Final Report July 2009

Feasibility Study into Re-opening the Sandbach to Northwich Railway Line to Passenger Traffic, including Re-opening Middlewich Station

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Commissioned by Middlewich Railway Steering Group

The cost of this commission was met by Cheshire and Warrington Economic Alliance, the former Cheshire County Council, Congleton Borough and Vale Royal Borough Councils and the new unitary Councils of Cheshire East and Cheshire West & Chester.

Executive Summary

E.1 Local road congestion, access to regional centres, and sustainable economic development are key issues in North West England. Solutions such as railway improvements are being sought to address these problems, in places such as the town of Middlewich, in Cheshire East, which has a population of over 13,000 and is recognised as one of Cheshire's fastest growing towns. Although a freight-only railway line between Sandbach and Northwich passes through the town, passenger services were withdrawn in January 1960. However, there has been a campaign for some time to reinstate these trains, and as a result the Town Council commissioned this feasibility study to cover capital expenditure, operating costs, passenger demand and revenues.

E.2 The physical works required to reinstate the service are relatively small. A new location for the station has been identified close to the earlier site, but requiring only a single platform, accessed via an existing car-park. Even including overheads, contingencies, etc., this is expected to limit station costs to £0.7m. Only minor works are needed to track and other infrastructure (e.g. to the platform at Northwich), giving a further £0.2m.

E.3 A number of possible service patterns have been developed and costed. The simplest of these is to divert the peak extra Manchester – Northwich - Chester services via Middlewich to Crewe, but (by definition) this offers only a peak service. All-day options include a shuttle service between Crewe and Northwich, with subsequent variants extending this first to Altrincham and then into Manchester. Operating constraints include the very restricted platform capacity at Crewe, single-line constraints between Sandbach and Northwich plus between Altrincham and Stockport, and line capacity between Stockport and Manchester Piccadilly. The operating costs of these main options range from £0.5m to £2.1m p.a.

E.4 Demand forecasts for the main service options have been developed using the Railway Consultancy's GCOST™ multi-modal spreadsheet model. Data on passengers' potential origins and destinations has been derived from Census Travel-To-Work data, and then allocated between different modes of transport depending upon the relative attractiveness of each, as measured by its generalized cost (a weighted index of journey time, frequency, fare etc.).

E.5 Modelling shows that expected demand for the main options ranges roughly between 500 and 600 passengers per day, leading to annual revenues in the range £0.6m - £0.7m. In addition, there are of course other benefits of the scheme, in particular time savings valued at between £0.25m and £0.5m p.a.

E.6 The preferred option uses an additional train to shuttle hourly between Crewe and Northwich during the offpeak period, combined with running two through services to/from Stockport in the peaks. These latter would be diversions of the existing additional trains on the Mid-Cheshire Lines, but those journey opportunities would be maintained through interchange at Northwich. Around 650 extra passengers per day are forecast to use rail services in the area in this option, which would increase revenues by c. £700,000 p.a. Whilst this is broadly the same as the forecast operating costs, time savings and other benefits spread over the life of the project and valued at over £3m give the project a Benefit:Cost ratio of around 5.

E.7 A recent announcement by the Transport Secretary offers a possible solution to funding this project, as schemes brought to fruition by local authorities are likely to be sustained by Central Government if the Benefit:Cost ratio after three years of operation exceeds 1.5. As the preferred option here does indeed appear likely to pass such a benchmark, further work is recommended with Network Rail in taking this project forward.

Sandbach - Northwich Railway Line Feasibility Study

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1 Introduction

Economic Development in Cheshire

1.1 Key issues being faced by planners in Cheshire include local road traffic congestion, transport difficulties in accessing key regional centres (such as Manchester, Manchester Airport, Chester, Crewe railway station) and ensuring that economic development occurs sustainably. Britain's railways are of increasing importance in addressing these problems, especially as people notice petrol prices and environmental considerations rising. Local Government can be the catalyst for railway improvements such as the re-opening to passenger traffic of freight-only lines, especially when these are seen in the wider context of regional planning and sustainable population growth.

1.2 In North West England, one such route is the railway between Sandbach (in Cheshire East) and Northwich (in Cheshire West and Chester). Not only could passenger services run on it form a useful local link to key regional centres including Chester and Manchester, but (if run beyond Sandbach to Crewe) could also provide inter-city rail connections to many parts of the country.

1.3 After a competitive tendering process, the Railway Consultancy was selected to undertake an initial feasibility study into the potential for (re)-opening the railway between Sandbach to Northwich to passenger traffic, including the re-opening of the station at Middlewich. This work was designed to address merely the first stage in Network Rail's project development process (GRIP 1), although in practice going rather beyond this is inevitable in several areas.

1.4 Following the recent local government reorganisation of 1st April 2009, local authority services for the area through which the railway line passes are provided by the town councils of Northwich, Middlewich and Sandbach working under the new Unitary Authorities of Cheshire East, and Cheshire West & Chester Councils. Middlewich falls within Cheshire East Council whilst nearby Northwich falls within Cheshire West & Chester.

1.5 Whilst environmental and economic benefits are clearly one objective of local government reducing road speeds may mean that improved public transport links to key destinations such as Manchester, Manchester Airport and Chester are perhaps more important. The raison d'être of any new rail service would be to support these objectives into the future. This is particularly the case given recently-published regional and economic development strategies, which see the Northwich area designated as a growth point (West Cheshire, 2008) looking for sustainable solutions.

1.6 Improving sustainable transport links would be expected to enhance the economic performance of the region, but this occurs at two levels. At the local level, a better link between Northwich, Middlewich, Sandbach and Crewe would help workers reach job opportunities, and students college places, more easily. However, re-opening the line between Northwich and Sandbach also provides a regional link between the important centres of Northwich and Crewe. With the connectional possibilities at Crewe, this re-opening can have the benefit of enhancing the linkages of the sub-region with the rest of the country.

Middlewich

1.7 Middlewich is a town of around 13,600 inhabitants in central Cheshire, surrounded by villages with a population of a further 740. Nearby towns include Crewe, Winsford, Northwich and Sandbach (see Figure 1.1). The town used to have a railway station on the line between Sandbach and Northwich. Unfortunately, it lost its rail service in January 1960, since when the town's population and traffic levels have grown significantly. With the town centre only a couple of miles on the A54 from junction 18 of the M6, traffic congestion is apparent throughout the day in Middlewich, even though it is a relatively small town. Whilst

some road improvements have been implemented, the proposed Eastern Bypass should further help to ease this problem.

1.8 The population of Middlewich has grown in recent years, whilst it continues to be a source of employment; for instance, the "Midpoint 18" industrial estate close to the station continues to expand. Whilst rail freight is beyond the scope of this study, it is therefore apparent that usage of a re-opened passenger station might come both from residents travelling outwards (e.g. commuting to Manchester) and those travelling into the town. Fortunately, the fact that the line has remained open for freight traffic provides an easier opportunity to re-connect Middlewich to the passenger network than might otherwise have been the case. Moreover, station sites are available which are relatively close to the centre of the town (see Figure 1.2).

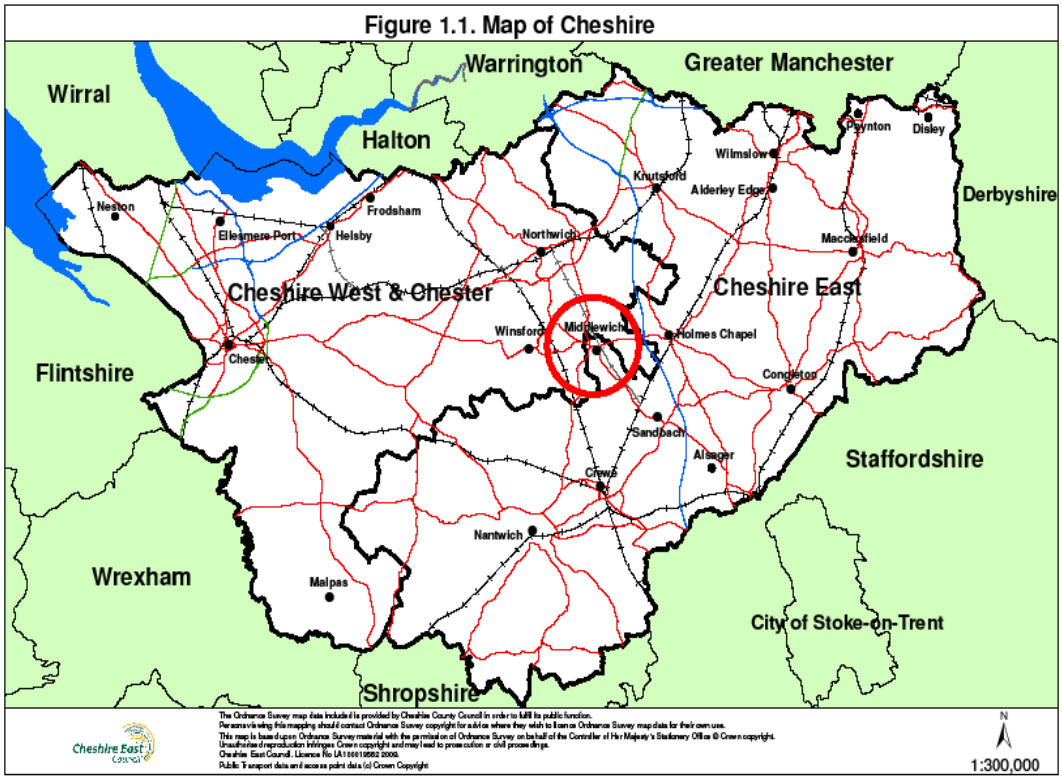
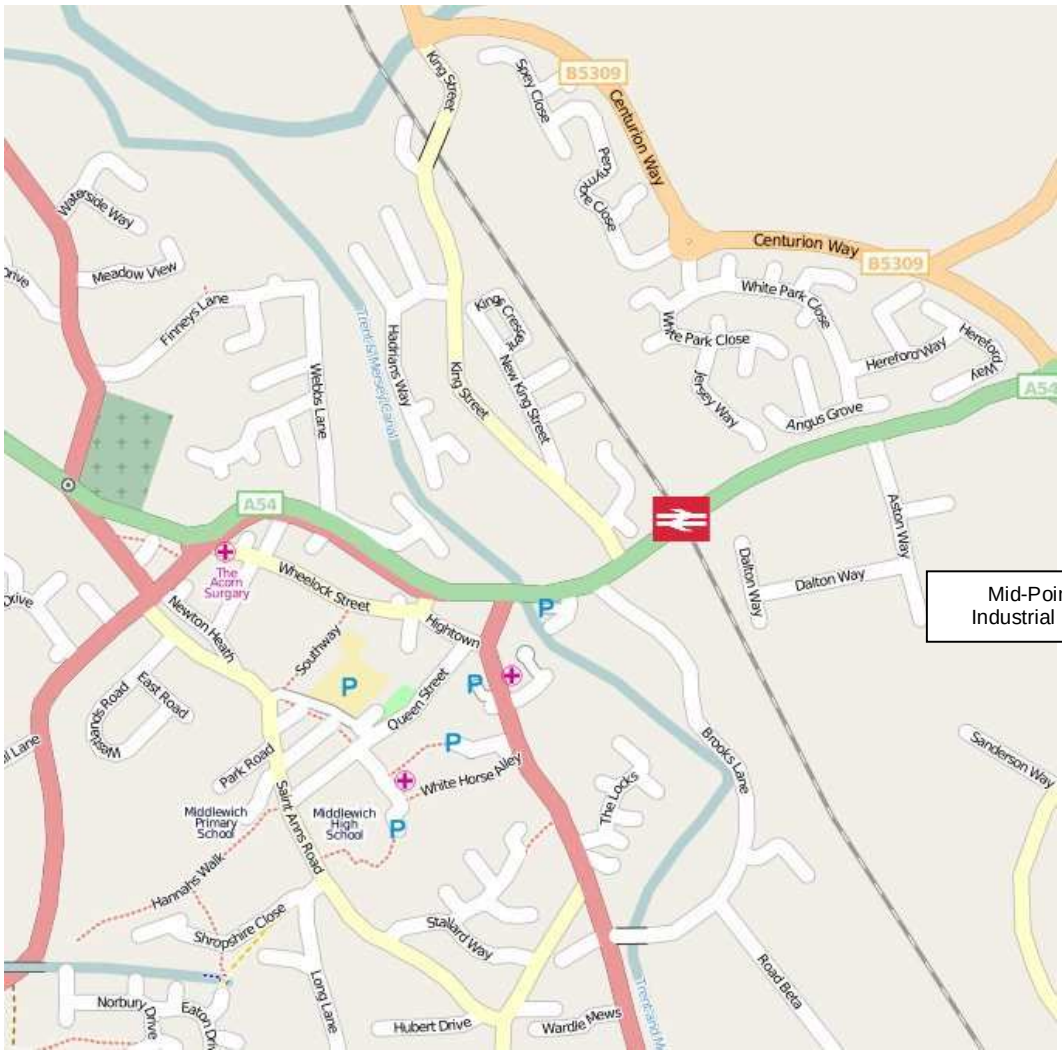


Figure 1.1. Regional Context of Sandbach – Northwich Rail Line

1.9 As a result, when the station re-opening project was reinvigorated by Middlewich Town Council, a number of other bodies wished to join the steering group, which also included representatives from

- Cheshire County Council;
- Cheshire and Warrington Economic Alliance;
- Mid-Cheshire Rail Users' Association
- Vale Royal, Congleton and Crewe & Nantwich Borough Councils (now Cheshire East, Cheshire West and Chester Councils)
- Winsford, Sandbach and Northwich Town Councils
- ASLEF (Crewe Branch)
- The Middlewich Rail Link Campaign
- Campaign to Protect Rural England
- Pochin PLC



(source: http://openstreetmap.org/ Licences: Creative Commons)

Figure 1.2. Map of Middlewich with Proposed Station Site

1.10 The structure of this report is as follows: Section 2 sets out the data and previous reports available as background information for the study. Sections 3-5 respectively cover the three key areas of capital expenditure, operational feasibility and commercial viability. Section 6 presents a preliminary appraisal of the options considered, whilst section 7 contains our conclusions and recommendations.

2 Literature Review and Data Sources

2.1 It is not the intention of this report to investigate in full all the options ever discussed for rail services in the whole of Cheshire. Rather, it is to make the best current estimate of the case for re-opening the Northwich - Sandbach line. However, the study team has read and trawled the Internet widely in order to find data which might help with that estimation, and it seemed helpful to make some comment on the key sources used; a full bibliography is set out at the end of this report. These documents also set the policy background against which any re-opening should be assessed.

Previous Reports

Regional & Economic Development

2.2 Plans for Cheshire include a significant number of new houses in the Northwich area as part of plans accepted by Central Government to designate the area as a Growth Point (West Cheshire, 2008). However, whilst focussing on the need to provide new housing at affordable prices, the strategy has been put in the context of sustainability and the provision of supporting transport infrastructure. The improvement of station facilities along the Mid-Cheshire line is one relevant activity which is specifically mentioned

2.3 There is also general pressure in the region for improvements to transport links between the urban centres of both Cheshire East and Cheshire West & Chester authorities. Pockets of road congestion (e.g. on the A556 and in Middlewich) do cause environmental problems as well as traffic delays, and are perceived to be detrimental to the economic development of the area, in limiting catchment areas for jobs. Although trip patterns are quite diverse, there are nevertheless some key links poorly-served by public transport, such as Northwich – Crewe.

2.4 In addition, population forecasts were made by the previous Cheshire County Council, disaggregated to the sub-borough level. The forecasts for Middlewich are now set out on the Cheshire East BC website (http://www.cheshireeast.gov.uk/community_and_living/research_and_intelligence/current_facts_and_figures/population_and_vital_statistic/population_forecasts.aspx) and show an expected ageing of the local population in the forthcoming years. Although the population of retired age is expected to rise by no less than 28% by 2026, the working age population (by whom the vast majority of trips are made) is not expected to increase in this period. Note, however, that our forecasts exclude any trips by children; whilst these are generally relatively unimportant, we accept that in some cases (in particular, trips on the mid-Cheshire line to/from Knutsford), these can be a significant proportion of total trips.

Route Utilisation Strategy

2.5 Network Rail's planning process for the national rail network involves a series of exercises designed to assess demand and capacity on sections (strategic 'routes') of the network, and to develop strategies to take the railway forward in the light of this. The RUS for North West England, published in 2007, included the Mid-Cheshire line and the possibility of increasing service frequencies (see section 5.3.12); MCRUA (2007) have also provided a substantive response to the draft of it, of which the element most important to this work is the section querying whether the base demand assumed by Network Rail is indeed correct. This is because NR's analysis is usually based on recorded ticket sales data, which may inadequately represent the actual level of demand, as travel on some types of tickets does not reach the LENNON rail revenue system at a level of detail sufficient to be attributed to specific lines. Lines (such as the mid-Cheshire line) where there are relatively many stations without ticket offices may lead to particular problems of ticketless travel (passengers being unable to buy a ticket, as well as those not attempting to), whilst multi-modal tickets are also a known source of data under-estimation.

2.6 MCRUA's train loading counts are also helpful in highlighting the importance of school traffic on the Mid-Cheshire Line. Typical offpeak loadings are about 30 passengers per train, rising to 100 in the peak, but contra-peak services carry loads of up to 180 passengers per train to/from schools at Knutsford.

Crewe Rail Gateway

2.7 During 2008, a proposal widely discussed was the possible relocation of Crewe station. Network Rail had identified various speed and train pathing constraints in the vicinity of the existing Crewe station, and it had been suggested to move the station South towards the bypass. However, whilst this might provide a reasonable alternative as an InterCity rail-head, this would not be practicable for interchange purposes (a major raison d'etre of Crewe station) and would not give easy access to Crewe town centre. If Crewe station were to be moved, whilst the Northwich – Sandbach reopening scheme would remain physically feasible, the economic case for it would fall as the site of the new Crewe station would no longer be attractive for potential local passengers between (e.g.) Middlewich and Crewe, unless another facility was retained which served the town centre. Fortunately, it now appears that the proposals to move Crewe station have now been dropped.

Middlewich Station

2.8 MCRUA commissioned an earlier (2000) analysis of the potential for Middlewich station from Roy Chapman; this included the collection of data on the household characteristics and residents' job locations of Middlewich. In particular, 28% of respondents gave their job location as Greater Manchester, 8% Crewe, 4% Merseyside and 1% Chester.

Transport Demand Data

Existing Rail Usage

2.9 The Office of Rail Regulation provides station usage data on their website. The latest data (for 2006-7) for relevant stations is set out in Table 2.1, demonstrating the relative quietness of many stations on the Mid-Cheshire route, compared to Knutsford, Altrincham and the key InterCity hub of Crewe. However, as the data is derived from ticket sales, any passengers without tickets are not included; this is a particular problem for the smaller unstaffed stations from which passengers may not always be able to buy a ticket. Analysis of actual count data supplied by MCRUA suggests that the actual figure for a station such as Mobberley may be 50% higher than that recorded by the ORR. An estimate of the equivalent bias at Sandbach has been made when calibrating the model to produce the demand forecasts for this study (see section 5).

Station	*Entries & Exits Mppa*	*Rank of 2518*	*Interchanges mppa*
Altrincham	0.283	976	
Hale	0.109	1453	
Ashley	0.004	2350	
Mobberley	0.013	2184	
Knutsford	0.291	959	
Plumley	0.016	2151	
Lostock Gralam	0.014	2170	
Northwich	0.155	1273	
Sandbach	0.136	1347	
Crewe	1.90	208	1.00

Table 2.1. Station Usage Data
(note that 0.06mppa is roughly equivalent to 100 return trips per day)
(source: ORR, 2009)

Trip Patterns in Cheshire

2.10 The base source of information on trip patterns is the Census, which included questions on home residence, workplace and main method of travel to work. The relevant data from the 2001 Census has recently been made available in a database, from which we have extracted the elements relevant to:

(i) residents of the two Middlewich wards (Cledford and Kinderton) plus Winsford (Wharton ward) travelling to local and regional centres (our potential market for rail travel *from* the proposed station at Middlewich);

(ii) residents of the modelled local and regional centres travelling to the two Middlewich wards (our potential market for rail travel *to* the proposed station at Middlewich)

(iii) residents of the three Sandbach wards (East, North & West) travelling to local and regional centres (which provides the basis for model calibration against existing rail use);

(iv) residents of the modelled local and regional centres travelling to the three Sandbach wards (ditto);

(v) residents of the modelled local and regional centres travelling to Northwich and Crewe (Alexandra, Delamere, Valley and Waldron wards) (the potential market for rail travel between these places currently not linked directly by rail).

2.11 The appropriate level of disaggregation of Census data is something of a judgment. It is clearly more important to understand the Middlewich end of journeys more than the distant end, so we have used larger zones to represent the latter. However, if too-large zones are used, errors can creep into the demand forecasting, as not all the trips within these zones are really representative of the conditions modelled. For instance, if trips to the whole of Greater Manchester are allocated to Manchester city centre, this will over-estimate the ease of reaching some locations.

2.12 Our approach is therefore to be relatively cautious, retaining data where its audit trail is clear, and deliberately omitting data when its applicability is uncertain. For instance, we have included all the trips recorded by the Census as travelling from Middlewich to (the unitary authority area of) Manchester but have excluded Salford (which is an employment growth area due to Media City) and Trafford (which is a high employment area due to the Trafford Park Industrial Estate) because their rail access is relatively more difficult. Similarly, we have included all trips to Stoke-on-Trent but excluded all those to Newcastle-under-Lyme (which is slightly further away from the station), included the Liverpool and Wirral elements of Merseyside, but not the other districts, and the Birmingham and Solihull elements of the West Midlands, but not the others. We believe that this provides a prudent but conservative basis on which to analyse the impact of new rail services. It should also be noted that our approach is not inconsistent with evidence which shows that 50% of rail demand at suburban stations comes from origins within 800m of the station.

Commuter View

2.13 The Office of National Statistics (ONS) has also developed the ‘Commuter View’ software to show graphically typical trip patterns from the Census data described above. Figure 2.1 contains a screen shot of data for Middlewich.

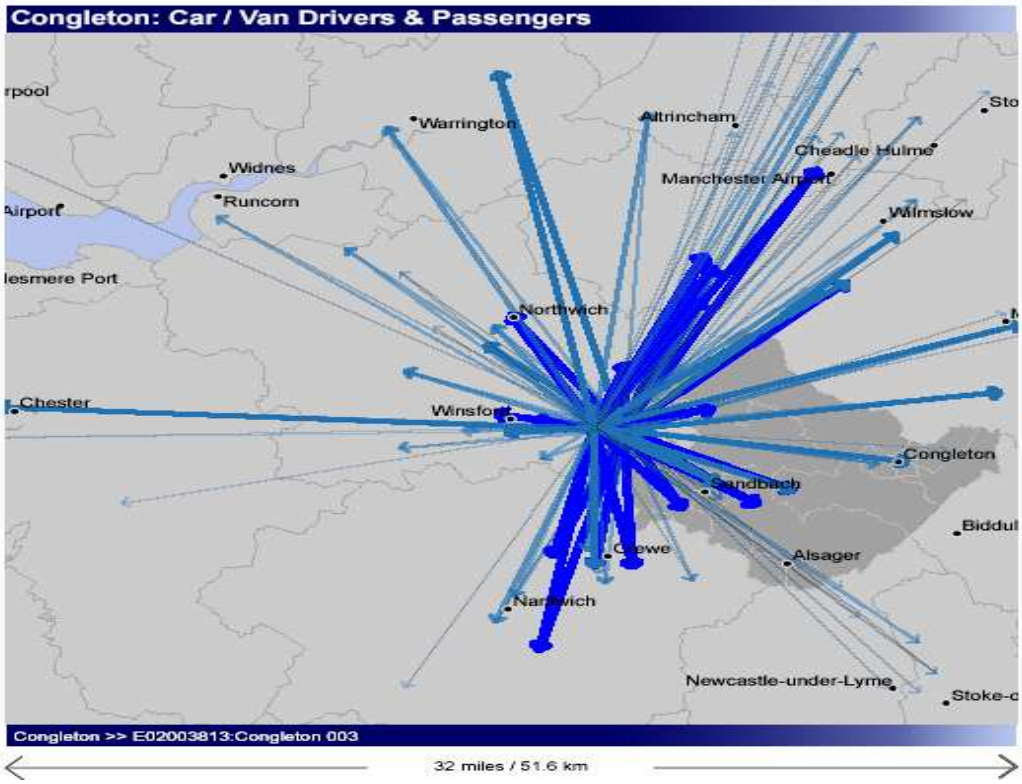


Figure 2.1. Trip Patterns from the two Middlewich Wards
Source: ONS Commuter View. Reproduced under licence no. 100038073
Dark grey area is Congleton borough

2.14 Although data from the National Travel Survey contains a distribution of trips by purpose and time of day, this distribution is not always appropriate for rail trips, which tend to be longer-distance in nature. We have therefore had to make some assumptions. First, we have assumed that the pattern of trips in the evening peak is the same as in the morning, but reversed; in fact, the evening peak period is more spread-out (which makes relatively little difference to our calculations), but there are also normally slightly more trips in the evening peak (which makes our forecasts slightly pessimistic). Secondly, we have assumed that the number of trips in the weekday offpeak (which spans 6 interpeak hours and 3-5 evening hours) is 93% that of each 3-hour peak period. Although real rail data from the mid-Cheshire line we have suggests that this is a reasonable assumption, it is only an assumption, and one cannot be sure that it would be the case for rail services through Middlewich; this must therefore be treated as a caveat on our results.

2.15 The 2001 Census was also the source of car ownership data, a key determinant of car availability and hence propensity to travel by rail. The dataset has the disadvantage of only recording car ownership by household, which is only an indirect proxy for car availability for any particular journey. In particular, some households (typically containing only elderly residents) do not have a car because the number of trips made are very low. Moreover, there has been a continuing increase in car ownership since 2001. We have therefore made an upwards adjustment of 4% to the % of trips having a car available, but it should be noted that the model appears quite sensitive to this.

Rail Economic Performance Data

2.16 Before examining in detail the potential of a station at Middlewich supported by a new train service, it is pertinent to understand the typical economics of railways in Northern England, away from the main lines. The easiest figures to start from are those for the average of Northern Rail's operations as a whole, since these are readily-available and cover a range of broadly-similar operations across the North of England. For the year ending 06/01/07 (source: TAS, 2008), passenger revenues on these services covered only 26% of costs; even including all miscellaneous income (car parks, rents etc.) the figure was only 35%.

2.17 However, for additional operations, per-mile costs would be expected to be lower (there being a smaller element of overhead costs, for instance). In addition, the restoration of the link between Northwich and the InterCity hub at Crewe might be expected to attract extra (e.g. long-distance) revenues, on top of those merely accruing from a new local service. So, whilst one might hope that revenues from Middlewich station alone might repay the station construction costs, revenues to support the Sandbach - Northwich line re-opening would be expected to be dependent upon the regional impact of the link.

Liaison with Rail Companies

2.18 Initial discussions with train operator Northern Rail (the likely operator of any service through Middlewich) highlighted the fact that they do not have a train crew depot at either Chester or Crewe, trains being worked from Manchester or Stockport (empty if necessary). They also no longer have any track access rights between Chester and Crewe. Neither of the above are 'show-stoppers', but could add to the difficulty (and hence cost) of some options.

2.19 Perhaps a more significant issue they identified was the shortage of appropriate rolling stock – not only do Northern not have any spare trains, but they have already considered sub-leasing a train from Arriva Trains Wales, who are unable to assist because they do not have any spare either. Most new trains being built are designed to relieve overcrowding and/or to serve background growth on existing services, although electrification of lines in Central Scotland in the next few years should enable some diesel multiple units to be made available.

2.20 Northern Rail accepted the logic of running Middlewich services through to Altrincham but felt that stopping at all stations on the Mid-Cheshire Line was not necessary, given the low levels of demand at some of them.

2.21 Comments from Network Rail are included in the discussion of individual components of physical works as described in the following section.

3 Capital Expenditure

Track & signalling

3.1 The line between Northwich and Sandbach is fully-signalled but currently used by only a few freight and empty passenger trains per day. The appropriate quantity of work required to enable regular passenger services on the line is, to some extent, an engineering judgment. Trains already run within Network Rail's safety case, so it can be assumed that safety is currently not compromised. There is then a balance to be made between the desired increased speed and the increased expenditure needed to support it. This is made more complicated by the fact that existing trains are generally heavy (20 tonne/axle), locomotive-hauled freight trains, whilst the passenger trains proposed are short light (10-12.5 tonne/axle) multiple-unit services. Elsewhere, there are many instances where differential speed limits are applied to different train types, and that could be appropriate here.

3.2 Viewed from various overbridges and foot crossings, trackwork actually appears to be in reasonable physical condition, with continuously-welded flat-bottom rail on steel or concrete sleepers in many places, in a condition which would support trains running at 50mph or even more. Moreover, recent visits showed ongoing improvements such as re-sleepering to areas of poorer track quality. Despite this, the whole line has a low speed limit – currently 20mph. This is partly because the demands of freight traffic do not necessitate a significant increase, and partly because of previous subsidence from salt mining in the area. In general, we believe that a speed limit of 50mph is easily achievable for light axle-weight multiple-unit trains on a line which is largely straight.

3.3 However, track at the Northern end of the Middlewich loop and in places South of Middlewich was observed to be of poorer quality, being of fish-plated rail on softwood sleepers. Whilst this is adequate for current traffic, at least some this would need to be replaced if the line were to support an hourly passenger service at reasonable speed, although a temporary speed restriction could be imposed until this work was carried out. It would also be sensible to replace the turnout at this end of the loop with one suitable for 40 or 50mph running. Not only would this reduce journey time and save fuel and brake wear and tear, but the line section to Northwich is the longer of the two, and increasing speeds on it would increase line capacity for all trains.

3.4 Line speeds on the curves into Northwich and Sandbach stations are currently 10 and 15mph respectively, although it is our view that these speeds could be increased to 25mph with only trivial attention. It should be noted that we do not believe it to be essential to replace the turnout at the North end of the double-track section from Sandbach. Whilst it would be helpful if this were to be replaced by one suitable for 40 or 50mph, this might be regarded as an optional extra.

3.5 It should also be recognised that minor repairs to bridges may be needed in order to cater for any residual subsidence from salt mining. Although it is believed that salt is no longer mined from underneath the railway, cracks may already have been incurred. It is possible to grout cracked masonry with resin (as has been done on the London – Portsmouth line, which carries 10-car trains with axle-hung motors at speeds of 90mph), and we recommend a solution such as that here, if it is necessary. These are only minor works, and a nominal £50,000 has been included for them.

3.6 Overall, we therefore believe that the above works would enable an increase in line-speed at relatively marginal cost, but Network Rail would need to undertake a full engineering assessment at a later stage in the project development process, to ensure this. This would need to include consultation with their asset maintenance and renewals program, which will include (at some stage) the repair of assets on this line anyway. Any scheme requiring use

of assets at the new higher level would generally be required to pay only the marginal cost (largely a financial one) of upgrading the assets earlier than had otherwise been envisaged.

3.7 More importantly, one has to consider the funding process. Network Rail is required by its licence to maintain the network in a state roughly equivalent to when it took over from Railtrack in 2002, following a similar requirement for Railtrack relative to its inheritance from British Rail. National funding levels agreed by the Office of Rail Regulation are intended to provide sufficient resources to do this, and in general this process works. However, there have been instances (most notably the Skegness branch) where it has become apparent that track quality levels have been allowed to deteriorate to the level required by the remaining train service. In such cases, the ORR would expect Network Rail to make good (at its own expense) any shortfall in maintenance and/or renewals. It really is not clear at this stage what is the position on the Sandbach – Northwich line, and we have therefore not included any additional trackwork costs until this position is clarified.

Middlewich station

3.8 When considering a station re-opening scheme, a natural first thought is to see if the previous site is still available and, if so, whether any of the previous infrastructure could be re-used. The line through Middlewich is generally single-track, but is double between just South of Holmes Chapel Road (the A54) and the bridge over the River Dane, about 925m to the North. The railway passes to the East of the town centre, but well within the built-up area. The original site of Middlewich station lay towards the Southern end of this loop, to the North of the A54, but recent developments have changed the situation in which the station finds itself; the “Midpoint 18” industrial estate now reaches towards the railway to the South East of the site, whilst houses in Regency Way have encroached right up to the back of the old Northbound platform.

3.9 It would still be possible to use the previous site. Both platforms would need to be raised, but both are still accessible from the overbridge, although the Northbound platform would need separate access by ramp from Tudor Close (off King Street), as well as by stairs from the road above. A row of leylandii conifers shielding a play area from the railway would need to be felled, in order to give sufficient platform width for the Northbound platform. However, intrusion of the housing estate means that the platform would only be long enough for 2-car trains, and it would only be of reduced width for the door furthest from the road.

3.10 An alternative and, we believe, preferable location with easier access lies to the South of the overbridge of the A54 (see Figure 3.1). Several car parks have been identified and will be safeguarded in the Local Development Framework. At this point, the two tracks of Middlewich loop merge to form the single line to Sandbach, and a short continuation of the ramp would permit access to a location on that line. This location has the important advantage that it would only require the construction of one platform; however, this has a number of operational implications which are discussed in section 4. At this stage, though, facilities at Middlewich are expected to be limited to lighting and a simple shelter, and Network Rail is not uncomfortable with this solution. Our costs of £370,000 (before overheads, contingencies etc.) are for a platform 50m long, which is ample for a 2-car train.

Figure 3.1. Site of Proposed Middlewich Station

Northwich station

3.11 The line from Middlewich reaches the Mid Cheshire (Altrincham – Chester) line at a triangular junction just to the West of Northwich station. Use of the Eastern curve gives access to the South face of the island platform at Northwich (see Figure 3.2).

3.12 A survey of this platform on 03/12/08 demonstrated that it is wide enough (that is to say, over 5m, sufficient to satisfy Group Standards) for about 3.5 cars' length – but only beyond the existing shelter (see Figure 3.3). The metal fence erected along the island platform would have to be removed, and some platform furniture moved; in particular, some of the lighting columns would have to be moved to the centre of the platform, in order to achieve the appropriate minimum clearances from the platform edge. The platform is a little low, but it is understood that Northern Rail are investigating raising it. It is not clear whether the track in the potential Middlewich platform is actually properly aligned to it, but an allowance has been made for adjusting the platform edge slabs to suit the exact track alignment.

3.13 It should be noted that there is no proper access for the mobility-impaired to the island platform at Northwich, which is only available via a 'barrow crossing' requiring staff assistance; it should be noted that the station is only staffed 0700-1400 Mondays - Saturdays. The relatively narrow nature of this platform means that improved access could only realistically be provided at its ends. Options include a light-controlled crossing (unlikely to be popular with Network Rail), a new bridge or a lift to Middlewich Road. The latter options could cost as much as £500,000 but have not been included in the costs here. Whilst new rail facilities are expected to be accessible, this project would have to take the view that the island platform at Northwich was not a new facility and therefore should not bear the cost of extra accessibility provision, desirable though that is.

Elsewhere

3.14 At this stage, no other capital requirements have been identified. Platform 3 at Sandbach appears usable on a regular basis without undue attention, whilst line capacity issues in South Manchester (e.g. through Cheadle) are part of other proposals for service improvement.

Costing Method

3.15 Capital costs have been estimated at ±30%, and an optimism bias[1] applied after overheads and contingencies totalling 30% have been added to the direct costs. There has been substantial cost inflation in the design and development phases of projects in recent years, but much of this has occurred in projects with multiple options, where detailed design of several has been required; we have not assumed this to be the case here, where the physical solution is straightforward.

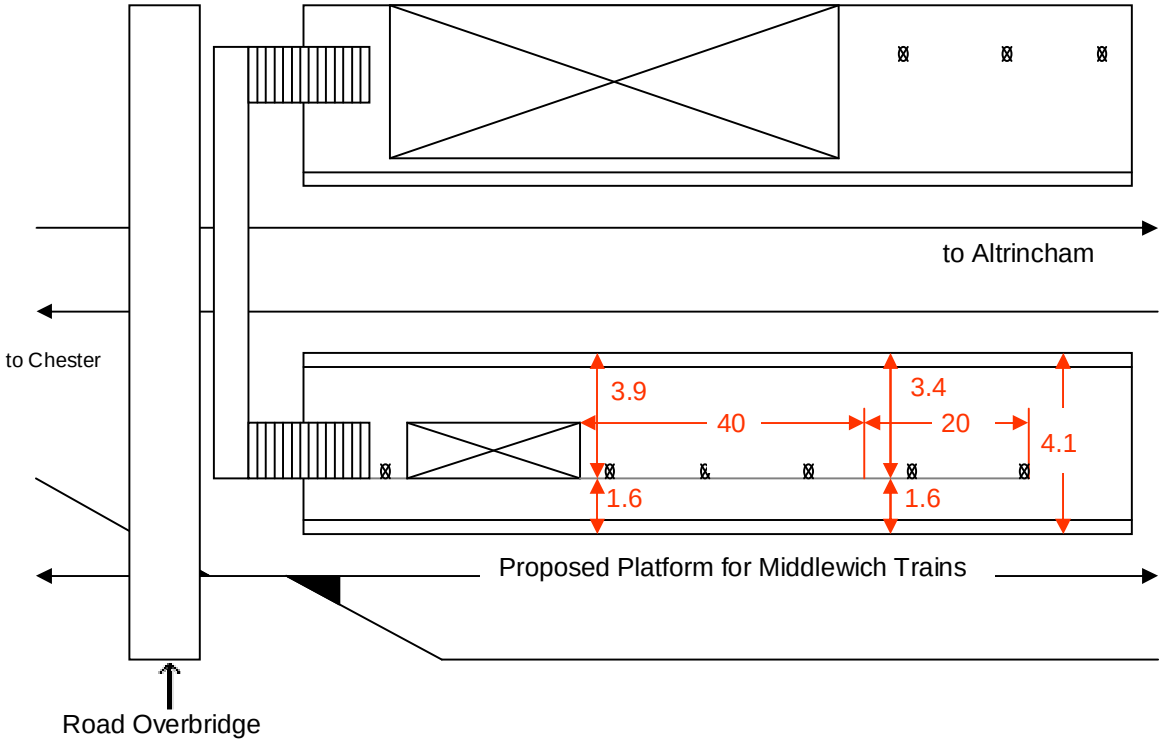


Figure 3.2. Diagrammatic Plan of Northwich Station
Measurements are in metres

[1] An optimism bias is an adjustment made to reflect the fact that there is often likely to be some difference between the expected costs of a project and the out-turn costs of what actually happens. See DfT's Transport Appraisal Guidance notes, section 3.5.9.

Figure 3.3. Northwich Station
N.B.: The Middlewich platform is behind the fence on the island platform to the right

3.16 In addition, track access rebate payments to train operators have been a huge cost on some schemes (notably on the West Coast Main Line), where genuine disruption to large numbers of passenger and freight trains has occurred when possessions of the track have been needed to undertake works. Here, however, the works are relatively simple and the line is relatively little-used. The daily empty passenger train only runs to enable drivers to retain route knowledge, so presumably could be cancelled without consequence for a day or two if required, whilst there are likely to be occasions when freight trains are not running because of works holidays or a lack of traffic on the day. We have therefore included only a nominal value of £10,000 for these possession payments.

3.17 However, it must be understood that there are a range of options for improving the line infrastructure, which is currently of somewhat unknown quality. We have recommended what we believe to be the minimum necessary to get the Middlewich line up to a standard appropriate for regular passenger trains operated by light multiple units. Further business decisions will need to be made in the light of more detailed engineering assessments, but we encourage the steering group and Network Rail to resist any temptation to 'gold-plate' the infrastructure. In particular, it would be very easy to spend very significant additional monies in renewing further track and pointwork at the Northern end of the Middlewich loop, and to attribute these costs solely to the station reopening project. These costs could easily increase the costs used in the appraisal in section 6 by a factor of three.

4 Operational Feasibility

Track Capacity

4.1 The line between Sandbach and Northwich is single, with the passing point at Middlewich being 3.5 miles from the former and 5 from the latter. With the current low line-speeds, this gives an effective headway between trains of 12.5 and 14.5 minutes on the respective sections (Network Rail, 2007, App. B p.5); however, this is not an issue at current train service frequencies of only a few per day.

4.2 Increasing the line speed is clearly necessary if services are to be attractive to passengers; that would also have the effect of reducing the headway. Locating the re-opened Middlewich station on the single line would increase the amount of time trains spend on the single line section, but this is likely to have a much smaller (negative) impact than the positive impact of speed increases.

4.3 Services from Middlewich have to pass through Northwich and Sandbach, each of which have platforms available for these trains off the main running lines used for other services. With the number of freight trains also passing through these extra platforms being limited, these locations do not appear likely to provide any significant constraints.

4.4 Elsewhere, however, this is not the case. The current track configuration at Crewe means that access to/from the Sandbach direction is easiest to/from platform 1, but this is already used twice per hour by trains reversing to/from Manchester. This does not prevent the use of this platform, but obviously reduces opportunities.

4.5 The line from Altrincham to Manchester via Stockport is partly single-track (in the Navigation Road and Cheadle areas) and this creates potential conflicts which need to be avoided. As Network Rail note in the RUS (section 5.3.12, option 2, p.113), reversing at Stockport is very difficult without causing undue delays to other trains but (on the other hand) trainpaths between Stockport and Manchester are also difficult to find, especially after the December 2008 Virgin High Frequency service upgrade.

Train Planning

4.6 The exact impact of these constraints depends, of course, on the options chosen for analysis, and a total of five have been suggested for consideration. Some of these were described in the brief, whilst others have emerged during the project and consultation with stakeholders such as GMPTE. In an attempt to be both comprehensive and logical, all the options analysed in detail are listed below, from the smallest to the largest in scope.

1 diversion of the two existing peak extra Stockport – Chester trains to Crewe via Middlewich;

2 shuttle service Crewe – Sandbach – Middlewich – Northwich;

3 combination of (1) and (2);

4 Crewe – Sandbach – Middlewich – Northwich – Knutsford – Hale – Altrincham (i.e. running semi-fast between Northwich and Altrincham);

5 As (4) but extended to Stockport and Manchester Piccadilly.

Option 1. Peak Diversions

4.7 Option 1 needs some explanation. At present, there are two extra trains on the Mid-Cheshire Line in each peak period; these run in the peak direction only, to provide a half-hourly service between Stockport and Chester via Northwich. Whilst it is possible merely to divert these to run between Northwich and Crewe instead of Northwich and Chester, it is, in fact, possible to do even better than this. One of the journeys in each peak can return to Northwich, reversing in the up goods loop there in order to complete its journey to/from Chester in the path of the other (see timetable below).

Current Service

	Train 1	Train 2		**Train 1**	Train 2
Chester	**06:35**	07:35			
Greenbank	**07:00**	08:00			
Northwich	**07:05**	08:05			
Knutsford	**07:17**	08:17			
Altrincham	**07:32**	08:32			
Stockport	**07:56**	08:56			
Stockport				**16:58**	17:58
Altrincham				**17:14**	18:14
Knutsford				**17:27**	18:27
Northwich				**17:40**	18:40
Greenbank				**17:45**	18:45
Chester				**18:13**	19:13

Proposed Service

	Train 1	Train 2	**Train 1**		**Train 1**	Train 2	**Train 1**
Crewe		06:42	**07:42**				**18:15**
Sandbach		06:49	**07:49**				**18:22**
Middlewich		06:55	**07:55**				**18:28**
Chester	**06:30**						
Greenbank	**06:55**						
Northwich	**07:00**						
Northwich		07:05	**08:05**				**18:38**
Knutsford		07:17	**08:17**				
Altrincham		07:32	**08:32**				
Stockport		07:56	**08:56**				
Stockport					**16:58**	17:58	
Altrincham					**17:14**	18:14	
Knutsford					**17:27**	18:27	
Northwich	**07:10**				**17:40**	18:40	
Northwich							**18:47**
Greenbank							**18:57**
Chester							**19:20**
Middlewich	**07:19**				**17:49**	18:49	
Sandbach	**07:26**				**17:55**	18:55	
Crewe	**07:35**				**18:07**	19:07	

4.8 The above service ("Option 1") gives Middlewich two through trains to Stockport via Altrincham in each peak, plus one to Crewe, and all for relatively little additional train mileage (39 miles per peak). Whilst there would be about 50 passengers disadvantaged per peak (those travelling between Chester and Greenbank on the extra services), some of these would only suffer an additional interchange at Northwich. Even making quite severe

negative assumptions, it seems unlikely that more than 20 such passengers might be lost: at £3 average fare and 500 peak periods per year, this would lead to a revenue loss from them of £30,000. In comparison, this option might achieve half the forecast peak demand on the Middlewich line (two of three trains to Manchester, one of three to Crewe). As described in section 5, this is likely to be about 65 passengers per peak, expected to generate £165,000 p.a.

4.9 A further alternative in which the trains between Crewe and Northwich use the west curve to access the demand at Greenbank, by reversing there, might also be possible. As Greenbank is the busiest of the stations west of Northwich, there could be benefit in serving it (and also unnecessary local opposition for not serving it), and this option might be worthy of further work.

Option 2: Crewe – Northwich

4.10 This option is designed to reflect the minimum cost option for all-day services. However, not only does it link Middlewich to Sandbach and Northwich, it also provides proper connections to the full National Rail network at Crewe. This is potentially of major demand benefit, an issue analysed in section 5. If track quality is already adequate or is improved to permit a sufficient increase in line speeds, it should be possible to run between Crewe and Northwich in about 24 minutes, meaning that a return trip could be completed in an hour. This would enable the service to run with only one trainset; as a single-car Class 153 is likely to be sufficient to cater for the demand on this section of route, this is an excellent option for minimising the resource costs allocated to the service.

4.11 Nevertheless, in order to maximise the attractiveness of this option for travel to the regional centre of Manchester, connections at Northwich have to be as good as possible – in both directions. Unfortunately, the other constraints inherent in planning this service (including the requirement to limit the number of trains in service to one, and limited platform availability at Crewe) mean that this is not possible. Solutions include poor connections (17 minutes in both directions), or bad connections to Manchester at Northwich (32 minutes) coupled with a good connection in the reverse direction (2 minutes). However, better connections for trips *from* Middlewich to Stockport and Manchester are available by changing at Sandbach, thereby minimising the impact of problems at Northwich.

Option 3: Crewe – Northwich and peak diversions

4.12 This option attempts to combine the best features of options 1 and 2. The two peak extra trains on the mid-Cheshire line are diverted to/from Crewe, whilst an additional trainset is fed into the system to provide an offpeak shuttle service between Crewe and Northwich. However, the extra trainset is also able to provide a connection to Chester from one of these. The option is worth having if the benefit of providing two through trains from Middlewich exceeds the disbenefit of the stations Greenbank and West thereof only being served by connections to/from the peak extra trains (it should be stressed that an hourly through service to Chester is maintained at all times on the mid-Cheshire route).

4.13 Although a detailed possible timetable is set out in Appendix B, the impacts of this option on the Western end of the mid-Cheshire line can usefully be summarised in terms of the train service offered to a typical station such as Mouldsworth, as follows:

Mouldsworth to Stockport (AM peak) – existing:

Dep	06:16	06:46	07:14	07.46	08:18
Arr	07:18	07:56	08.19	08:56	09:21

Mouldsworth to Stockport (AM peak) – proposed:

Dep	06:16	06:41	07:14	07:41	08:18
Arr	07:18	07.56*	08:19	08:56*	09:21

Stockport to Mouldsworth (PM peak) – existing:

Dep	16:30	16:58	17:19	17:58	18:30
Arr	17:31	17:59	18:21	18:59	19:21

Stockport to Mouldsworth (PM peak) – proposed:

Dep	16:30	16:58	17:19	17:58	18:30
Arr	17:31	18:04*	18:21	19:04*	19:21

*: change at Northwich

MCRUA count data suggests that the five-minute increase in journey associated with an interchange at Northwich affects only around 60 passengers per peak. About 15 of these are travelling between Greenbank and the Altrincham direction, and some of these might choose to use Northwich instead. However, if any of the 60 passengers value a through train very highly, the basic hourly through service is still of course still available.

Option 4: Crewe – Northwich – Altrincham

4.14 It has long been an aspiration to increase service frequencies on the Mid-Cheshire line between Northwich and Altrincham, but it has proved difficult to develop a business case (although Network Rail's RUS was based on understated demand data). Others have argued for a speeding-up of that line (which takes 90 minutes from Manchester to Chester) by omitting some of the more lightly-used stops, but this tends to be politically-unpopular, weakens the demand at those stations even further, and would require amendments to the Passenger Service Requirement.

4.15 However, the operation of additional services does *not* have to conform to existing stopping patterns, and that does provide the opportunity to combine an extension of the Middlewich service with a slightly faster journey on the Mid-Cheshire Line. The increase in speed also potentially helps resource utilisation, since trains would otherwise take about 52 minutes between Crewe and Altrincham, which might not always be sufficient to provide a robust hourly service. Missing out some of the quieter stations should get the journey time down to about 47 minutes, which should enable a robust timetabling option requiring only two trains to be identified and operated.

4.16 This service would largely supplant the existing peak service enhancements on the mid-Cheshire line. Nevertheless, it is considered important to continue providing Stockport with a half-hourly service in peak periods, which requires an additional train set over and above the two needed to support the all-day operation of a Crewe – Altrincham service.

Option 5: Crewe – Northwich – Altrincham – Stockport – Manchester

4.17 This option is included primarily as an 'end-state', since it is required more in order to address other deficiencies in rail services, rather than for Middlewich itself. Pathing North of Stockport is clearly difficult, and politically-sensitive choices have already had to be made about which trains can call at which stations. As an order of magnitude, we have developed some costs, but unless and until another wholesale timetable revision occurs in South

Manchester, this option should be regarded as unattainable. In addition, demand for such a service is also dependent upon the provision of other potential new stations (e.g. at Cheadle), forecasts for which are outside the scope of this exercise.

4.18 A further option concerns the potential of mixed light and heavy rail tram/train, with services going into Manchester via Sale; however, this is considered outside the scope of this study, which concentrates on options for the short- to medium-term.

Operational Costs

Traincrew Costs

4.19 The exact cost of traincrew is, in practice, affected in detail by the way in which different elements of work spread across different lines and days are combined into an overall roster with the correct average number of hours per month. In the early stages of planning, however, it is only really feasible to analyse the change in costs as a function of the increase in train miles or train hours. No structural changes are proposed to traincrew arrangements for the mid-Cheshire line, which is largely worked by staff based at the Manchester end of the line. All trains are assumed to be worked by a two-person crew of a driver (employed gross costs approx. £41,000 p.a.) and a conductor guard (employed gross costs approx. £33,000 p.a.).

4.20 In option 1, there is a slight increase in traincrew costs to reflect the fact that there are 3 hours 20 minutes', not 2 hours 40 minutes', worth of work on the extra trains in each. We made a nominal estimate of this as £15,000.

4.21 The estimated traincrew costs for options 2, 4 and 5 are as follows:

	Extra train miles p.a.	Extra sets of traincrew	Increase in cost £k p.a.
Option 2	134,000	5	370
Option 4	230,000	10	740
Option 5	375,000	15	1110

Train Leasing Costs

4.22 The base level of resources provided on the mid-Cheshire line enables the 'normal' hourly service to be run. The two extra peak services require another two trainsets. Any additional train services between Northwich and Sandbach would of course need additional trainsets, each of which has leasing and maintenance costs.

4.23 The costs of rolling stock are divided into three: (a) the leasing of the capital value (about £50,000 p.a. for a 2-car 142), (b) an allowance for periodic heavy maintenance (undertaken by the vehicle owner) (about £80,000 p.a. for a 2-car 142), and (c) light maintenance. The first two of these are paid to the Rolling Stock leasing companies (ROSCOs), whilst light maintenance is undertaken by the relevant train operator.

Train Maintenance Costs

4.24 In recent years, considerable improvements in rolling stock failure rates have been improved through better maintenance processes, so there has been little reduction in maintenance costs. In addition to the leasing costs, we have included a further £70,000 p.a. for the maintenance of a 2-car 142.

4.25 All the costs quoted are the marginal costs relating to these trains, and assume that (for instance) depots do not need to invest in extra maintenance staff or equipment. Whilst the recent Competition Commission report on train leasing costs may lead to a reduction in these costs, this has not been assumed. Our work has therefore assumed the following as the total of train-related costs (i.e. leasing + maintenance):

		Additional Trainsets Needed	Annual Costs £k p.a.
Option 2	Northwich shuttle	1x Class 153	125
Option 3	Nthwich shuttle & pk diversions	1x Class 142	200
Option 4	Altrincham shuttle	1x Class 142	200
Option 5	Manchester	2 x Class 142	400

Access Costs – applied to the number of train miles

4.26 Train operators in Britain pay Network Rail for access to the track, on the basis of the train miles. Over the years, there have been a number of changes to the way in which these costs are charged, but the basis of the current charges (applicable to Control Period 4, which ends in 2014) is that the majority of costs are paid as a fixed element, designed to reimburse Network Rail for the costs they incur in sustaining the base train service run at the time of privatisation. However, for additional services, a mileage-related charge is made relative to each vehicle type, in order to reflect the wear and tear on the track. In addition, a capacity charge is made for those train miles which occur on sections of line which are congested.

4.27 The track access charges for a 2-car Class 142 and a 1-car Class 153 (the two train types considered here) are 7.9p and 5.26p per train mile respectively. The capacity charges vary by service group, but for a typical Northern Rail service are around 10p/train mile (source: http://www.rail-reg.gov.uk/server/show/nav.1917). This leads to costs of around £21k, £24k and £57k p.a. for options 2, 4 and 5 respectively.

4.28 In addition, Network Rail make a charge to the main operator of stations for their long-term upkeep and replacement when life-expired (as opposed to cleaning etc., which is the responsibility of the train operator themselves). This station access charge is expected to be around £15,000 for a simple single-platform station such as Middlewich.

Rolling Stock Availability

4.29 At present, there is a shortage of rolling stock appropriate for this line i.e. diesel multiple-units. Current orders of new trains (e.g. Class 172 units for the London Midland franchise) are designed to enhance capacity on overcrowded routes, although this is being achieved through a cascade of vehicles across different franchises. It is not clear that this will actually liberate any trainsets at the lower end of the market as surplus to requirements. Whilst a one-car Class 153 would be sufficient for the Northwich – Crewe shuttle, the other options require the interworking of trains onto the Mid-Cheshire Line, where a 2-car train is essential to cope with peak demand. We anticipate the use of Class 142 units on any mid-Cheshire line services through Middlewich, as these are compatible with others on the line. Although they have a relatively low capacity, they are still appropriate here.

4.30 The Scottish Government has, however, announced plans for the electrification of a number of busy routes in Central Scotland which are currently operated by Class 170 diesel multiple-unit trains. This is likely to lead to some diesel trains being rendered surplus to requirements, and we have assumed that this could provide an opportunity to cascade to provide Class 142s for any Middlewich service.

4.31 Option 1 (the Northwich shuttle) only needs a single-car Class 153, but it is unclear exactly how and where such a vehicle might be acquired. We have assumed, however, that this does become possible from a route where traffic growth means that demand is outstripping the capacity of a single-car unit.

5 Demand Forecasting

Method of Analysis

5.1 There are a range of methods for forecasting rail demand. Much rail planning work is undertaken by examining the likely impact of service improvements on existing demand levels as reflected by ticket sales data. Whilst this is potentially useful for estimating the impact of service frequency increases on the Mid-Cheshire Line, such an approach is inappropriate on a new line such as Sandbach - Northwich, and other transport planning techniques have to be used.

5.2 For Middlewich station itself, we rejected the use of a trip end model because the likely accuracy is insufficient for the purposes here. We also rejected the use of gravity model because it is difficult to apply for a single, minor, mode, instead producing forecasts of all trips (i.e. by all modes). Although the outgoing Cheshire County Council had a Sub-Regional Strategic Transport Model developed by the Peter Davidson Consultancy, this was not considered likely to produce robust results for a minor mode many of whose trips were expected to be to/from places outside the county. However, the model was used to provide inputs for checking other data sources, ensuring that the current study was comparable with other work.

5.3 We have instead used a generalised cost framework for our analysis. Travellers are known not generally to choose one mode over another because of one attribute (e.g. fare), but because of a whole basket of elements of the 'hassle', disutility or 'generalised cost' of travel. The formula used for our analysis is:

$GC = b_1A + b_2W + b_3R + I + (f/VOT) + b_0$
where GC = generalised cost
b_1, b_2 and b_3 are weighting parameters (1.8, 2 and 1 respectively used here)
A = access time to stations (also egress time from stations)
W = waiting time
R = running (in-vehicle time)
I = number of interchanges, assessed as having a 10-minute penalty each
b_0 = quality factors impacting on the relative choice between modes[2]
F = fare
VOT = Value Of Time (typical average £6/hour)

5.4 Our GCOST™ model (described in more detail in Appendix A) is populated with data on these aspects of journeys as made by different modes of transport, and then calculations are made using a logit model to provide the proportions of traffic expected to use each mode. This is not done on an 'all-or-nothing' basis whereby the best (i.e. lowest generalised cost) mode gains all traffic, but rather on a percentage basis, the proportion of traffic depending upon the relative generalised costs of the alternatives. If there are two modes of transport which are quite close in generalised cost terms, then the split of traffic may approach 50:50; on the other hand, once one mode is significantly better than the alternatives, it will dominate the expected mode shares.

5.5 Four modes of transport have been considered: car, bus, existing rail (e.g. via Winsford) and the rail option under investigation. Trips have been analysed in both peak and offpeak periods, and for those both with and without a car available for their journey (the latter group obviously only being given choices involving bus and train). Note, however, that typical households with one car often have people who effectively have no car available, because someone else is already using it.

[2] Passengers inherently prefer some modes to others; rail in this area is estimated to be 12 minutes poorer than car but 8 minutes better than bus. This also implicitly takes account of other factors, such as the ability of car passengers to carry luggage easily, or to share (e.g. parking) costs with other passengers.

5.6 Journeys have been examined for relevant trips between 20 representative locations, which are set out below. As can be seen, these include the key local traffic centres, and some more significant destinations further afield. They have also been chosen to include some suburban locations as well as city centres.

Middlewich	Knutsford
Elworth (via Sandbach station)	Altrincham
Sandbach	Manchester Airport
Winsford	Stockport
Crewe	Central Manchester
Chester	Leeds (Middlewood)
Colwyn Bay	Rotherham
Liverpool	Stoke (Burslem)
Rudheath, Northwich	Birmingham (Aston)
Barnton (via Northwich station)	London (Hammersmith)

Table 5.1. Zones Used for Analysis

5.7 Road travel time data was taken from www.transportdirect.info, with separate queries made for different times of day in order to reflect varying levels of traffic congestion; this is important, as some roads in the area (notably the A556) have been reported to be amongst the most congested in the country. Moreover, to ensure that the data quoted was indeed representative of local conditions, it has been checked against data from the Cheshire model for a number of key flows to/from Middlewich. In fact, relatively little adjustment was needed for any of the sampled flows, and the adjustments were not all either up or down, suggesting that there was little if any overall bias.

5.8 Public transport data was generally taken from timetables, in terms of waiting times, journey times and the number of interchanges. Waiting times were applied to the average headways of services, and no attempt was made to reflect specific connections, as these cannot be guaranteed to occur in all future timetables.

5.9 Fares data was taken from www.nationalrail.co.uk; peak journeys were assumed to use 1/10 of the weekly season ticket price (for local journeys) or ½ of the ordinary ('full') fare (for longer-distance journeys); offpeak journeys have been assumed to use ½ of the offpeak return rail fare. Car-parking charges have also been applied for trips to London, Manchester, Liverpool, Chester and Crewe.

5.10 The model has been calibrated on the number of rail trips at Sandbach, comparing it to data available on the ORR website. This was a relatively difficult process, because there are three local flows which have unusual characteristics: First, Crewe has significant railway employment, where staff may receive privilege travel facilities and therefore their trips will not register in the ticket sales database. Secondly, the rail fares used in the model are averages, which conceal an increasingly-wide range between First class Ordinary and Standard class Advanced Purchase, which may only be 10% of the price; variations in the proportions of these can make a significant difference to the average value. Lastly, and perhaps most important in this context, Manchester Airport has a high number of taxi trips, which are difficult to model. Nevertheless, using a logit model constant of -0.09, the model predicted just under 98,000 trips p.a.. This compared to the 85,000 given by the ORR for 2006-7. As the latter exclude any trips made for which no ticket was held, this suggests that the model does indeed reasonably reflect trip-making behaviour in the area of interest. However, ORR's 2007-8 data for Sandbach suggests a significant increase in rail trips, to around 130,000 trips p.a.; this might imply a general increase in local rail-based trip-making, giving further support to this scheme.

5.11 It should be noted that a non-trivial number of current trips to/from Middlewich are understood to use rail at present, either via Winsford or Sandbach.

Results by Option

5.12 The model has been run for the four of the options identified in section 4 (options 2-5). As would be expected, about 2/3 of the revenue is attributable to peak traffic. Rail passengers are expected to have different travel patterns in the different scenarios, given the different services suggested. For instance, passengers between Altrincham and Crewe would only be expected to travel via Middlewich if through services were to be provided; if not, they are expected to continue to travel via Stockport.

5.13 Option 1 (diversion of peak trains to Crewe)

Undertaking demand forecasts for this option is particularly difficult, since extra assumptions have to be made about the proportion of peak users for whom the two specific trains are convenient. Although there are two journey opportunities for Manchester-bound commuters, there is only one journey opportunity per peak to Crewe. Our judgment is that traffic potential is about one-third of that of option 2 (see below), although the revenue proportion would be slightly lower, because of the relatively poor interchange which it is possible to arrange at Northwich.

5.14 This option does, however, disadvantage a few passengers on peak services between stations Greenbank-Chester travelling to Knutsford and beyond, since there would be a reduction in the frequency of through trains (even if one journey opportunity remained with an interchange). A preliminary impact of the revenue estimate of this is -£30,000 p.a.

5.15 Option 2 (shuttle service Crewe - Northwich)

The model forecasts demand at Middlewich station of around 660 passengers/day (c. 175,000 p.a.), plus an additional 70/day travelling between Crewe and Northwich. These passengers would be expected to generate about £630,000 revenue p.a., whilst time savings from this option are valued at £4.7m p.a.

5.16 Option 3 (Northwich shuttle plus diversion of peak trains to Crewe)

Reworking of the train service enables the provision of through services in each peak, as well as the offpeak shuttle between Crewe and Northwich. Forecast demand at Middlewich is about 670 passengers/day, with a further 110/day travelling between Crewe/Sandbach and stations on the mid-Cheshire Line. The expected increase in revenue from the new service is around £700,000 p.a.

5.17 In addition, this option avoids the loss of any journey opportunities at the Western end of the mid-Cheshire line, enabling the provision of connections to/from both trains diverted to Crewe. It seems unlikely that this would lead to a revenue loss of more than £10,000 p.a.

5.18 Option 4 (shuttle service Crewe – Northwich - Altrincham)

Passenger demand at Middlewich station in this option is forecast to be around 680 passengers/day (c. 175,000 p.a.), with a further 110 passengers travelling between Crewe and the mid-Cheshire line. The increase in offpeak service frequency on the Mid-Cheshire Line is also likely to add another 50 passengers/day. In all, revenues are forecast to increase by over £800,000 p.a.

5.19 Option 5 (new service Crewe – Northwich – Altrincham – Manchester)

This option clearly has demand and revenue increases greater than option 4, although the difference from passengers at the Western end of the route is very small. This is because passengers from Crewe and Sandbach already have adequate services to Manchester, whilst for the relatively few travelling to/from Middlewich it is likely to be quicker to change at Sandbach. The real benefits of this option are in its ability to provide better services between Altrincham and Stockport, thereby enabling the provision of an appropriate urban-

area service to other potential stations e.g. at Cheadle. Whilst the Railway Consultancy would be happy to undertake demand forecasts for those stations, that was outside the scope of this study.

Other Demand Issues

5.20 However, these are not the only increases in demand and revenue attributable to the options being tested here. Some of the train service options investigated also include running additional services between Northwich and Altrincham or even Manchester. Because the existing service on the Mid-Cheshire Line is only broadly hourly (albeit increased to half-hourly in the peak, in the peak direction only), improvements in frequency are potentially significant in increasing demand levels. Unfortunately, however, timetabling constraints mean that it has not proved possible to run the extra services exactly half an hour before/after the existing trains, so we have not assumed the maximum benefit from the extra services. Moreover, the additional services on the Mid-Cheshire Line have only been assumed to apply during the interpeak and contra-peak periods on weekdays, and between 0800 and 1900 on Saturdays.

5.21 Our approach to estimating these has been to take, from MCRUA count data, the numbers of offpeak and contra-peak passengers involved, and to apply an elasticity to their journey improvement, as calculated from the reduction in generalised cost before and after the service increase. The typical journey we have used for this is Knutsford – Manchester. We estimate that the current generalised cost of 127 minutes would fall by about 7.5 mins[3], or 6%; applying a generalised cost elasticity of -2.5 suggests an increase of 18% in traffic. On an offpeak base of over 190,000 trips p.a. on the mid-Cheshire line, this suggests an additional 35,000 trips respectively. At an average (half offpeak return) fare of £2.75, these frequency improvements would therefore be expected to generate £95,000 p.a.; the time savings associated with this service frequency increase are valued at £145,000 p.a.

5.22 This method has been based on the trip patterns underpinning employment trips, as recorded in travel-to-work data recorded in the Census. However, we are aware that Manchester Metropolitan University has a campus in Crewe, only about 5 minutes walk from the station, and our estimate does not include any potential trips made by such students. Access to the college from the Northwich direction would be a potentially-attractive extra source of demand, and would be spread across the day, in relation to lecture timetables etc. Whilst a peak-only train service (as per option 1) would therefore not be likely to attract many students, all the other options provide a potentially-useful service, the demand for which needs further investigation, in liaison with MMU.

5.23 It should be noted, however, that we have not at this stage attempted to calculate the extra trips which might accrue between the Altrincham area and Stockport, which would form an important plank of any business case for enhanced frequencies on that section of line.

5.24 Similarly, none of the demand forecasts here include any revenues from any potential stations on that line e.g. at Cheadle. Although the capital costs of those stations have similarly been excluded from the analysis, incorporation of those stations into some of the options here could help the business case. This is because the extra demand from those stations would not also require additional train service costs to support them, as these would already have been borne by the Mid-Cheshire Line service proposals stimulated by Middlewich.

[3] Access time = 10 mins, weighted by 2; waiting time = 18.75 mins, weighted by 2, journey time = 42 mins, egress time = 10 mins, weighted by 2, fare = £2.75 @£6/hour gives 'before' total of 127 g. c. mins. 'After' scenario assumes waiting time of 15 mins, weighted by 2, giving revised total of 119.5 mins. Generalised cost elasticity is of the order of -3, given the PDFH fares elasticity value of -0.75, and fares comprising 23% of generalised cost.

5.25 We have, however, made a preliminary estimate of the number of new trips which might be generated by the line in the Middlewich area. These are trips either not made at all at present, or where trips to a nearer destination (perhaps made on foot, or by car) are replaced by trips to a more distant destination made by rail. As might be expected from the very significant improvement in public transport, these are potentially non-trivial. An order-of-magnitude estimate of these[4] suggests that they might be of the order of another 100,000 trips p.a. in options where through trains are introduced between Middlewich and the mid-Cheshire line. However, it is not normal practice to include such trips in the core case of railway business appraisals in Britain, although this figure may be helpful in understanding an 'upside' sensitivity test.

5.26 It is also always worth benchmarking the forecasts against other stations. The forecasts of the annual numbers of passengers using *Middlewich* station in the three main options are of the order of 200,000. This would give Middlewich a patronage about 2/3 that of the much larger town of Knutsford (key factors underlying this including the better range of destinations at Middlewich, and no need to double-back via Stockport for trips to the South). Whilst Roy Chapman's (2000) estimate of station usage was only 35,000 passengers per annum (ppa), this was a stated intentions survey limited to respondents within 800m of the station, whilst journeys to work have also generally become longer (and hence potentially more amenable to rail) in the intervening years.

5.27 We have also undertaken some sense checks using other methods. One technique has suggested 75,000 ppa, whilst trip end analysis suggests that a 4% mode share of work trips only would give 130,000 ppa. Relative to this, including a further 70,000 offpeak trips p.a. would be not unreasonable, and would replicate the modelled result.

5.28 It should also be noted that forecast demand levels would not be expected to accrue immediately, but over a number of years. The traffic build-up curve we would recommend would suggest 33% of final-year demand in year 1, 66% in year 2, and 90% in year 3, with the 'final' level only being achieved from year 4 onwards.

Other Benefits

5.29 The most significant non-monetary benefit of public transport improvements is generally that of time savings, and that is the case here. At current and constant Values of Time, the value of the time saved in the three main options is £0.17m, £0.37m and £0.37m p.a.

5.30 Road congestion relief is obviously one key target benefit, but the results are disappointing. The Northwich shuttle option is not forecast to attract extra travellers with a car available for their trip. However, there will be local road congestion relief benefits from passengers accessing the rail network at Middlewich rather than more distant stations. Rail trips resulting from an improvement in train frequency on the mid-Cheshire line would generate further road congestion benefit, not least on the A556, which has been reported to be one of the most congested roads in Britain.

5.31 However, options involving the diversion of peak trains to/from Crewe also generate a small disbenefit for the passengers affected. In option 3, the journey time increase of 5 minutes plus enforced interchange for about 30 passengers/peak leads to a disbenefit of c. £22,500 p.a. The disbenefit in option 1 is harder to calculate without knowing passengers' ability to transfer to the remaining through services, so we have taken a nominal value of £50,000 p.a.

[4] The reduction in generalized cost for trips between Middlewich and Knutsford resulting from the new rail service, for example, is about 38%. A generalized cost elasticity of -2.5 applied to the 100 passenger trips/day forecast to undertake this journey would imply almost another 100 passengers per day (25,000 passengers p.a.) for this particular flow alone.

6 Option Assessment and Development

The Principles of Assessing Rail Schemes in Britain

6.1 The appraisal of transport schemes should form part of a wider process seeking to address key identified problems. Objectives should then be formulated to address these issues, and only then should schemes be developed. Appraisal of particular schemes needs to answer two key questions:

(i) Are there better ways of achieving these objectives?

(ii) Do the options represent value for money?

The overall process is shown diagrammatically in Figure 6.1.

6.2 In recent years, the Department for Transport (DfT) has developed a more comprehensive project appraisal process (the 'New Approach to Transport Appraisal' (NATA)), which takes into account the various benefits that can accrue from transport investments. This is generally advantageous to rail schemes, since there are opportunities for their high costs to be balanced out against their wider benefits, which are seen to include five main categories:

- environmental;
- safety;
- accessibility;
- integration; and
- economy.

Public transport schemes tend to do well on the first four of these, and the Middlewich scheme is no exception. This analysis does not include an assessment of Wider Economic Benefits (WEBs) (see, for instance, CBP (2008)), which are likely to be small but positive in this case. The key question is therefore whether schemes pass the economy test.

6.3 Scheme appraisal needs to reflect the fact that most capital works have to be undertaken in advance, whilst operating costs and revenues are accrued on an ongoing basis. Discounted cash flow techniques are used to compare figures on a like-for-like basis, bringing them together to provide a Net Present Value (NPV) basis. The current discount rate to be applied to rail projects is 3.5%.

6.4 Rail projects have a slightly different emphasis to NATA in their development, before they can be taken forward through Network Rail's GRIP process and for DfT approval. First, the Benefit:-Cost ratio must be satisfactory. Logically, of course, this means that benefits (primarily revenues and time savings) must exceed costs, although in practice funding constraints, and a need to ensure a robust project case, mean that Benefits need to be approaching, if not exceeding, the costs by a ratio of 2:1.

6.5 Unfortunately, there are a number of different ways of calculating Benefit:Cost ratios, which can cause confusion for those generically familiar with economics but not with the particular definitions used here. The formula recommended by the DfT (2007) as part of the NATA process is:

$$\text{B:C ratio} = \frac{\text{PV of net benefits to consumers \& the private sector}}{\text{PV of cost to Government}}$$

where PV = the Present Value of the scheme (with all costs and benefits brought forward to a consistent current year).

6.6 There are, however, a couple of technical comments needed to explain the detailed application of this here. First, we have assumed that track access charges paid by the private-sector TOCs are sufficient to compensate Network Rail for its costs in maintaining and renewing the new infrastructure over its lifetime, so that it does not matter whether

Network Rail is considered to be a public or a private company. Secondly, whilst we have included in our 'net cost to Government' the initial costs of revenue support (until patronage has built up sufficiently that additional revenues exceed the marginal increase in operating costs), we have not made any deduction from this for the small operating surplus that is expected, once the scheme is up and running; this is because the value is sufficiently small that it is likely to be difficult to identify it within the budget of a large TOC.

6.7 In addition, cost over-runs in previous projects have made Central Government very wary of cost estimates, which are now required to include an 'optimism bias' (in order to account for uncosted items which are typically uncovered as projects progress). The appropriate level of these depends both upon the type of work envisaged, and the progress through the project: the further through a project, the greater the amount of risk already uncovered. In line with DfT guidance, we have applied a 40% optimism bias to works at stations (where conditions are largely unknown but where a preferred option has been selected) but only a 6% bias for trackworks (which relate almost entirely to renewals activities, where project management/timing risk is the only key risk).

6.8 Secondly, it is normal for the Department for Transport to expect some contribution to the scheme from interested parties e.g. local authorities. One-off capital contributions are most likely, although some 'top-up' funding for early years, during which traffic levels will not have built up to their end-state, is another possibility.

6.9 Historically, the DfT wanted to ensure that the operating costs of the scheme were largely, if not entirely, met from increased revenues. A positive annual operating contribution can be understood to go some way towards repaying the capital expenditure, even if only very slowly. In fact, this is quite an onerous test for regional services, as few (if any) achieve this in full; however, the charges made by Network Rail for long-term asset replacement may be excluded from this, and any scheme in which the TOC is better off financially is likely to be considered.

6.10 In the past, getting additional regular passenger services into the national timetable was almost impossible in the regional sector, where extra Government support was likely to be needed. However, a statement from then Transport Secretary Geoff Hoon on 5th February 2009 set out a new policy whereby, if local or regional councils initiate and support a rail service improvement for three years, Central Government could then decide to take on the financial burden, provided certain economic tests are met. Critically, if the Benefit:Cost ratio exceeds 1.5, the Department for Transport would be expected to continue the service. The whole test of the Middlewich project is therefore an economic one based on the Benefit:Cost ratio.

Option Development and Appraisal

6.11 The text of sections 3-5 has already set out the types of revenues and costs likely to be associated with options for the Sandbach – Northwich line, and these support the expectations set out at the end of section 2.

6.12 A summary of the options examined here is set out in section 7; all figures are in £'000, and currently exclude the impact of increasing GDPs over time[5]. We have deliberately not completed the figures for option 5, since they would exclude a number of benefits from increasing services in the GMPTE area, benefits which have not been calculated in this study. Importantly, we have not calculated any traffic increases between Altrincham and Stockport, nor those relating to any new stations which might be opened on that section of line.

[5] These have the result of enhancing the impact of ongoing income/expenditure at the expense of one-off capital expenditure in earlier years

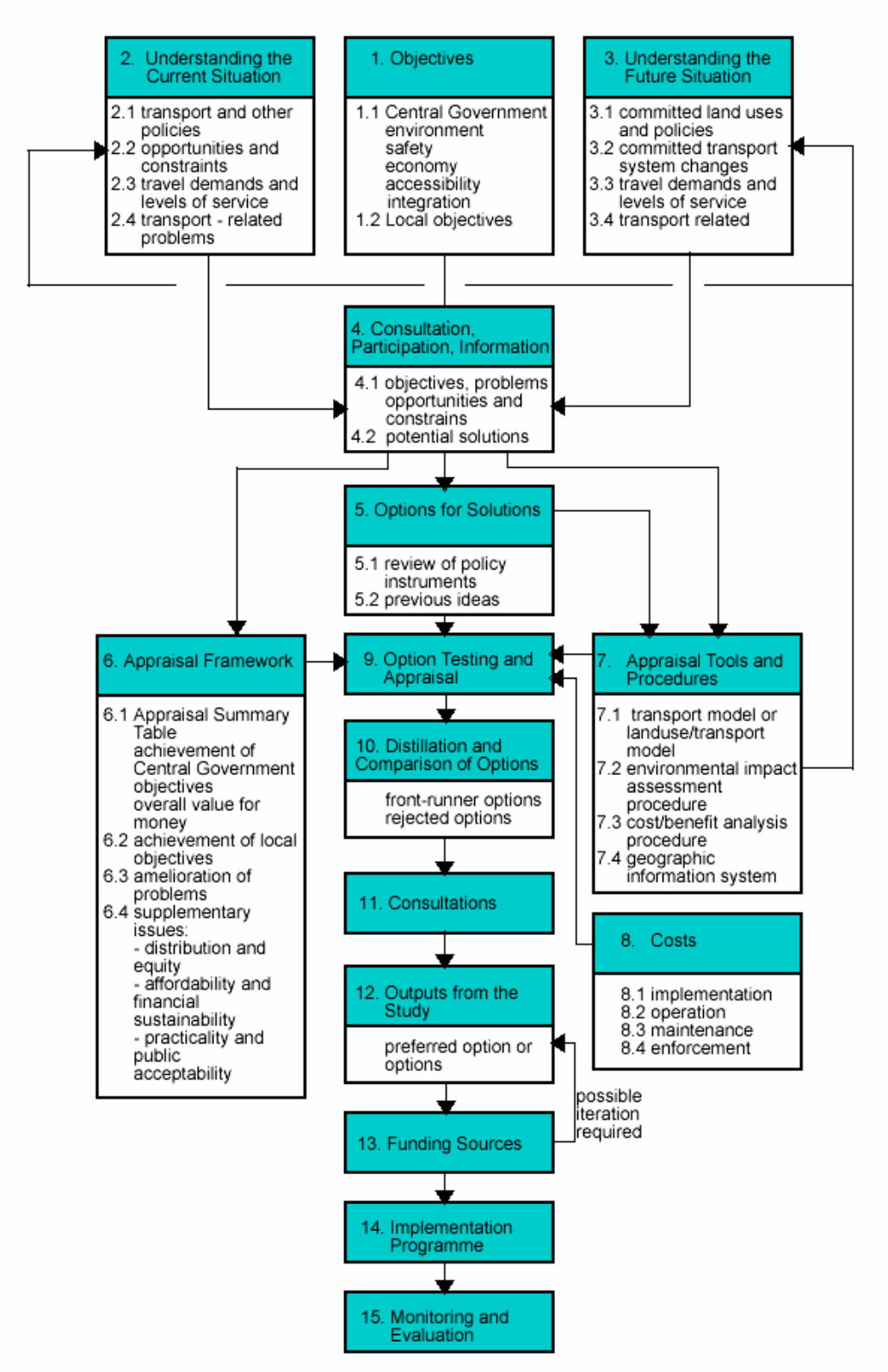


Figure 6.1. Recommended Transport Study Approach
(source: DfT, 2005)

6.13 In due course, a range of sensitivity tests need to be undertaken on this work. On the demand side, for instance, specific variables to be considered include levels of local demand and employment growth, road congestion levels, and car parking charges, whilst more work is needed on the likely demand increases from extending to Manchester. On the train operating side, the value of mid-evening services needs to be considered in terms of cost-effectiveness, whilst diversion of option 1 services via Greenbank also needs to be evaluated. On the capital investment side, as has been stressed, considerable work is needed with Network Rail to understand the real condition of the assets, the likely replacement schedule for these and how this might be funded. No work has also yet been undertaken to see if any private-sector contributions might be available for any part of the project.

Proposed Way Forward

6.14 Analysis appears to show that option 3 should generate a positive impact on the rail operating budget, largely because the benefits of providing through services in the peak from Northwich to Crewe via Middlewich outweigh the costs of service provision. As the (time saving) benefits of re-opening the line far outweigh the capital costs of the works required, there does appear to be a business case which passes the Department for Transport's funding threshold.

6.15 We therefore recommend the following:

- engaging with Network Rail to set up a Project Sponsor (client);
- understanding the true condition of the track, and the anticipated expenditure associated with it in the coming years;
- understanding fully Network Rail's requirements for any funding costs (e.g. resulting from their need to undertake capital expenditure before receiving any track access charges);
- undertaking further sensitivity analysis, in conjunction with other stakeholders e.g. Northern Rail; and
- continuing dialogue with the Department for Transport.

If further work shows that a favourable outcome is possible, then Regional monies would be needed to initiate and sustain the Middlewich service until Control Period 5 (2014), when this scheme will come into effect. They will, however, require a business case based on the preferred option from those analysed above.

6.16 Because of the traffic build-up issue mentioned in section 5, the funding gap for the first two years of operation of option 3 would be of the order of £400,000 and £150,000 p.a. respectively. These figures need to be budgeted for by local and/or regional Government.

7 Conclusions and Recommendations

7.1 The provision of improved rail services is seen as supporting the solution to key economic development issues in the North West which include:

- improving sustainability;
- increasing road traffic congestion leading to deteriorating road speeds to access key regional sites/areas (such as Manchester and Manchester Airport);
- the location of housing growth relative to employment opportunities.

7.2 The specific proposal examined in this report to address these issues is the re-opening of the Sandbach - Northwich railway line to passenger traffic, with services extended to/from Crewe. This enhances the catchment areas of both Northwich and Crewe, and enables better inter-regional access by rail via Crewe, which functions as a railway hub.

7.3 The Sandbach - Northwich line is in reasonable condition, and it is physically feasible (and relatively cheap, in railway terms, at a total cost of perhaps £600,000) to reinstate a station at Middlewich. The most cost-effective option for this appears to be the construction of a single platform to the South of Holmes Chapel Road. A number of other items of infrastructure work are, however, required before a train service could be operated. Minor works (c. £150,000) would be needed to the island platform at Northwich, whilst some improvements to track and pointwork along the Sandbach – Northwich freight line would be needed in order to achieve a competitive rail journey speed. However, many of these are in hand or planned as part of Network Rail's ongoing maintenance and renewals programme and requirements to maintain the network, so the costs of them have not been included here.

7.4 A number of service options have been derived, including hourly services between Crewe and either Northwich, or Altrincham, or even Manchester, the latter options increasing service frequencies along the mid-Cheshire line. Although timings are not always ideal, it does appear feasible for an hourly train service between Crewe and Northwich to be resourced with one trainset, and for an hourly service between Crewe and Altrincham to be resourced with two.

7.5 Demand forecasts show that at least 650 (single) passenger trips per day would be expected to use Middlewich station, with a further 100 or so using the line to link between (for instance) Northwich and Crewe. Revenues accruing from these trips are of the order of £700,000 p.a., which is approximately the same as the estimated operating costs of the options, including train leasing, track access charges and traincrew costs. However, diverting the peak extra services between Manchester and Chester to/from Crewe can provide further net increases in patronage and revenue.

7.6 A summary of the options is set out in the table on the next page. In the light of these results, we recommend option 3, which provides for the diversion of two peak-hour mid-Cheshire line trains to Crewe via Middlewich, with a Northwich – Crewe shuttle service operating between the peaks. This has a Benefit:Cost ratio of around 5, therefore substantially exceeding the threshold required to taking the project further.

7.7 Considerable work is also needed with Network Rail in order to ascertain the state of the existing infrastructure and their plans for maintaining and renewing it, whilst liaison with the Department for Transport is also recommended, in order to ensure that the project follows the requirements of the funding regime recently announced for potential new regional rail services.

7.8 In the meanwhile, budgetary provision might reasonably be made for future years, for scheme development and implementation, whilst other local authority plans need to be amended to take account of the proposed station, in order that those other plans and the

railway can develop to their mutual advantage. In particular, GMPTE need to be consulted about the possibility for joint development of improved services through to Stockport and beyond, where many of the benefits accrue to Greater Manchester residents and are therefore not the appropriate recipient of Cheshire funds.

Sandbach - Northwich Reopening Appraisal

	Option 1 peak only pass/day	Option 2 Northwich pass/day	Option 3 peak+Nth pass/day	Option 4 Altrincham pass/day	Option 5 Man Picc pass/day
Passenger demand (single trips)					
Middlewich	220	660	670	680	680
Crewe-Northwich/Knutsford	10	70	110	110	110
on mid-Cheshire line	0	0	0	50	50
other	0	0	0	0	???
sub-total of demand	*230*	*730*	*780*	*840*	*840*
	£'000 p.a.	£'000 p.a.	£'000 p.a.	£'000 p.a.	£'000 p.a.
Passenger revenue					
Crewe-Middlewich-Northwich	200	630	700	710	710
mid-Cheshire	-30	0	-10	95	*110*
other	0	0	0	0	???
sub-total of revenue	*170*	*630*	*690*	*805*	???
Traincrew costs	-15	-370	-370	-740	-1110
Train leasing & maintenance costs	-5	-125	-200	-200	-400
Track access costs	-4	-21	-24	-42	-57
Station access costs	-15	-15	-15	-15	-15
sub-total of operating costs	*-39*	*-531*	*-609*	*-997*	*-1582*
Impact on operating account	131	99	81	-192	???
	£'000 NPV	£'000 NPV	£'000 NPV	£'000 NPV	£'000 NPV
NPV of operating account	2230	1156	762	-4380	???
Capital costs					
Middlewich station	-370	-370	-370	-370	-370
Northwich station	-120	-120	-120	-120	-120
Trackworks Sandbach - Northwich	-50	-50	-50	-50	-950
Direct costs	-540	-540	-540	-540	-1440
Possession Payments	-10	-10	-10	-10	-10
Overheads & contingencies (30%)	-165	-165	-165	-165	-435
Sub-total	-715	-715	-715	-715	-1885
Optimism bias (stations, 40%)	-255	-255	-255	-255	-255
Optimism bias (track, 6%)					-75
Grand total	-970	-970	-970	-970	-2215
Financial case before optimism bias	*1515*	*441*	*47*	*-5095*	???
Financial Case	1260	186	-208	-5350	???
Passenger Time Benefits					
Middlewich	*1502*	4730	7390	8640	8830
mid-Cheshire	-900	0	-400	145	*150*
generated					
Other Benefits (Environmental, Road Safety, Wider Economic) not assessed but +ve					
Total Benefits	602	4730	6990	8785	???
Project NPV	**1862**	**4916**	**6782**	**3435**	**???**
Initial revenue support required	0	438.3	534.9	1469.6	???
Benefit: Cost ratio	2.92	4.18	5.15	1.81	???

???: dependent upon demand impacts in GMPTE area not known at present

Abbreviations Used

DfT	Department for Transport
GDP	Gross Domestic Product
GMPTE	Greater Manchester Passenger Transport Executive
GRIP	(Network Rail's) Guidance to Rail Improvement Projects
MCRUA	Mid Cheshire Rail Users' Association
NATA	New Approach to Transport Appraisal
NPV	Net Present Value
ORR	Office of Rail Regulation
RUS	Route Utilisation Strategy
TOC	Train Operating Company (likely to be Northern for any service through Middlewich)

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Appendix A.

The GCOST™ Model:
A Technique for Estimating Rail Passenger Demand

There are a wide range of techniques for estimating the demand for railway services, ranging in scope, complexity and accuracy. There are two basic approaches – aggregate approaches (top-down methods using market data) and disaggregate approaches (bottom-up methods using data taken from individual passengers and residents).

Trip Rates

Perhaps the simplest way of estimating the demand for a service is through the application of trip rates. For a given size of population, the number of trips may be relatively constant. One might therefore estimate the number of trips at a completely new site from its population. The main problem with this approach is that it does not take into account the distribution of trips. For a railway network, with a limited number of stations and lines, this is a critical issue. If demand is not to the places that the railway serves, the size of the population is virtually irrelevant. Local pressure for stations may need to be resisted if the railway is in an inappropriate direction. For instance, residents of Soham in Cambridgeshire have long campaigned for a station, but trains would run between Ely and Bury St Edmunds. As the favoured destination is Cambridge, which would require a change of trains, the station is unlikely to be successful, and demand estimates based on its population will be misleading.

Gravity Model

The distributional element of trip-making is taken care of in a gravity model. This recognises that trip rates vary by distance as well as the size of population. The formula normally used for it is:

$$T_{ij} = k \cdot \frac{P_i \cdot P_j}{D_{ij}^2}$$

where T_{ij} is the number of trips between places *i* and *j*
P_i and P_j are the populations of the two places
D_{ij}^2 is the distance between the two places
and *k* is a constant.

This method enables rail planners to discern between alternative destinations. If these are not located on the rail network, then rail trips to and from them will not be assumed. However, the primary weakness of this approach is that it takes no account of service quality. In reality, the level of rail trips will also depend upon road speeds on parallel

roads. Where roads are substantially improved, rail demand falls off; if the railway is subsequently upgraded, or the road gets congested, rail demand may build up again.

Network Models
In areas where there is a great deal of planning activity, it may make sense for a local authority or transport provider to set up a network model. This will contain information about the current number of trip ends, the networks of the different modes, and the service patterns of different public transport alternatives. As this data collection exercise is substantial, its costs make it too expensive for most applications outside metropolitan areas.

However, once collected, demand can be assigned across the network very easily, and estimates made of the potential use of new facilities and services. The demand may be assigned between modes using a **logit model**, which allocates traffic dependent upon the difficulty of using them. This latter is usually measured in 'generalised cost', which may be considered by the layman as an index of hassle. To the economist, it represents a measure of disutility. The mode with the least hassle (or least disutility of use) will be that which is favoured in an 'all-or-nothing' model. The logit model, however, is more realistic, in assigning demand across a range of modes, although of course that with the lowest generalised cost gets the largest share. The logit statistical function, however, also allocates significant amounts of traffic to alternatives which are close in generalised cost; conversely, as generalised costs increase, the proportion of traffic forecast to use them falls off steeply.

Stated Preference
The main weakness of a network model is its difficulty in representing qualitative elements e.g. seat comfort, the ability to listen to one's own music, lack of information etc. These issues, which are difficult to quantify, are collectively described as modal preferences. A second problem area associated with network models has been their deterministic nature e.g. if an alternative is better in generalised cost terms, then most traffic will be allocated to it. In reality, however, this may not occur, especially if the potential traveller has no experience of the new alternative. It may be, for instance, that it is intended to introduce a tram system, but most British residents have not travelled on a tram for generations. Its benefits may therefore not be understood.

By describing the constituents of tram travel, however (e.g. the quality of stops, the smoothness of the ride, the appearance of the vehicle), and trading these off against variables which are understood (e.g. fare), it is possible to ascertain valuations of qualitative elements of the journey. Stated Preference analysis is the recognised technique for doing this, but it does require considerable fieldwork and analysis if robust results are to be obtained. SP results fed into a network model whose mode choice is allocated using a logit function would, however, provide the best method available, if resources permitted.

The GCOST™ model
Many schemes and options, however, are only analysed at the feasibility stage. A full SP analysis at this level of detail would be prohibitively expensive. The Railway Consultancy Ltd has therefore developed the GCOST™ model, which is a time-efficient and cost-effective way of analysing options for new stations and services.

The GCOST™ model is a spreadsheet-based model constructed as a series of Excel worksheets (see below). Each of the first five comprises details of an element of the journey, for a range of pairs of key traffic origins (Os) and destinations (Ds). The data is collected separately for peak and offpeak conditions, and for the main modes involved e.g. car, bus, train, park & ride. Journey elements which may be appropriate include access (e.g. walking to the station), waiting, in-vehicle time, the number of interchanges, and public transport fares and car parking charges. The sixth sheet calculates the generalised cost for each O:D pair.

The seventh sheet contains some global information about trips, which can be adapted to the circumstances. It may be that Journey-to-Work data is available from the Census, or perhaps only settlement size data exists, in which case a gravity model would be used to estimate the likely volumes of traffic (by all modes) between Origins and Destinations. Critically, however, the main part of this sheet comprises a logit model, which allocates traffic between the various modes. It is calibrated to reproduce existing data – a small-scale survey may be needed here, in order to ensure that the model is working correctly. Once calibrated, however, the model can be used to forecast new situations, by varying the input data to reflect options for the future – perhaps faster services, or a new station. The number of trips on the proposed service is a key output, whilst analysis can also easily provide time savings and an assessment of the environmental benefits of car miles saved.

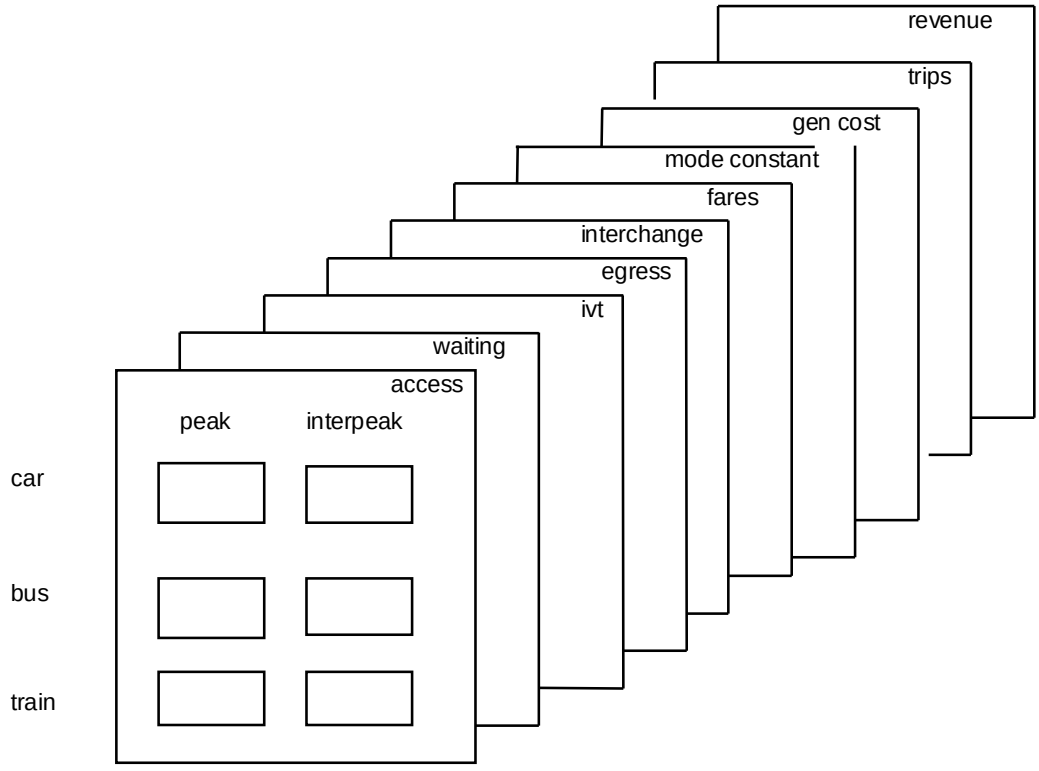

Figure A1. GCOST™ Model Structure

Other outputs, however, are also easily derived. With information already known on both fares, and the number of trips, by Origin:Destination pair, revenue can also readily be calculated. With the number of trips and total time known, time savings between options are also easily derived – and this can form the basis of a preliminary Cost:Benefit Analysis (for a section 56 Government grant, or SRA Rail Passenger Partnership funding).

Previous Experience

The general modelling approach used in the GCOST™ model is well-established, but has been adapted specifically for this purpose by The Railway Consultancy Ltd. It has been used on studies including:

- new park and ride station at Millhouses, Sheffield (South Yorkshire PTE)
- new platforms at High Meads, Stratford (London Borough of Hackney)
- new interchange station at Allerton (Merseyside PTE)
- Gospel Oak – Barking Line Development Study (Silverlink Trains)
- National maglev network (UK Ultraspeed)

We believe that it is best suited for situations in which around 20 key traffic zones are required, although with a powerful-enough pc, up to 75 zones can be catered for. In larger applications, the data assembly exercise becomes quite onerous, but the required data can more easily be collated from appropriate network models, as occurred in the Allerton study.

More Information

More details about this approach, including costs and timescales, can be obtained from Dr Nigel G Harris at The Railway Consultancy Ltd head office (contact details at top of this document).

Appendix B. Revised Altrincham and Northwich to Crewe specification

Monday to Saturday
(MF only trains*)

N.B. change of pattern enforces reliability in the p.m. peak

Miles			1*	2		3*	1		3	*at the same mins past each hour* 3		3			1			2	
	conn ex Chester			*615*															
0	Crewe			642			742		842	*942*		1542		1700			1815			1915	
	conn ex Mcr			*635*																	
4.5	Sandbach			649			749		849	*949*		1549		1707			1822			1922	
8	Middlewich			655			755		855	*955*		1555		1713			1828			1928	
	Chester	605	630		703	730		807		907		*1007*		1607		1707	1807		←	1907		←
13.5	Northwich	635	700	705	733	800	805	837	905	937	*1005*	*1037*	1605	1637	1723	1737	1837	1838	1842	1937	1938	1942
	conn to Chester			*712*			*812*										→			→		
15	Lostock Gralam	638		708	736		808	840		940		*1040*		1640		1740			1845			1945
17	Plumley	641		711	740		811	843		943		*1043*		1643		1743			1848			1948
19.5	Knutsford	646		717	745		817	849		949		*1049*		1649		1749			1854			1954
22	Mobberley	650		721	749		821	853		953		*1053*		1653		1753			1858			1958
24	Ashley	654		724	753		824	856		956		*1056*		1656		1756			1901			2001
24.5	Hale	657		728	757		828	859		959		*1059*		1659		1759			1904			2004
26.5	Altrincham	701		732	801		832	904		1004		*1104*		1704		1804			1909			2009
35	Stockport	718		756	819		856	921		1021		*1121*		1721		1821			1926			2026
	Manchester	731			832			936		1036		*1136*		1736		1836			1941			2041

			1		3			*at the same mins past each hour*	until			1	3*		2	1*	
	Manchester	617		717		817		*917*	1517		1617			1709			1817
	Stockport	630		730		830		*930*	1530		1630	1658		1719	1758		1830
0	Altrincham	646		746		846		*946*	1546		1646	1714		1735	1814		1846
2	Hale	649		749		849		*949*	1549		1649	1717		1738	1817		1849
2.5	Ashley	652		752		852		*952*	1552		1652	1720		1741	1820		1852
4.5	Mobberley	655		755		855		*955*	1555		1655	1723		1744	1823		1844
7	Knutsford	659		759		859		*959*	1559		1659	1727		1749	1827		1859
9.5	Plumley	703		803		903		*1003*	1603		1703	1731		1753	1831		1903
11.5	Lostock Gralam	707		807		907		*1007*	1607		1707	1735		1756	1835		1907
	conn ex Chester																
13	Northwich	712	714	812	814	912	914	*1012*	*1014*	1612	1618	1712	1740	1745	1802	1840	1845	1912
	Chester	745		845		945		*1045*	1645		1745		1815	1835		1915	1945
18.5	Middlewich		723		823		923		*1023*		1627		1749			1849	
22	Sandbach		729		829		929		*1029*		1633		1755			1855	
	conn Mcr																
26.5	Crewe		738		838		938		*1038*		1642		1805			1905	
	conn to Chester										*to S end* of platfm						
					has to shunt via siding								has to shunt via siding				

Numbered columns represent the use of trainsets additional to the basic hourly service