bristol, via Barnt Green and Gloucester,

(b) Birmingham to Newport, via Worcester and Hereford,

(c) Birmingham to Newport and Bristol, via Stratford-on-Avon and Gloucester.



(1) General Considerations

(a) Route via Barnt Green

This route between Birmingham and the South West is the south section of the former Midland Railway Company's route to the West Country.

It is the shortest of the three routes under consideration between Birmingham and Bristol. From Gloucester it connects with the Great Western line via Lydney and Chepstow to Newport.

(b) Route via Worcester and Hereford

This route provides a link between Birmingham and Newport of approximately the same mileage as route (a), and in so doing it serves the centres of Worcester and Hereford. It does not provide a direct connection between Birmingham and Bristol.

(c) Route via Stratford-on-Avon and Gloucester

This is part of the Great Western route from Birmingham to South Wales. It provides a through route to Bristol by feeding into the Midland route at Gloucester.

There are no major centres of population or industry located on this line.

(2) Physical Characteristics

A survey of the three routes under review has revealed no large items of maintenance expenditure likely to be incurred during the next 10 years.

The Table on pages 98 and 99 summarises the main physical features of each route.

The following points are of particular interest:—

(iv) The Midland line has a gradient, over a length of 2 miles, of 1/38. This is just south of Barnt Green and is known as the Lickey Incline.

(v) The Worcester—Hereford—Newport route has gradients steeper than i/ioo for approximately 8 miles of its length with a ruling gradient of 1/45.

(vi) The route via Stratford-on-Avon has 5 miles of gradient steeper than 1/51 and a ruling gradient of 1/41.

(vii) The even spread of permanent speed restrictions over all three routes.

(3) Present Traffic Densities

Again the point is made that whilst selection of routes for trunk movement must take account of capacity required for future traffic flows, the levels of freight traffic passing today over each route are not without interest:—

Freight traffic carried over the West Midlands — South Wales and South West Routes: 1964	
Route	*'000 Tons per week*
Via Barnt Green and Gloucester	9«
Via Worcester and Hereford	70
Via Stratford-on-Avon and Gloucester. .	60

The route via Barnt Green shows up as the principal freight route. It is also a good route between Birmingham and Bristol, from the point of view of inter-city passenger services, as it is the shortest link between these two centres. It is also attractive as a link between Birmingham and Newport, with a mileage roughly the same as by the Hereford route.

(4) Routes selected for development

The conversion of future traffic flows into train loads per day in each direction produces a total demand of some 45 trunk trains per day between the West Midlands and Bristol, and a similar number between the West Midlands and South Wales.

Of the alternatives, the Barnt Green route, except for the Lickey Incline, is more easily graded and is shorter. The effect of the Lickey Incline will diminish in the future as a result of technical improvement to traction and rolling stock.

Approximately 70% of the trains from the West Midlands to the South West and South Wales will have an average speed of 50 mph, the remaining 30% being divided equally between trains having an average speed of 35 mph and 70 mph.

The practical capacity of the Barnt Green route under these conditions of speed mix is calculated to be about 140 trains per day in each direction. Therefore, with a future

load of 90 trains each way, spare capacity will exist even when both Bristol and South Wales trunk trains are routed over the section between Birmingham and Gloucester.

The concentration of trunk flows on to one route between Birmingham, Bristol, and South Wales, will substantially reduce the route unit cost (see Table 4 of main report) for trunk traffic, compared to the costs which would arise if all three existing routes were retained for trunk movement.

(5) Network Considerations

At its northern end, the Barnt Green route links naturally with the selected route from Birmingham via Derby to Yorkshire.

By branching at Gloucester, the selected route connects with the main London—South Wales route at Severn Tunnel Junction.

At Bristol it provides a direct connection with the selected route between London and the South West.

It will be appreciated that some of the selections were simpler to make than others and involved less background work. In each case, however, the investigations were carried to a depth sufficient to establish the conclusions beyond reasonable doubt.

PHYSICAL CHARACTERISTICS OF ROUTES															
Route	Route Mileage	Maximum permitted speed mph	Permanent Speed Restrictions* (Distance)				Total cases	Gradients		Tunnels		Bridges		Viaducts	
			0 – ½ miles	½ -2 miles	2-5miles	over 5 miles		Ruling	Next severest	No. of separate bores	Aggregate length in miles	Over Bridge	Under Bridge	No.	Aggregate length in miles
Birmingham/ S.W. via Barnt Green (Midland route) to Gloucester	52	75	3 cases	1 case	1 case	—	5	1/38	1/80	7	0.5	69	71	1	0-125
			1 x 15 mph	1 x 60 mph	1 x 40 mph										
			1 x 30 mph												
			1 x 35 mph												
Birmingham/ S.W. via Stratford-on- Avon to Gloucester.	62	75	3 cases	1 case	—	1 case	5	1/41	1/47	3	0.5	85	112	4	0-75
			1 x 20 mph	1 x 40 mph		1 x 60 mph									
			1 x 25 mph												
			1 x 35 mph												
Birmingham Worcester Hereford Pontypool Road	96	90	2 cases	2 cases	1 case	-	5	1/45	1/51	8	2-5	127	203	8	1.0
			1 x 30 mph	1 x 10 mph	1 x 60 mph										
			1 x 50 mph	1 x 40 mph											
*Restrictions below 65 mph															