Guidance note on passenger demand forecasting for third party funded local rail schemes

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Chapter 1 - Introduction and context

Scope of this guidance note

More and more local authorities (LAs) and Passenger Transport Executives (PTEs) are considering local rail schemes as a means of meeting local and regional transport needs. They are being joined by Local Enterprise Partnerships (LEPs) who will be considering whether a local rail scheme can contribute to economic growth objectives within their area.

The purpose of this guidance note is to provide advice and information to scheme promoters carrying out or commissioning demand forecasting studies for new local railway stations and local passenger services. The target audience is LAs, PTEs and LEPs, and the document has been written with a view to:

(1) making the LA / PTE / LEP or scheme promoter a more informed customer when commissioning rail demand forecasting studies from consultants; and

(2) encouraging the LA / PTE / LEP or scheme promoter to engage early with DfT when carrying out or commissioning rail demand forecasting studies because ultimately the scheme may require a DfT grant and/or it may need to be included in a franchise.

In turn, this will assist the LA / PTE / LEP or scheme promoter to develop their proposals in the most constructive and economic way.

The guidance note contains information on the process of carrying out demand forecasting studies as well as basic information on the various approaches to forecasting. It is intended to assist users, in working with their technical advisers, to choose the most appropriate demand forecasting approach and to increase awareness of both the potential and the limitations of demand forecasting methods.

The guidance note is intended to be an easy to use document – a starting point for the less experienced that also points readers towards the wealth of information that already exists on demand forecasting. It therefore does not assume any basic knowledge of demand forecasting. Similarly, it is not intended as a "textbook" and does not cover all the possible options and sophistications that can be found in some types of transport models, as this would only serve to duplicate the detailed technical material already available.

Demand forecasting techniques are constantly developing and improving. New data sources may become available. The DfT therefore has to take a view as to the best and most appropriate techniques at any point in time. It is expected that this guidance note will be reviewed on a regular basis to take into account new evidence and new research. For example, the Department recently commissioned research on newly opened local railway lines and stations[1]. It sought to investigate whether or not demand at newly opened local rail stations has consistently been greater than forecast, and if so, what are the reasons for this. The results of this work (which shall be referred to as the "New Stations Study") has informed this guidance note.

Finally, this note can never provide all the answers that may be required. Where users are still uncertain, specific advice on the application of passenger demand forecasting techniques is available from DfT. Please e-mail: rail@dft.gsi.gov.uk.

[1] '*Station usage and demand forecasting for newly opened railway lines and stations'* study. The report of this research is available on the DfT website: http://www.dft.gov.uk/publications/new-stations-study

Chapter 2 - Demand forecasting in the Overall Planning Context

Demand forecasting is the activity of estimating the quantity of a product or service that consumers will purchase in the future. For railways, this will usually be estimating the numbers of passengers opting to travel by train and where they travel to and from.

Accurate forecasts of rail passenger demand are required to underpin a broad range of requirements:

- **Strategic planning** – in the High Level Output Specification (HLOS), the Government outlines what it wants to buy from the railways and future demand for travel is a key driver;

- **Franchise specification** – before specifying a franchise, both the Government and bidders of franchises need to make an assessment of the forecast demand for travel within the area covered by the franchise for the duration of the franchise;

- **Financial forecasts** – forecasting Train Operating Company (TOC) revenue; and

- **Scheme appraisal** – option appraisal of programmes, projects and policies.

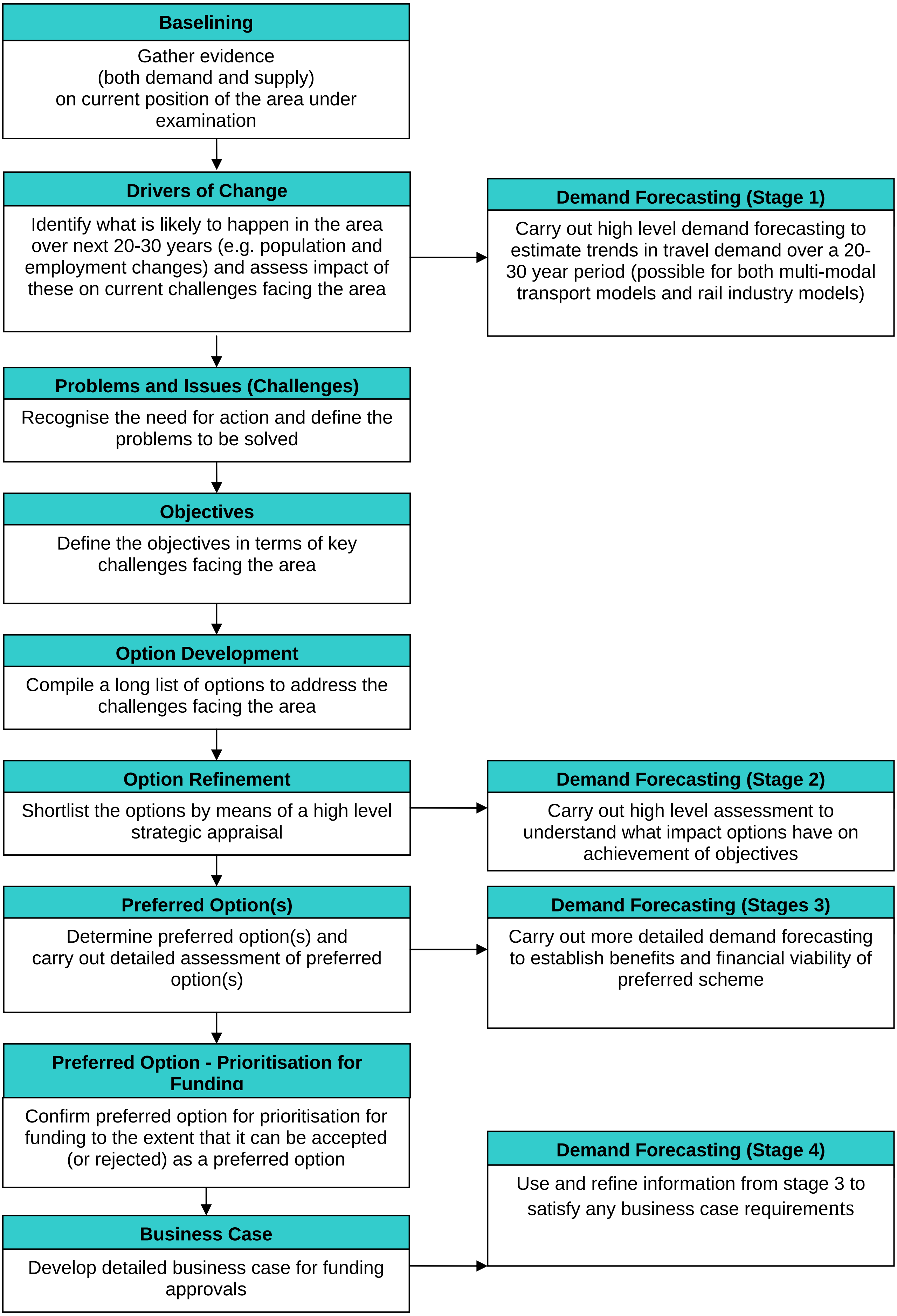
It is the latter function that is the focus of this guidance note.

Demand forecasting lies at the very heart of scheme development and assessment, helping to understand the impact on demand for travel as a result of both changes in society (exogenous changes such as GDP, employment and population growth) and specific courses of action which are taken on the transport network (endogenous changes such as changes to the frequency of services).

This document focuses primarily on rail demand forecasting for endogenous changes – in other words, the sorts of improvements to the local rail network that would be promoted by LAs, PTEs and LEPs. However, in undertaking such work, an understanding of exogenous factors is important as the impact over the appraised life of any improvement will be influenced by such factors (for example, population growth) which are likely to trigger the need for an intervention in the first place.

The forecasting of the change in behaviour arising directly from an intervention is one stage in an overall planning process. This process can be divided into a number of activities and the stages at which demand forecasting should be carried out are as follows:

Figure 1


Baselining
Gather evidence (both demand and supply) on current position of the area under examination
Drivers of Change
Identify what is likely to happen in the area over next 20-30 years (e.g. population and employment changes) and assess impact of these on current challenges facing the area
Demand Forecasting (Stage 1)
Carry out high level demand forecasting to estimate trends in travel demand over a 20-30 year period (possible for both multi-modal transport models and rail industry models)
Problems and Issues (Challenges)
Recognise the need for action and define the problems to be solved
Objectives
Define the objectives in terms of key challenges facing the area
Option Development
Compile a long list of options to address the challenges facing the area
Option Refinement
Shortlist the options by means of a high level strategic appraisal
Demand Forecasting (Stage 2)
Carry out high level assessment to understand what impact options have on achievement of objectives
Preferred Option(s)
Determine preferred option(s) and carry out detailed assessment of preferred option(s)
Demand Forecasting (Stages 3)
Carry out more detailed demand forecasting to establish benefits and financial viability of preferred scheme
Preferred Option - Prioritisation for Funding
Confirm preferred option for prioritisation for funding to the extent that it can be accepted (or rejected) as a preferred option
Demand Forecasting (Stage 4)
Use and refine information from stage 3 to satisfy any business case requirements
Business Case
Develop detailed business case for funding approvals

As is evident from the above, demand forecasting is not simply a single exercise that is carried out once in the overall planning cycle. On the contrary, it is necessary to carry out demand forecasting work at different stages of the planning process at different levels of sophistication. Referring to the stages set out in **Figure 1**, **stage 1** should be carried out to establish at a high level whether there is an issue that needs to be addressed in the foreseeable future; **stage 2** to ensure that a particular option is an appropriate one to address the identified problems and issues, and meet objectives; **stage 3** to help determine the relative priority of the scheme and to assure both the promoter and funder that the scheme delivers value for money and can be afforded over the life of the scheme; and **stage 4** to satisfy any business case requirements, for example, a Major Schemes Business case. The work carried out in stages 3 and 4 can be combined.

It is also important to remember, however, that the scale of each of the demand forecasting studies will vary at the different stages that they are carried out. Generally speaking, a simple study may be all that is necessary towards the earlier stages of planning, whereas more detailed modelling exercises may be desirable as the scheme progresses. The following chapter explains this in more detail.

Based on the overall planning process outlined above, the subsequent chapters assume that the promoter has reached the “Option Refinement” stage. This is the point at which a rail option is believed to be a feasible way of helping to address the issues and achieving the objective. To have arrived at this stage, it is expected the following activities will have been carried out so that the promoter is satisfied that a rail option is worth pursuing further.

Activity
Engagement with wider Rail industry: The promoter would have engaged with Network Rail and relevant Train Operating Companies to verify that a scheme is potentially deliverable.
Demonstration of evidence base: There must be good reason and evidence to show that the scheme fits well with the strategic objective and addresses the issue. The promoter should be wary of starting with pre-conceived schemes or solutions around which to build the evidence. Neither should it solely focus on a rail option for the sake of it. Instead, the promoter should be clear about the challenges facing the area and consider all solutions (including non-rail options) and the timescale. When assessing the merits of pursuing a scheme, a useful exercise for the promoter to undertake would be a basic benchmarking exercise. The next chapter goes into more detail about benchmarking but, at this stage, the promoter may wish to consider doing a basic sense-check of its own project against comparable examples elsewhere to ensure that the assumptions and evidence on which it has based the scheme are realistic. Having gone through all the stages of the optioneering process, if the promoter is still satisfied that a rail option is an appropriate way of addressing the issue, it should then consider taking the scheme forward in the manner outlined in the subsequent chapters of this guidance note.
Identification of funding sources and timescale: The promoter would have identified a potential funding source both in terms of capital and ongoing revenue funding, and the implementation timescale in terms of when the scheme is needed, when it can be delivered and when it can be funded.

Chapter 3 - Demand forecasting: general principles

To ensure that the demand forecasting exercise is robust, this chapter outlines some general principles for the promoter to take account of. When embarking on a demand forecasting study, it is worth bearing in mind the following factors:

Proportionality
As mentioned in the previous chapter, demand forecasting is an iterative process that will need to be carried out at various stages of the planning cycle, and the scale of each study will vary at the different stages of the planning process.

There are a range of demand forecasting model types that vary in complexity and cost. Multi-modal approaches tend to be more expensive to build, maintain and run than single-mode approaches. However, there is also a spectrum of single-mode model types ranging from the simpler and less expensive versions to the more complex and costlier ones. Broadly speaking, unless a LA is undertaking a wider transportation study of the area, a scheme may benefit from a simple type of model towards the earlier stages of planning **(stages 1 and 2** in Figure 1**)**, whereas more detailed modelling exercises may be required during the later stages **(stages 3 and 4** in Figure 1). For example, it may be unwise to invest large sums of money in an elaborate forecasting tool towards the start of the planning phase when the need for a scheme is likely to be far from certain. In addition, for some simple schemes, it may be appropriate to use just one particular type of model throughout the course of the planning cycle and refine it as the planning reaches its later stages. For other potentially more complex schemes, it may be necessary to use a different modelling approach (or even a combination of approaches) at later stages of the process.

There is an inevitable trade-off between accuracy and the complexity and cost of a demand forecasting exercise. In some cases considerable insights can be achieved using a relatively simple and cheap approach, as the extra degree of accuracy that could be delivered through a more sophisticated type of model could be disproportionate to the stage at which the project is or to the overall scope of the project itself. In other cases, however, the additional resources devoted to developing a more sophisticated forecasting tool or refining an existing type of model may be invaluable in understanding complex travel market interactions that are vital to the decision-making process. Whatever model is used, however, the quality of the outputs is significantly dependent upon the quality of the data which is fed into the model.

The selection of a forecasting approach will involve striking the right balance between issues such as functionality, model specification, data availability, accuracy, complexity and, resource and time constraints. The promoter should be wary of commissioning overly detailed modelling exercises when a simple study would suffice and vice versa. More detailed guidance about choosing an appropriate type of model is provided in the next chapter.

Accuracy of forecasts
This guide does not propose to recommend a single methodology that should be applied at each stage – each circumstance is unique. Neither, through following the guide, will any exercise guarantee 100% accuracy as no demand forecasting exercise can estimate or reflect every single potential effect. However, the aim

should be one of achieving an accurate representation of the most important influences on rail demand in the areas affected by any intervention.

Benchmarking

In addition to modelling, a worthwhile exercise for the promoter to undertake after a demand forecasting study has been carried out would be to benchmark its own project with a comparable example elsewhere. For example, if the promoter is looking to open a new station and is aware of a station which serves a settlement with similar characteristics to that of its own locality (i.e. a settlement with a similar catchment area and demographics), understanding the level and nature of demand at the established station would provide a guide as to whether the forecasts derived from a model appear reasonable. To do this, the promoter should start with its own choice of model first and then sense check it against a comparable scheme rather than base its forecast figures on those generated from the project of comparison.

For new stations, a useful source to check demand forecasts against is the station usage figures on the website of the Office of Rail Regulation: http://www.rail-reg.gov.uk/server/show/nav.1529

It is important to bear in mind however, that every situation is unique and that what happens in one area might not be replicated in another.

Understanding the model and how the forecasts were derived

The promoter should be clear about how it arrived at the demand forecast figures. If the scheme requires government funding, DfT will scrutinise the results closely to be satisfied that they are plausible. Devoting a proportionate amount of effort to get the approach right will save the promoter from time-consuming and costly changes further down the line. A checklist of sensible questions to ask or areas to explore in order to interrogate the model sufficiently is provided in chapter 5**.**

Chapter 4 - Demand forecasting model types

The principal source of rail passenger demand forecasting advice is the "Passenger Demand Forecasting Handbook (PDFH)" which underpins DfT's WebTAG[2] unit 3.15.4. This is updated from time to time based on new evidence which may emerge from new research. The PDFH provides the general framework within which rail passenger demand forecasts should be conducted. It summarises collective rail industry knowledge of the effect of various influences on passenger demand, and draws forecasting parameters from previous experience and research. It also provides guidance on applying this knowledge to the preparation of passenger demand forecasts. It should be noted that PDFH is a guidance document. Where there is strong evidence that additional specific local factors should be included, sponsors should consider factoring in robust local evidence where it is available.

The handbook is available to all members of the ATOC Passenger Demand Forecasting Council (of which DfT is a member) and organisations working on their behalf at an associate membership fee of £3.4k[3]. For more information on obtaining a copy, please refer to the ATOC website: http://www.atoc.org/about-atoc/commercial-activities/passenger-demand-forecasting-council/how-to-become-an-associate-member.

The information in this chapter is therefore based on that given in the PDFH as it is the PDFH that should serve as the promoter's main source of reference.

When forecasting changes in demand as a result of a transport intervention, it is important to distinguish whether the intervention is a change to an existing service or station (for example, a more frequent service on an existing line) or whether it is a brand new service or station. However, in some cases, a new service might not only serve new stations but also provide an increase in frequency at already served stations. The type of intervention will determine the choice of demand forecasting model type, or may require the use of two model types.

The promoter should note the distinction between demand forecasting ***model types*** (in other words, an approach / technique) and actual demand forecasting ***models*** which are based on an approach. With the exception of MOIRA which is a commonly used model for understanding the effect of changes to the timetable, only examples of demand forecasting ***model types*** are provided below. Chapter A3 in the PDFH however, sets out the rationale for which ***models*** to use and summarises the most commonly used tools.

Forecasting demand for changes to existing services or stations

Elasticity Approach

Elasticity is defined as the ratio of percentage change in one variable to the percentage change in another variable. Rail forecasts have traditionally been

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[2] The Department for Transport's website (www.dft.gov.uk/webtag) for guidance on the conduct of transport studies. The guidance should be seen as a requirement for all projects/studies that require government approval. For projects/studies that do not require government approval, WebTAG should serve as a best practice guide.

[3] Fees correct in 2010.

prepared using an incremental elasticity-based approach. In this approach, historic evidence is used to determine a statistical relationship between the observed demand for travel (in this case rail services) and a range of variables representing those factors that affect rail passenger demand. As mentioned in the previous chapter, these factors can be classified as (1) background (exogenous) changes to rail demand that are caused by factors assumed to be outside the direct control of the rail industry and (2) scheme or policy-related (endogenous) initiatives which are assumed to be within the direct control of the rail industry. The following table provides examples of exogenous and endogenous factors – please note that these lists are not exhaustive.

Exogenous factors	**Endogenous factors**
GDP or employment	Rail fares
Population	Rolling stock
Car ownership costs (e.g. fuel / maintenance)	Punctuality / reliability of rail services
Cost of travel by other modes (e.g. bus / underground / air)	Station facilities
Journey times by other modes	Rail journey times
	Crowding

<u>Example: Forecasting rail passenger demand between Leeds and London</u>

- We know how many people travel between Leeds and London;
- We know from experience how changes in one of the variables (for example, fares) impacts on demand;
- We can calculate an elasticity of this relationship; and
- We can then forecast new demand as a result of this change in variable.

To demonstrate this using figures:

- Let us assume that 400 people travel between Leeds and London;
- If rail fares increase in real terms by 1%, we would expect demand to fall;
- When calculating an elasticity of this relationship, if we have previously observed a 0.5% fall in demand as a result of this 1% fares increase, this means the fares elasticity is -0.5 / 1 = -0.5.
- Based on this elasticity, we can therefore forecast that a 10% real increase in fares in the future will reduce demand by 5% (-0.5/1)*10). Therefore, of the 400 people currently travelling between London and Leeds, a 5% reduction of this number would mean that only 380 would travel in the future (0.05 x 400 = 20: 400-20 = 380).

Points to note when using the elasticity approach:

- It is an approach used to consider the demand for travel on a mode-by-mode basis, that is to say, it has a very limited representation of other modes;

- Models based on the elasticity approach are relatively simple to use as one does not require any data for factors which remain constant through time; and

- Although most rail forecasts are commonly prepared using this method, to use this incremental approach, a base demand figure (i.e. historic data of observed demand) is required. Therefore, it is unlikely to be appropriate for forecasting demand for new stations and passenger services where there is no history of demand.

MOIRA

MOIRA is an example of a demand forecasting model that uses the elasticity based approach described above. It is the only demand forecasting model that has been described in this guidance note as it is frequently used.

MOIRA is a system designed to predict how changes to the planned timetable will affect passenger revenue. The model takes the complete Great Britain (GB) timetable and ticket sales information, and allocates passengers to trains. MOIRA is useful whenever there are planned changes in journey time, frequency and the need for passengers to interchange. It is a good tool for working out not only the revenue benefits of service improvements but also the revenue dis-benefits of service cuts. Examples of when MOIRA can help include:

- New services impacting on existing routes – new services introduce new journey opportunities. MOIRA can be used to work out corresponding revenue gains.

- Stopping pattern changes of train services – MOIRA can be used to look at stopping pattern changes on trains. For example, if a promoter was considering stopping existing train services at a new station (which would result in longer journey times for passengers travelling longer distances), MOIRA could calculate the associated effect on revenue based on existing journeys (but not revenue generated from the new station).

For more detailed information on using MOIRA, please e-mail railtag@dft.gsi.gov.uk.
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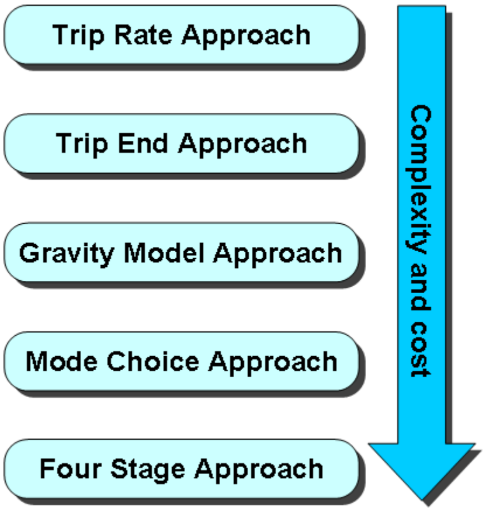
Forecasting demand for new services and stations

As the elasticity approach is not an appropriate means of forecasting demand for new stations and passenger services, other methods need to be considered. There are five alternative types of models that can be used to forecast demand in these situations:

Figure 2[4]



Broadly speaking, **Figure 2** shows the range of complexity and cost of the types of models collectively, from the trip rate approach being the simpler and less costly technique to the four stage method that is considered the more complex and more costly approach. However, it is important to bear in mind that this is somewhat of a generalisation and does not always turn out to be the case (for example, one may have a simple model based on a four stage approach but a very complex model based on a trip end approach). Also, the promoter should once again note that there is no single correct methodology; it depends on context, data availability and whether an existing model which the promoter has at its disposal can be used or developed. In some cases, a combination of models may have to be used at any one stage of the planning process at which a demand forecasting exercise is carried out.

Trip Rate Approach

This type of model can be used in relation to new stations and estimates trip rates of people living within a particular station catchment area. The trip rates are simply the average number of trips made by rail from the area. Trip rates can be differentiated according to distance from the station. However, a trip rate model type does not include key matters such as journey times and frequency of train service. As there are obviously no demand figures for a new station which does not yet exist, this method can only rely on estimating trip rates based on those identified in comparable situations (i.e. a collection of stations with similar catchment areas and demographics). Whilst it is very basic, this approach may be suitable for very early option assessment and sifting.

Trip End Approach

This type of model applies also to new stations and builds on the trip rate model type by incorporating additional information on demographic, socio-economic and service-related data for areas around stations (more details of the use of this data are set out below). In addition to estimating the number of trips made from the potential catchment area, the trip rates forecasted using this model can be destination specific (for example, trips made to the nearest large city). A trip end model type can also incorporate journey times and frequencies.

[4] Note that each of the types of models in this diagram are independent than a single collection of types of models that follow on from each other.

Gravity Model Approach
This is a type of distribution model, generated from an analogy with Newton's gravitational law. It illustrates the trip making behaviours of groups of individuals between origins and destinations of trips. Trip making increases with the size of these places, for example, as population at the origin and employment at the destination increase so does trip making between these two places. Conversely, distance, time and cost of travel act as a deterrent to trip making and so the number of trips made decreases as these factors increase.

The gravity model approach can be used when a large change in demand is expected such as when opening a new station or introducing passenger services between two places that were not previously linked by rail. The model must first be calibrated to replicate the existing number of trips as closely as possible. It is then possible to introduce new stations (or 'places') within the framework and calculate the change in trip making behaviour in this new system, compared to the original. A gravity model is able to handle complex changes in trip making habits, for example, where a new service or station fundamentally affects how people use the rail network.

The trip generation analysis using both the trip end and gravity model types is based not only on existing demand patterns for comparable situations but on local characteristics, with the gravity model approach also being able to estimate the number of trips made to a range of possible destinations.

The local characteristics include:

- Distance from the station (for example, there will be different forecasts for different distance bands);

- Socio-economic characteristics of the resident population (for example, people in higher socio-economic groups are known to make more trips than those in lower socio-economic groups);

- Quality of rail services from the station (to the destination if relevant); this may simply be frequency of services and/or journey times/speed as well as fares;

- Quality of competing modes of travel (for example, buses); and

- Attractiveness of destination (for example, number of workplaces or shopping/leisure facilities).

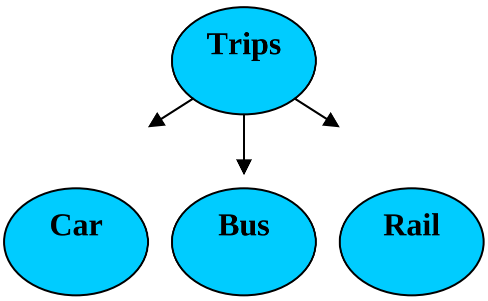
Points to note when using the trip end and gravity model approaches:

- Most models do not reflect the quality of competing modes or the quality of the rail services proposed in terms of comfort / age of rolling stock etc.; and

- On the other hand, the strengths of these model types are that socio-economic characteristics can be included, and they address the issue of accessibility to the new station by factoring in the distance to the station from the commuter's place of origin;

Mode Choice Model Type
An element of the four stage modelling process (see below), this type of model can be used in relation to new stations that are expected to attract (rather than generate) passengers from a wide range of origin areas (for example, rail stations at airports). As **figure 3** below depicts, by factoring in the travel by existing modes of transport on the area served (for which the necessary data needs to be gathered), it forecasts the extent of diversion to rail following an intervention. The model type can also be used for new rail routes where there are no comparable existing services.

Figure 3



Points to note when using the mode choice model type:

- Where data on other modes is available, the promoter gains a good insight into the overall market picture in terms of the competing transport modes;

- Generally speaking, the model does not distinguish between different socio-economic groups; and

- This approach does not factor in a situation where people may change their destination as a result of introduction of a rail service.

Four Stage Model Type
This type of model can be used to forecast demand when considering a range of transport options in a particular transport corridor or geographic location. However, this method is seldom used to forecast demand for rail schemes. This is because only 2% of journeys are made by rail[5], therefore, with such a small sample size, demand figures would typically end up being under forecast.

As **figure 4** below shows, a four stage approach models the travel choices of commuters including:

- Whether and how many trips there are to make of a particular type (trip generation);
- Where to go (trip distribution);
- What mode to use (mode choice); and
- What route to take (trip assignment).

Points to note when using the four stage approach:

[5] Data from National Travel Survey.

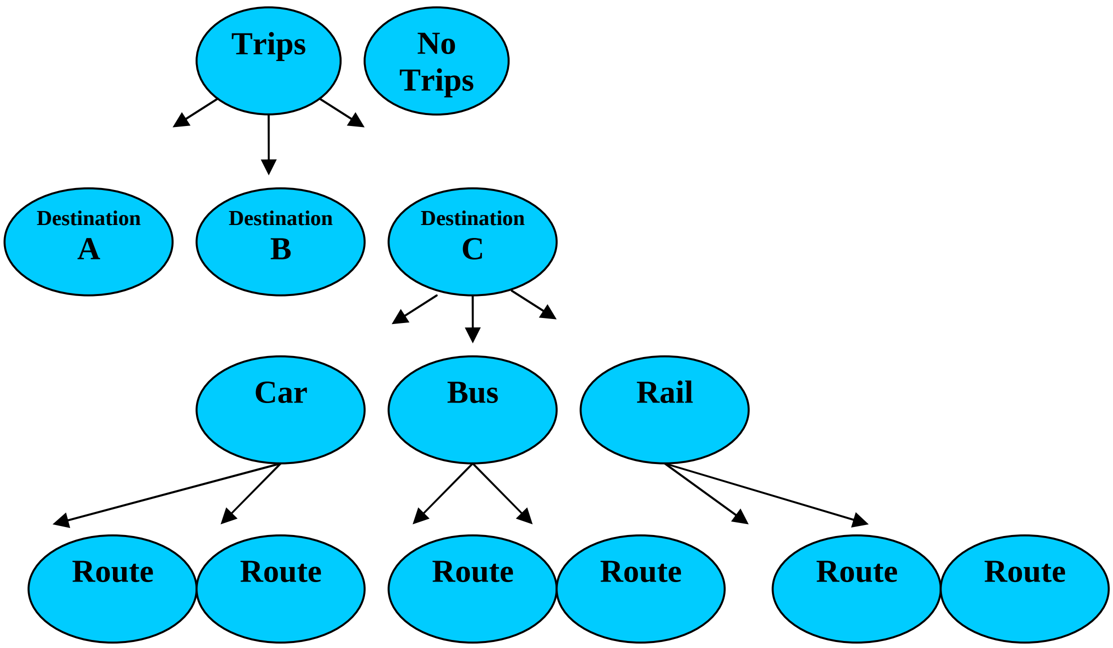
- Models based on this approach are usually large which take considerable effort and money to develop because of the amount of data that needs to be collated;

- This type of model does not allow for car access to rail stations to be taken into account, that is to say, car travel being used as a complement to rail travel;

- In terms of journey types, this approach performs particularly well when forecasting the journey to work (although it does consider the whole range of journey purposes as well); and

- A key strength of this type of model is that it reflects the real travel choices that commuters have over where to go and how to get there. For example, a person's choice of where to go shopping is made simultaneously with what mode they are going to use; to use a more specific example, if someone chooses to go to Bluewater shopping and leisure centre close to the M25, it is more likely that they will drive; however, if the person opts to go shopping in the West End, it is more likely that they will travel by public transport.

Figure 4 – A typical 4-stage model hierarchy



Key inputs into demand forecasting models

The promoter might wish to be aware of the following key inputs into rail demand forecasting models:

LENNON

This is the ticketing-based system that allocates revenue to routes and therefore train operators. This is carried out through either an automated allocation of revenue between operators or through survey-based agreements on contested flows. It replaced an earlier system called CAPRI and is run on behalf of all the National Rail operators through Rail Settlement Plan (RSP) which belongs to the Association of Train Operating Companies (ATOC).

TEMPRO (__**T**__rip __**E**__nd __**M**__odel Presentation __**Pro**__gram**)**

This is a computer software that provides summaries of National Trip End Model (NTEM)[6] forecast data for transport planning purposes. The forecasts include population, employment, households by car ownership and trip ends. All the data is available for free on the TEMPRO website (http://www.dft.gov.uk/tempro/), for anyone to use.

[6] The National Trip End Model (NTEM for short) provides a set of predictions of growth in car ownership and car traffic, with associated planning data projections, at any geographical level down to local authority districts. It forms a starting point for local forecasting procedures. It is a forecast of vehicle movements rather than a forecast of personal travel.

Summary table of demand forecasting model types

Type of Models	Application
Elasticity Approach (for example, MOIRA)	- Changes to existing passenger services between known destinations where historical data on existing rail usage is available - Changes to existing stations (such as enhancements to passenger facilities at stations)
Trip Rate Approach	- New stations (early option assessment and sifting)
Trip End Approach	- New stations (local stations with relatively minor impacts on the wider rail network)
Gravity Model Approach	- New stations - New or significantly enhanced passenger Services
Mode Choice Approach	- New stations expected to attract (than generate) passengers from range of origin areas - New rail routes where there are no comparable existing services
Four stage Approach	- Seldom used for rail schemes but can potentially be use for major line reopenings especially where there are heavy commuter flows

Chapter 5 - Demand forecasting and types of investment

In the previous chapter, information was provided on the type of models that can be used by promoters. This chapter relates this to the types of projects that promoters may be considering and provides guidance on the demand forecasting approach that the promoter may wish to use. It is important to reiterate that these are only suggested approaches and the information here should simply be used as a guide than as a hard and fast prescription. This chapter also includes a checklist setting out a series of questions which the promoter should be able to answer at the completion of a demand forecasting activity.

This guidance note classifies the types of schemes that promoters may wish to consider as follows:

1. New or reopened stations on existing or new routes;
2. New or enhanced service (with or without additional infrastructure), on predominantly existing routes.

New or reopened stations on existing or new routes
One of the findings of the recent New Stations Study, is that every station has unique characteristics. Therefore, there is no one modelling technique that can be prescribed as the best way to forecast demand for new or reopened stations on existing or new routes. In the New Stations Study, the majority of demand forecasts for a single new station used a trip rate or trip end approach. However, other techniques including the gravity model approach, four stage and mode choice model types, or a combination of these were also used by some promoters. This was particularly the case when more than one station was being opened and new services being introduced.

Therefore from the evidence gleaned from the study, it can be concluded that for a single new station with a relatively straightforward demand profile, an appropriate type of model to use would be one based on a trip rate and/or a trip end approach. However, a gravity model approach might be more appropriate for more complex schemes where the scheme is likely to have a significant impact on trip-making patterns. This does not rule out the use of more sophisticated models where they are already available. In some cases, the use of a combination of model types might be appropriate.

The point to note here is that whatever type of model the promoter decides to use, it is vital that the appropriate characteristics of the area and train service are taken account of in the model. This was a key conclusion of the New Stations Study which found that in the majority of instances where demand had been inaccurately forecasted, the most common reasons were:

- Forecasting methodologies not reflecting local characteristics (for example, rail demand arising from the construction of new housing developments or from regeneration of the area. Also, new housing developments may have different demand profiles from well established residential areas.);
- Inclusion of incorrect train service supply assumptions (for example, in one case, the incorrect destination of where rail services operate to was used in the model); and
- Misunderstanding of the likely “function” of the station or the markets that it will serve (in the case of one station for example, the potential demand arising from the existence of a nearby leisure centre was not taken into account which

resulted in demand figures being significantly under forecast; In other instances, the role of the station as both a destination as well as point of origin was ignored).

Whichever type of model is used, the promoter must be satisfied and be able to demonstrate that it is fit for purpose, operating as intended, and generating plausible results. A checklist of sensible questions to ask or areas to explore has been provided at the end of this chapter.

New or enhanced service (with or without additional infrastructure) on predominantly existing routes

Improved passenger services on existing routes could include speeding up journey times or increasing the frequency of services, or running services at times when they currently do not operate (for example, late evenings and Sundays). In such cases, where the timetable change is incremental (for example, improving services from an hourly pattern to a half hourly pattern), MOIRA would be an appropriate forecasting tool to employ. Where forecasts need to be made for services which currently do not exist such as a Sunday service, a bespoke trip rate model type may be more appropriate using other existing services as a comparator. As mentioned previously, for more detailed information on using MOIRA, please e-mail railtag@dft.gsi.gov.uk.

It is recommended that alternative methods such as a gravity model, is used in situations:

- Where a new train service is being introduced; or
- Where the change to the existing service pattern is a significantly enhanced service (with or without additional infrastructure); or
- Where it has a network effect and will lead to changes in people's trip making behaviour.

If the enhancement also involves increasing capacity (using longer trains, that is) or improving services where there is already crowding (for example, during peak periods), the promoter would also need to use a crowding model. These are somewhat complex tools to work with, therefore it is recommended that the promoter seeks specialist advice when developing such models. Further advice can be sought from DfT analysts; please email railtag@dft.gsi.gov.uk

The following is a series of non-exhaustive questions which the promoter should be able to answer during completion of a demand forecasting activity:

- **What rail service pattern (train frequency, journey time to key destinations) and fares have been assumed?**
    - If this is yet uncertain or if there are more than one option, a sensitivity test should also be carried out for each possible variation.

- **What is the expected profile of demand during the day/week (peak/off peak demand)?**

- **How has demand been annualised?**

- **Will stopping services at the new station result in longer journey times for existing passengers travelling through the station, thereby resulting in an associated reduction of demand for such journeys?**

  - An estimate of this can be made by using MOIRA

- **What are the main markets (demand generators) that would be served by the new station?**

  - For example, will it serve:
    - established housing?
    - new housing development?
    - local employment?
    - shopping facilities?
    - leisure / tourist facilities?
    - park and ride, or parkway station?
    - bus interchange for more distant origin?

  - Where (as it is most likely to be the case) the new station serves more than one market, demand forecasts for each of these markets should be provided, including details such as (a) description of the volume of local housing and where it is located, (b) location of local employment markets, amenities and leisure facilities, and (c) the likelihood of any proposals for new housing, business or recreational developments to go ahead. Sensitivity tests in respect of volume and timing of future developments should also be carried out.

  - What are the associated risks with the housing / business / recreational developments that are linked to the new station proposal? What sensitivity analysis has been carried out around these issues, for example, in the eventuality that these proposals for new housing / business / recreational developments do not materialise?

  - Where the proposed new station will attract new demand from new developments, has rail demand from this new development in the absence of the proposed new station been estimated (and included these in the "do nothing" assumptions)[7]?

  - What segmentation of demand (for example, journey purpose / ticket type / socio-economic characteristics of local population) has been applied?

- **What are the main origins / destinations of trips using the new service /**

[7] As the name suggests, this refers to the option of not opening the proposed new station at all (that is to say, doing nothing). This option would involve assessing the level of rail demand generated from the new development in the absence of the proposed new station whereby passengers would have to make use of the nearby stations that already exist.

station?

- **What are the expected levels of demand in terms of brand new trips** (for example, trips which would not have been made without the new facility)?

- **What are the expected levels of demand in terms of mode switch** (for example will passengers previously travelling by bus or car, now use the train to get to their destination?)

- **What are the expected levels of demand in terms of abstraction** from existing stations (in other words, will passengers previously using nearby stations now use the new station for their journey)?

    - Promoters should include forecasts of the demand generated through the abstraction of trips from other nearby stations to the new station. Where the promoter believes this is not relevant, he/she should explain the reasons for this.

    - Are there any issues with car park capacity at neighbouring stations? If so, this may have an impact on abstraction (and trip generation) assumptions; for example, where a car park is full at an existing station and the new station will provide relief allowing for the generation of new trips from the existing station

- **What assumptions about other competing modes of transport have been made?**

    - What is the alternative bus network assumed to be?

    - What changes are likely to take place on the road network?

- **Has underlying rail demand growth been forecast?**

    - Where housing is evidently linked to the new station proposal, how is this compensated for in overall underlying growth (distinguishing between growth generated by new housing already factored in the demand forecasts and other sources of demand)? Beware of double counting.

    - What is the rationale for the choice of growth forecast? How do they compare with TEMPRO/Route Utilisation Strategy (RUS)/local forecasts?

- **Has build up in demand (that is to say, ongoing growth in demand at the new station from the day it opens until the time it is established) been considered?**

    - What is the estimated year or period of time after introduction when the new station / service is assumed to be 'established'?

  - What is the assumed build up in demand from opening day to when the station is fully established?

- **Having established demand, how does this translate into revenue?**

  - What is the split between revenue generated from:
    - brand new trips or trips abstracted from other modes;
    - trips abstracted from other stations / routes

  - What is the loss or gain in revenue to the railway as a whole from trips abstracted from other stations?

  - What is the revenue lost from trips not being made by rail as a result of longer journey times?

- **Where the new route requires a new service, has account been taken of the impact on revenue on existing routes where the new service adds to the overall frequency?**

Additional information

Benchmarking
Finally, as mentioned in chapter 3, after forecasting demand using a modelling approach, it is worthwhile "benchmarking" the resulting demand figures produced from the model with an existing situation elsewhere to assess whether the figures appear realistic and sensible.

DfT Funded Schemes
Where the promoter is requesting DfT funding, it will be necessary to provide a copy of the supporting demand forecasting documentation and model to DfT. This should include a description of all assumptions used to prepare the demand forecasts, a full description of the demand forecasting methodologies used and the parameters used in the demand modelling.

Presentation
When presenting demand forecasting information for a future year, it is important that forecasts are presented in a way that enables a direct comparison to be made with a base line position, that is to say, the "do nothing" or "do minimum" assumptions.

Chapter 6 - Conclusion

The purpose of this guidance note is to provide advice and information to promoters carrying out or commissioning rail demand forecasting studies for new railway stations and passenger services.

Although we have sought to equip the promoter with basic information on the various approaches to forecasting and assist it in choosing the most appropriate demand forecasting approach, it must not be forgotten that this guidance note is exactly as the name implies - a guide than a rigid prescription.

The promoter is encouraged to engage early with DfT when carrying out or commissioning rail demand forecasting studies because ultimately the scheme may require a DfT grant and/or it may need to be included in a franchise. The promoter needs to have a good understanding of how the demand forecasts are arrived at and be confident that they are sufficiently robust to estimate the benefits of the scheme and demonstrate that it is value for money. By following this approach, the promoter will be able to develop their proposals in the most constructive and economic way, determine the benefits that are expected to arise, and understand the financial implications and risks of the proposed scheme.