Forecasting Long-term Rail Demand in Scotland

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1 Introduction

Every five years Network Rail is required to update its long-term strategy for the network in Scotland. The Scotland Route Study (SRS) provides the evidence base on which rail investment plans are developed by the industry and its funders. It will underpin both the industry's Initial Industry Plan for Control Period 5 and Scottish Minister's High Level Outputs Specification (HLOS) for Scotland to be issued in 2016 and 2017 respectively.

The Scotland Market Study (SMS) provides the demand forecasting evidence and the conditional outputs for the railway in 2023 and 2043. The forecasts enable capacity-related conditional outputs to be developed, and inform the appraisal of the potential enhancement schemes that are being developed to meet them. The demand forecasts discussed in this paper build upon the modelling approach taken by Network Rail to support the other (GB-wide) passenger Market Studies, utilising a generalised cost-based 'logit' methodology to forecast rail demand based on cost, population and employment data supplied by TS and on Scotland-specific scenarios developed by the project team.

These forecasts represent the most detailed demand forecasting exercise ever completed for the railway in Scotland, providing forecasts at a corridor level for the first time. The scenarios provide different views of where people could work and live – and what transport costs they could face - over the next thirty years. When combined with an analysis of anticipated network capacity, these forecasts provide a strong analytical support to investment choices for the rail network. The paper focuses on the Urban Commuter and Interurban market forecasts produced for the SMS: an analysis of the Rural markets considered is also contained within the Scotland Route Study itself.

2 Background to this paper

2.1 The Long-term Planning Process

The SRS was published in draft form in December 2015 as part of the Scotland Route Study. The final report will be published in mid-2016, and this paper considers both the draft forecasts as well as providing a commentary on where and why these are likely to change in the final document.

The SMS has been prepared to inform the SRS, which sets out choices for industry funders in Scotland for the next planning cycle, with a planning window stretching to 2043. The SRS is the first stage in the Scottish Rail Industry's Long-term Planning Process (LTPP) and is a regulatory output for Network Rail.

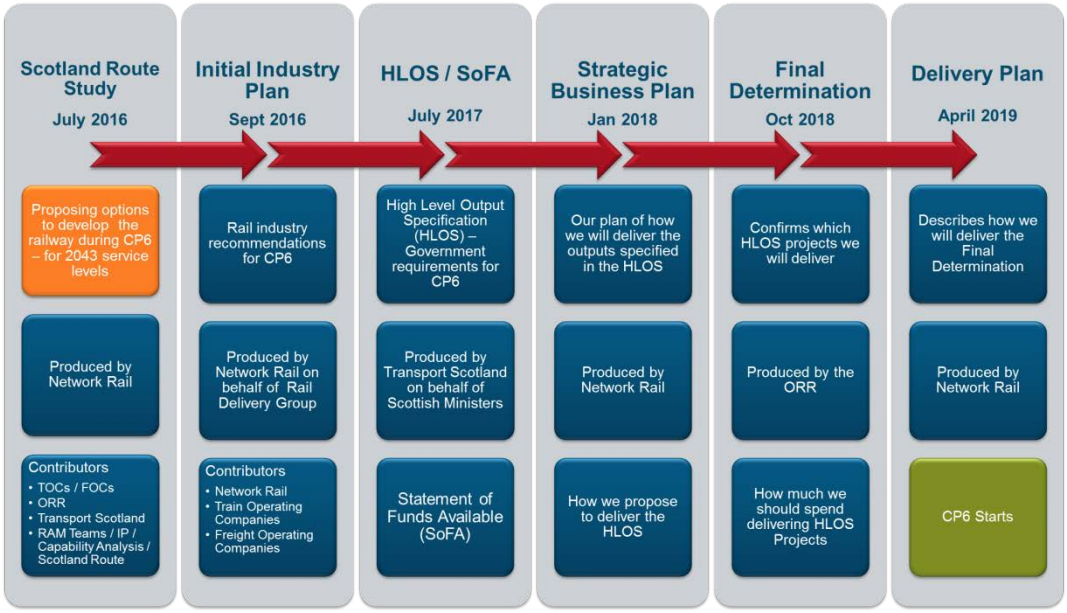

Figure 1: The Scotland Route Study in the context of the Long-term Planning Process for Scotland

2.2 Building on the Route Utilisation Strategies

Iin June 2005, Network Rail's network licence was amended to require the establishment of Route Utilisation Strategies (RUSs) across the network. A RUS is defined in the network licence as "*a strategy which will promote the route utilisation objective*". This objective is defined as: *"the effective and efficient use and development of the capacity available, consistent with funding that is, or is reasonably likely to become, available during the period of the route utilisation strategy and with the licence holder's performance of the duty".*

Since privatisation in 1995, both passenger and freight demand has increased significantly (passenger demand has more than doubled). Whilst much of this demand has been accommodated on a network by adjusting the network at a tactical level, the LTPP was established in 2011 to ensure that a longer term, strategic approach was taken to planning for further significant passenger and freight growth.

This long-term approach is necessary because railway infrastructure assets are (a) relatively long lived and (b) comprise a significant proportion of the industry's cost base. Both upside and downside risks are therefore significant in terms of both the overall industry financial position and its ability to meet the objectives required of it by passengers, freight customers and railway funders.

2.3 The Market Study Programme

A key element of the LTPP is that the Route Studies should be supported by, and work to, outputs set as part of, Market Studies.

2.3.1 Defining Markets

A Programme of market studies was initiated in 2011 and the first four of these (Freight, Long Distance, London and South East and Regional Urban) were established by the Office of Rail Regulation (as it was then known) in 2013.
The market Studies established by the ORR were:

1. Long Distance Market Study (LDMS)
2. London South East Market Study (LSEMS)
3. Regional Urban Market Study (RUMS) and

4. Freight Market Study (FMS)

2.3.2 Market Study Outputs

The passenger Market Studies had three key outputs:

1 The identification of the long-term strategic goals which define the successful provision of rail services to the market they operate in, based on the aspirations of current and likely future rail industry funders;

2 Demand forecasts for the sector over a 10 and 30-year planning horizon (starting in 2013) with scenarios being used to reflect key uncertainties, where appropriate;

3 'Conditional outputs' for the each market. The conditional outputs are aspired levels of service in terms of connectivity.

2.3.3 Conditional Outputs

The conditional outputs reflect stakeholder views of how rail can:

- support the delivery of stakeholder strategic goals,
- take advantage of opportunities created by planned investments,

The conditional outputs all relate to connectivity in one form or another. Where rail demand is forecast to erode the proposed level of connectivity (i.e. where forecast excess demand starts to crowd people off trains), capacity-related conditional outputs have also been defined. All conditional outputs are conditional on them being both affordable and providing good value-for-money, both which are determined as part of the subsequent Route Studies. Investment choices are presented to funders in the form of a quantified business case, the benefits of which are heavily dependent on demand forecasts.

2.4 The Scotland Market Study

The fifth and final market study in the current series is the Scotland Market Study (SMS). The separate funding arrangement for the railway in Scotland, combined with the range of traffic carried on the network here, led to a requirement that a separate market study be developed for passenger flows wholly within Scotland, covering AM Peak Commuter, Inter Urban flows and Rural markets. It was timed be carried out following the appointment of a new ScotRail franchisee in November 2014.

3 Demand Forecasting

The purpose of the demand forecasts is to (a) help define the transport problem (i.e. define where capacity-related conditional outputs need to be set), (b) help appraise different possible responses to schemes developed to meet the conditional outputs

3.1 Demand forecasting methodology

3.1.1 A corridor-level approach to planning

The application of demand forecasts at a country or city level does not take account of the fact that (a) some corridors are more likely to grow at a faster rate than others and (b) funding of schemes is likely to become increasingly diverse in the coming years. Given both these factors, and the fact that TS provided cost distance and demand datasets at the relevant level, meant we were able produce forecasts at a corridor level.

3.2 Scenario-based planning

All forecasting is subject to risk and uncertainty, and long-term forecasting is particularly challenging because structural changes can occur over time which radically alter how people and respond to the incentives they face. For example, most forecasts of national rail demand produced in the late 1980s

would have failed to recognise any likelihood of the approximate doubling of passenger journeys that occurred over the following 20 years.

A scenario-based approach starts with a 'view of the world', and then considers what assumptions might be necessary (at a high level, and on our current expectations) to deliver this 'view', before then considering the likely implications for rail demand.

3.2.1 Drivers of the scenarios – the economy

The first part of the exercise for developing the scenarios was to develop a high-level economic model (see Figure 2 below), identifying linkages between key exogenous and endogenous (to government) factors, and setting out how they are likely to affect the key modelling variables we have identified.

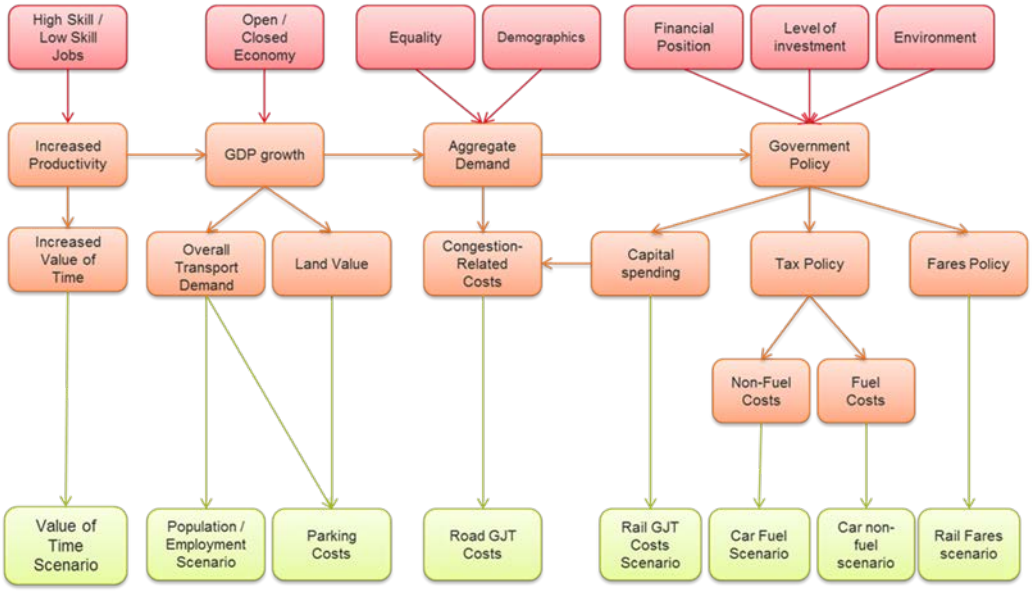

Figure 2: Overall scenario modelling structure

We then took the four high-level scenarios developed for the 2013 market studies and applied these to this model. The four scenarios divide the future into four quadrants as shown in Figure 3 below.

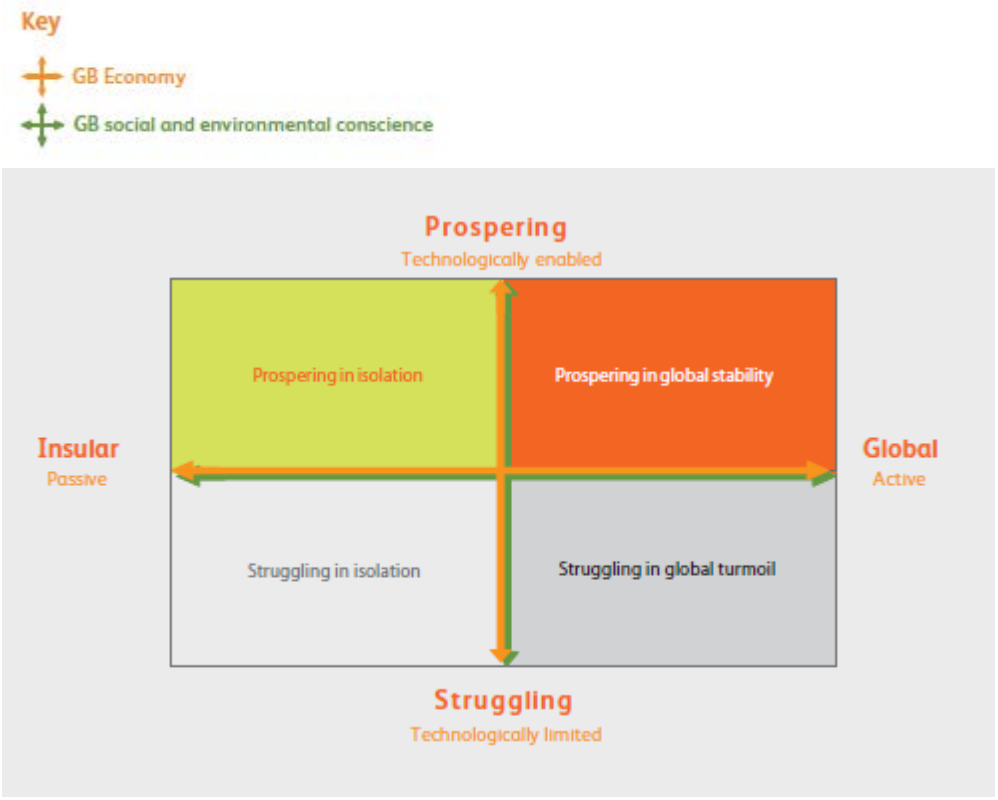

Figure 3: Scenario Structure

The scenarios consider the future in terms of the economy (high growth/low growth; global/insular) and in terms of social/political attitudes (passive/active; technologically enabled/technologically limited).

3.3 Scenario descriptions

The Four core scenarios are based on (a) economic factors and (b) social/political factors

3.3.1 Prospering in Global Stability (PGS)

- Strong, global. A strong economy on the global stage which prospers from its integration with the rest of the world.
- Active, technologically-enabled. Great Britain society and Governments actively seek to reduce social inequality and carbon emissions, with technology limiting the requirement for this to be achieved through taxation.

3.3.2 Struggling in Global Turmoil (SGT)

- Mid-ranking, global. A mid ranking economy on the global stage which suffers from its integration and trading position with other national economies.
- Active, technologically limited. Great Britain society and Governments actively seek to reduce social inequality and carbon emissions, although limited assistance from technology requires taxation to achieve this.

3.3.3 Prospering in Isolation (PII)

- Strong, insular. A strong economy on the global stage which prospers from its self-sufficient nature.
- Passive, technologically-enabled. Great Britain society and Governments are passive in their approach to social inequality and carbon emissions, although technological advancements allow some problems to be addressed.

3.3.4 Struggling in Isolation (SI)

- Mid-ranking, insular. A mid-ranking economy on the global stage which suffers from an absence of trade with other countries.
- Passive, technologically-limited. Great Britain society and governments are passive in their approach to social inequality and carbon emissions, and technology offers little solution to these problems.

3.4 Applying the scenarios to Scotland

In terms of developing the scenarios in Scotland, these scenarios were useful as a high-level guide. However, following the publication of the Draft for Consultation, some stakeholders commented that a stronger narrative was required to make them credible at a Scotland level and therefore useful to funders. As a response to this we have carried out more analysis to ensure that the scenarios reflect the Scottish context more fully.

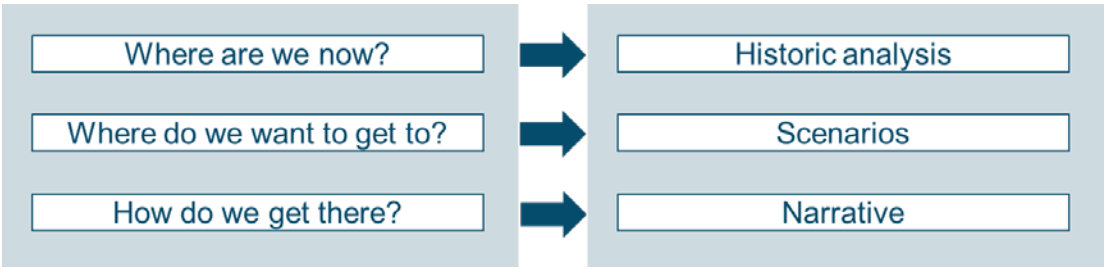

Figure 3: Developing scenario narratives

This is particularly important where the scenarios are not geographically uniform. Under the 'PGS' scenario, for instance, strong economic growth is combined with government policies designed to equalise economic outcomes for its population. Given the current income distribution, this implies that Greater Glasgow would have to grow faster than (say) the Edinburgh or Aberdeen city regions.

3.5 Market Size Scenarios

The principal drivers of market size are city centre employment (for the AM Peak Commuter market) and residential population (for the Inter Urban market).

3.5.1 City Centre Employment

The scenarios for city centre employment were developed using Experian employment data between 1997 and 2014, and the Experian forecast for 2015 to 2018. The employment data is broken down by occupation with employment activities selected on the basis of how likely they were likely to occur within the city centre (for example, office-based employment types).

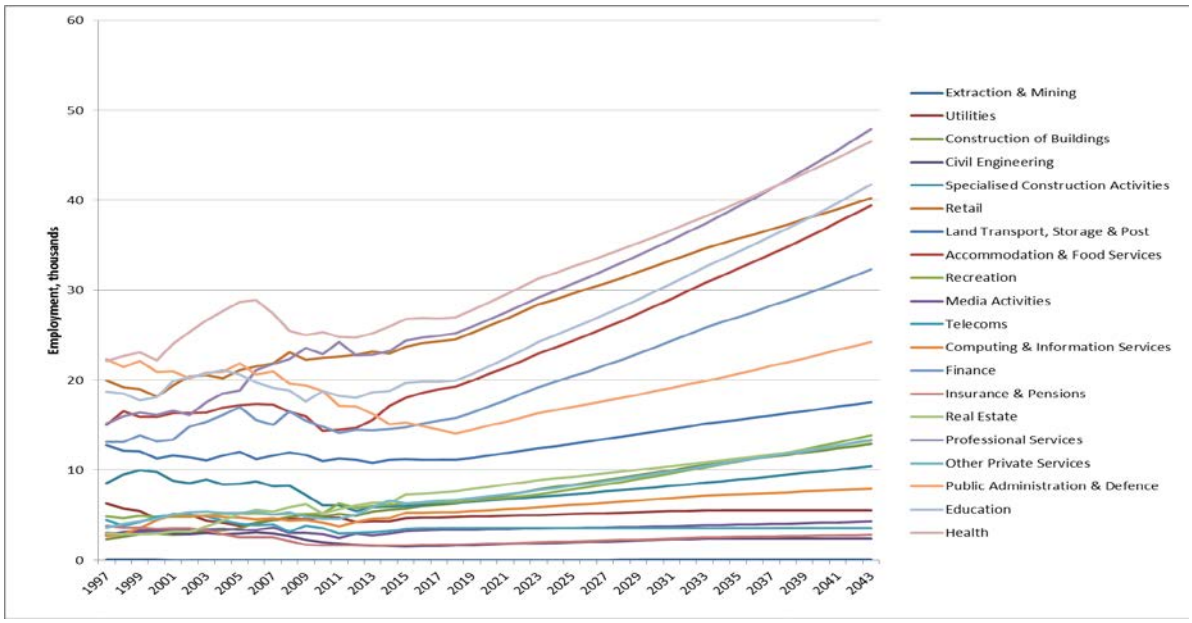

Figure 4: Glasgow city centre employment under the PGS scenario

Growth rates for each employment were then applied on a consistent basis across each city centre (Glasgow, Aberdeen, Edinburgh) as per Figure 4 above. Where a city was assumed to enjoy a comparative advantage in an industry (for instance energy in Aberdeen and finance in Edinburgh), the growth rates were tweaked to reflect this. The overall impact of this approach was to provide a coherent narrative based on each city's economic structure on which the overall growth rate (see Figure 5 as an example) was plotted for each scenario.

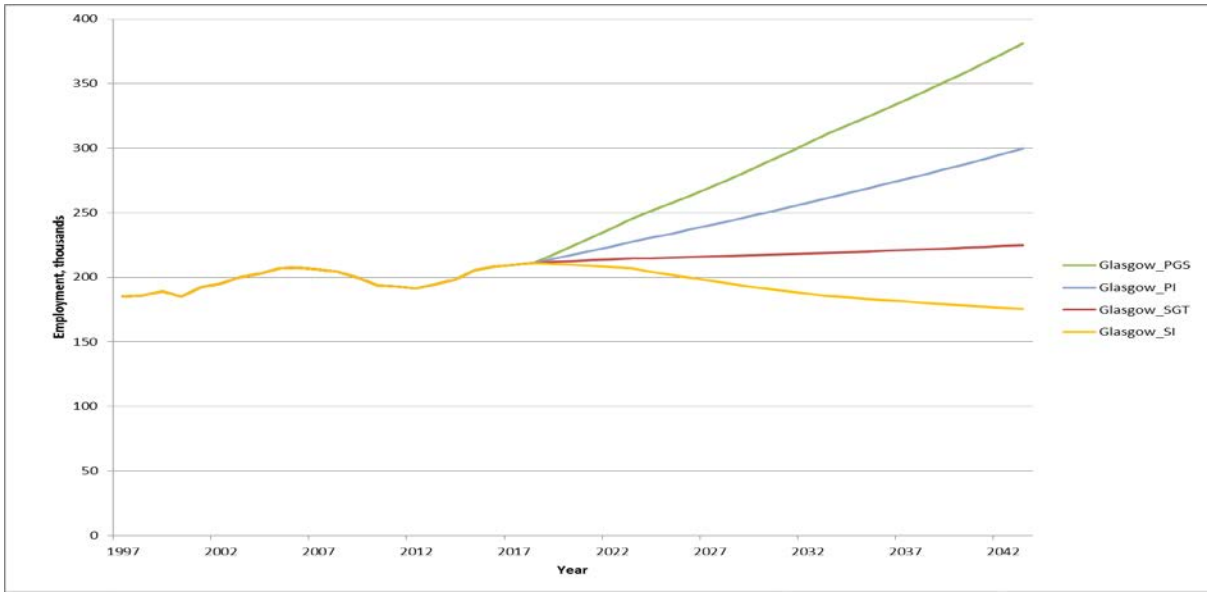

Figure 5: Glasgow employment by scenario

3.5.2 Population

The population scenarios are used to develop a forecast of market size in the Inter Urban markets. The scenarios are based on National Records of Scotland data and forecasts from 1981 up to 2018. Scenarios have been developed for:

- Births

- Deaths
- International migration to Scotland
- Migration from other parts of the UK to/from Scotland

The scenarios were applied at a Regional Transport Partnership (RTP) level, with the same methodology being applied as in the city centre employment scenarios. The final scenarios are presented in Figure 6 below.

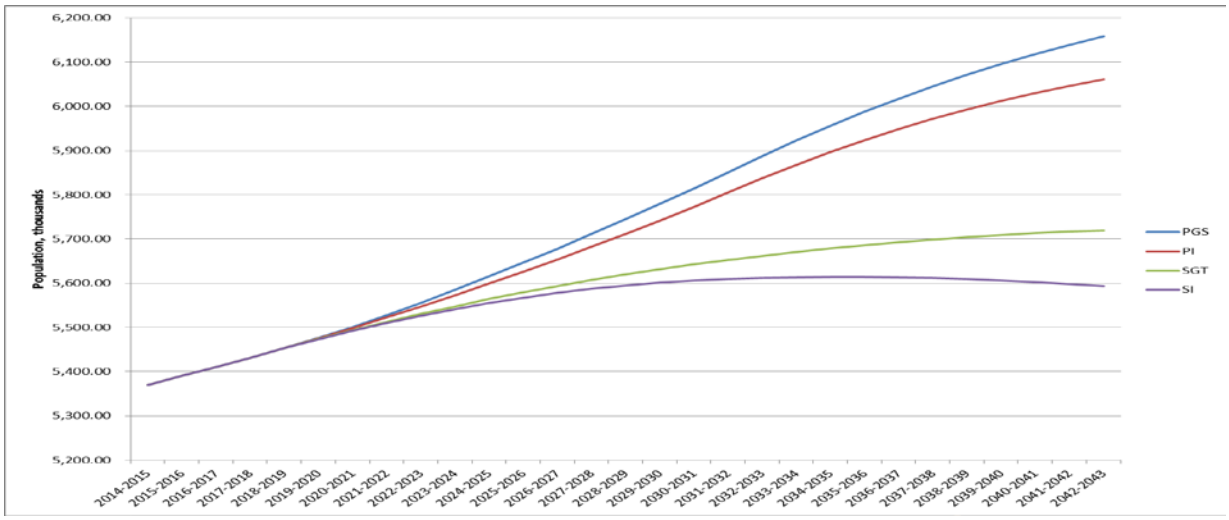

Figure 6: Population scenarios

3.5.3 Market Share Scenarios

Unlike the market size scenarios (where differential growth rates are applied for city centre employment and for residential population) the presumption with the market share scenarios is that they should be applied on a uniform basis throughout the model. The exceptions to this principle is the scenarios for parking costs and Generalised Journey Time (GJT) growth (congestion), which are applied at a city centre and RTP level respectively.

The growth scenarios applied for market share factors are:

- VOT;
- Fuel price;
- GJT (congestion);
- Train fares;
- Non-fuel price;
- Parking costs;

3.6 Demand Forecasting Methodology

The same multi-modal modelling approach as the other passenger market studies was used. This reflected the 30-year length of the planning window, the need to consider the whole transport market and the requirement that the model should have a strong geographical basis. For the SMS we were able to use cost data from Transport Scotland's (TS) TELMOS models for road, rail, and bus and for both population and employment.

Figure 7 below sets out the principal data sources, and the models they informed.

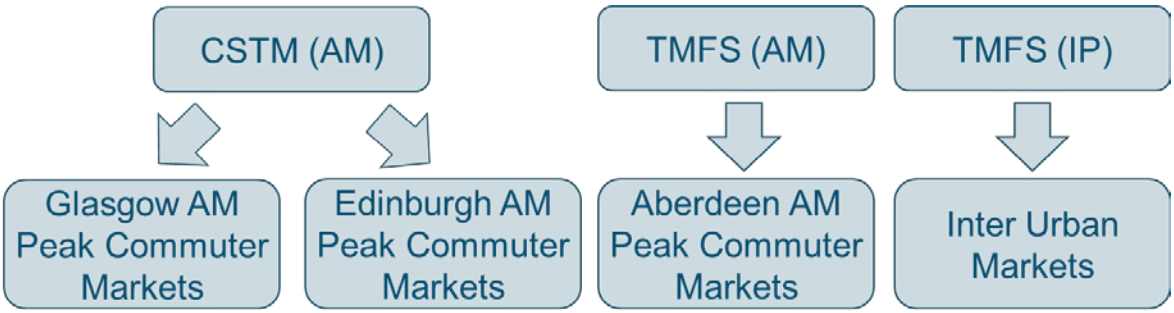

Figure 7: TELMOS data sources

3.7 Estimating Demand Growth

Rail demand growth is estimated by forecasting rail demand on a station-to-station basis for four forecast years: 2012, 2018, 2023 and 2043. The demand forecasts for each station pair are then assigned to corridors and adjusted to 2014 before being applied to 2014 base demand. This section of the paper considers the methodology for estimating rail demand growth using a market size/market share approach.

3.7.1 Market Size / Market Share approach

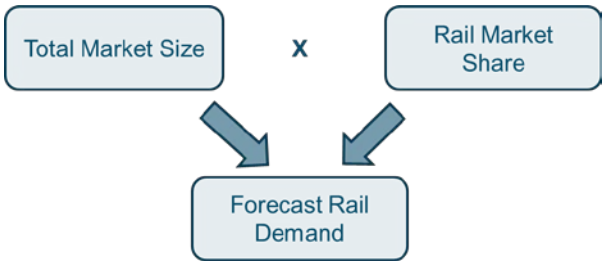

Figure 7: Estimating forecast rail demand

3.7.2 Estimating Rail Market Share

Rail market share is estimated by comparing the generalised costs of travelling by each mode (car, rail and bus) using a logit function. The sensitivity of a decision to changes in Generalised cost is dictated by the mode spread parameter in the logit function. Generalised cost (GC) is a marginal concept which doesn't factor in sunk costs (such as those associated with car ownership) that might influence mode choice. A hierarchical structure was therefore employed to ensure that public transport mode choice decisions were more sensitive to generalised cost than car vs public transport decisions (see Figure 8 below).

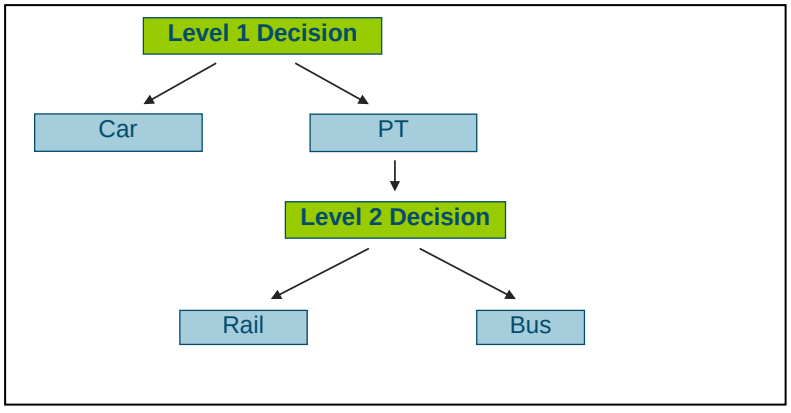

Figure 8: Modelling Hierarchy

Rail market share on a given trip is estimated by multiplying the Level 1 decision mode share (Car vs Public Transport) by Level 2 decision mode share (Rail vs Bus).

3.7.3 Data sources

TS supplied cost data from Central Scotland Transport Model (CSTM), which focussed on the Central Belt. We used CSTM data to develop forecasts for the AM Peak Commuter markets into Glasgow and Edinburgh.

TS also supplied cost data from Transport Model for Scotland (TMfS) to enable us to model the AM Peak Commuter market into Aberdeen and (using inter peak data) the Inter Urban flows on the network in Scotland.

The cost data for 2012 and 2018 supplied by TS (via their consultant Jacobs) consisted of:

- Car distance
- Car GJT
- Rail and Bus GJT
- Rail and Bus fares
- Demand by mode

The fuel, non-fuel and value-of-time costs associated with each Origin-Destination (O-D) pair were developed using standard values from STAG up to 2018. Parking costs follow the TMfS technical guide for 2012, but the cost estimates for 2018 are based on consultation with the Regional Transport Partnerships (RTPs) and reflect our belief that the cost of car parking has and is likely to continue to change in the coming years. It is acknowledged that the evidence on car parking costs is weak and that addressing this needs to be a focus of future work

3.7.4 Journey time assumptions

One of the benefits of using TMfS/CSTM journey time data is that the impact of the major schemes planned by the Scottish Government could be taken account of in the modelling. The list of road schemes completed by 2018/19 is as follows:

- M8 completion
- A90 Balmeddie to Tipperty Dualling
- Aberdeen Western Peripheral Route (AWPR)
- Queensferry Crossing (Forth Replacement Crossing)
- M74 Raith Interchange
- Inveramsey Bridge Improvement

Figure 9 Committed road schemes

The list of rail schemes completed by 2018/19 is as follows:

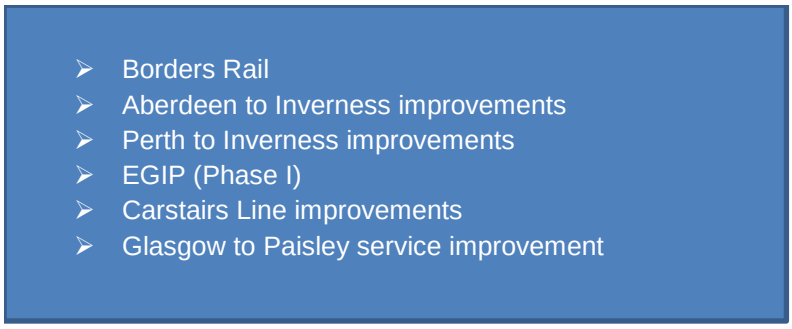

Figure 10 Committed rail schemes

3.7.5 Estimating rail market size

As discussed above (and following 2013 market studies), the market size element of the AM Peak Commuter model is driven by forecasts of city centre employment, whereas the market size element of the Inter Urban forecasts is driven by population growth forecasts. TELMOS population and employment forecasts were used up to 2018, with scenario growth of these variables applied for the 2023 and 2043 forecasts.

3.7.6 Model calibration

In the first instance, the models were calibrated to and compared with both CSTM and TMFS rail demand for 2012 and 2018, recognising that the Network Rail model has fewer explanatory variables than either CSTM or TMfS. The main issue that came to light during the calibration process was the issue of how parking costs were treated compared to TMfS/CSTM.

In addition to comparing the model to TMfS/CSTM (i.e. comparing a model to an already calibrated model), we carried out analysis on a corridor by corridor basis to compare forecast growth with historical growth rates

3.8 Estimating Base Demand

Although on-train counts were our preferred approach to estimating base demand, the quality of the count data was too mixed to be applied across the network. Our preferred approach was therefore to use estimates from MOIRA (which is based on the LENNON ticket sales database), and to supplement this with count data where required or where omissions were identified.

One shortcoming of using MOIRA is that while it covers the vast majority of rail journeys, it does not capture ScotRail “Flexipass” carnet tickets for use on the Edinburgh and Glasgow line or SPT Zonecard multi-modal tickets for use within the SPT area.

Further work has been carried out following for the Final document to ensure that these trips are reflected in our 2014 base data.

3.9 Application

Figure 9 below illustrates the process undertaken to derive corridor-level capacity metrics from the initial demand forecasting model.

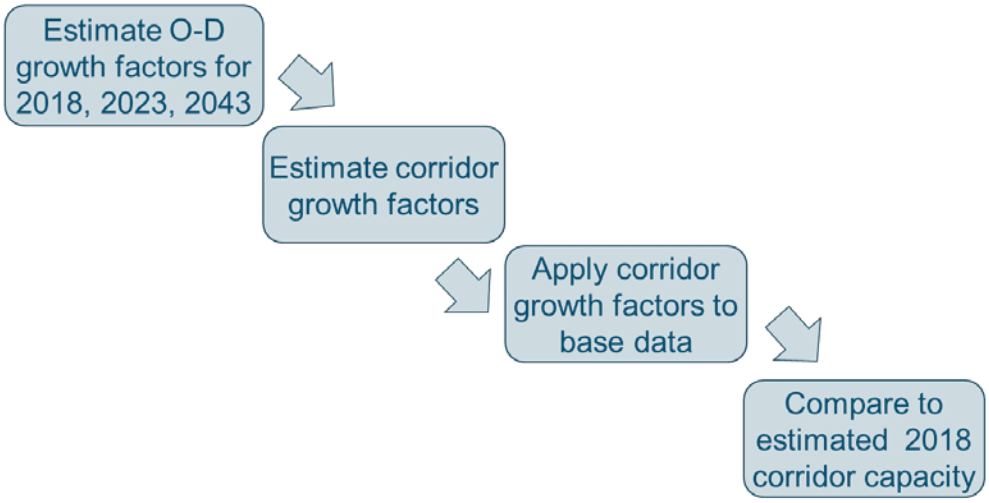

Figure 9: Process of identifying capacity shortfalls from origin-destination station growth forecasts

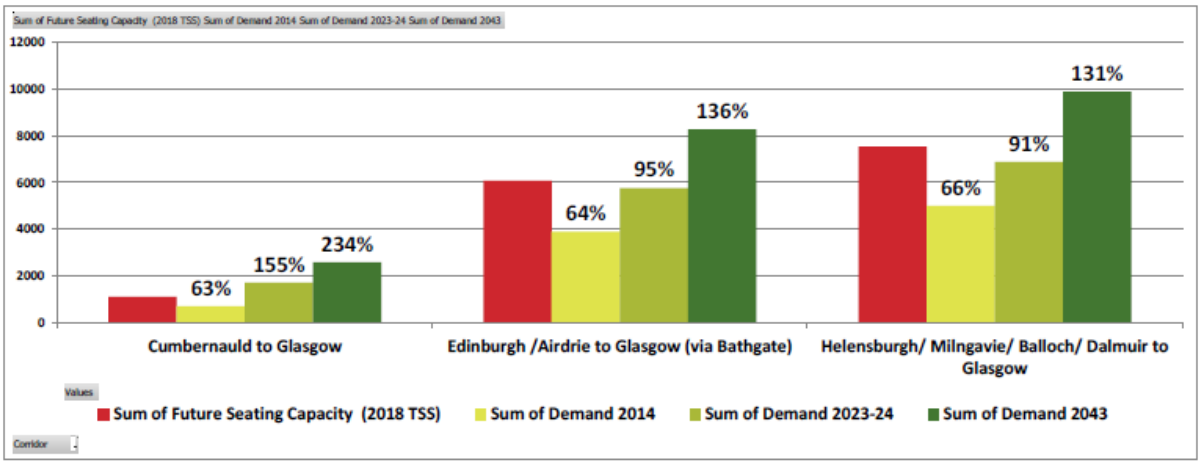

Figure 10: Sample demand/capacity graphs

4 Results

4.1 High-level provisional results

The Draft for Consultation SMS was published in November 2015, with the consultation period closing on the 10th March. Due to time constraints in preparing the model, one scenario (PGS) was published for the draft.

4.2 Results

Table 1 below

Market	Compound Annual Growth Rate 2012-23	Compound Annual Growth Rate 2023-43
Edinburgh Morning Commuter	4.1%	1.6%
Glasgow Morning Commuter	3.6%	1.8%
Aberdeen Morning Commute	3.9%	2.5%
Interurban markets	*8.9%*	*0.9%*

Table 1: High-level summary of Scotland Market Study results

4.2.1 Commentary: Glasgow AM Peak

Glasgow is a mature commuter market served by a well-developed rail network, and as a consequence rail already has a relatively high market share on many routes into the city centre. This is because most major residential areas have access to relatively high frequency rail services and relatively competitive journey times by rail when compared to the private car or bus.

The principal enhancement to the network in and around Glasgow is the Edinburgh to Glasgow Improvements Programme (EGIP), but although this scheme reduces end-to-end journey times and increases capacity per train, it does not expand the network or to increase service frequency (unlike Borders or Airdrie-Bathgate).

This relative stability in the rail 'offer' relative to other transport combined with the congestion assumptions derived from the scenarios, mean that demand growth in the morning Peak was driven more by city centre employment than by a significant increase in rail's share of the overall market for travel.

Glasgow city centre is the biggest city centre in Scotland, and a significant proportion of the city centre has redevelopment potential. The PGS scenario for Glasgow therefore assumed employment growth of 21 per cent between 2012 and 2023 and 70 per cent by 2043 and it is this employment growth that drives rail growth in the draft.

4.2.2 Commentary: Edinburgh AM Peak

The commuter rail market in Edinburgh is much more focussed on connecting outer suburbs with both the city centre and with major employment centres to the west of Edinburgh. The Airdrie-Bathgate project significantly increased service frequencies into Edinburgh from West Lothian and beyond during Control Period 4, whilst the recent reopening of the Borders Railway has opened up a significant commuter market to the south of the city to rail. Both of these enhancements significantly increase rail's reach in this market and therefore its market share.

The dominance of market share factors in explaining modelled rail demand growth into Edinburgh is caused in part by a shortage of development land in central Edinburgh and a commitment – under the PGS scenario – to avoid significant office building (and therefore significant employment growth) within the city centre with most potential sites (located around Haymarket) already having been developed.

On the basis of this scenario, the headline forecasts for commuter rail demand into Edinburgh in the morning peak are for it to grow by 56 per cent between 2012 and 2023 and by 114 per cent between 2012 and 2043.

4.2.3 Commentary: Aberdeen AM Peak

Aberdeen has only one rail corridor, and to the south of the city the railway line follows the coast, therefore rail is not the mode of choice for many commuter trips from the west of the city and the north east. From a purely modelling point of view, the size of the TMfS zones mean that relatively small changes in travel costs can have disproportionately large impacts on forecast rail demand compared to the highly disaggregate CSTM-based models for Edinburgh and Glasgow.

This is complicated by the volume of infrastructure investment due for delivery by 2018/19: Road connectivity around Aberdeen is due to improve significantly while the rail offer from the north west of the city is also due to improve during CP5 as service frequencies increase. Road improvements are unlikely to greatly improve journey times to the city centre and Dyce/Aberdeen Airport for those commuting in from Inverurie, a corridor which has experienced significant rail growth in recent years (MOIRA estimates recent growth regularly exceeding 10 per cent per annum since 2010).

Consequently, the model forecasts demand to increase by 52 per cent between 2012 and 2023 and by 151 per cent by 2043. It is worth noting that these results are relatively insensitive to assumptions made about employment growth: the increased demand is largely a function of market share rather than of market size.

4.2.4 Commentary: Inter Urban markets

In the Interurban model, population change is the principal driver of the size of the overall travel market. PGS scenarios have been used to derive assumptions for both population and travel costs factors post-2018.

Rail, road and bus costs – together with overall travel demand – for 2012 and 2018 are based on the TMfS inter peak data. The model is calibrated to TMfS rail demand for 2012 and 2018.
Forecasts from the model have been produced for corridors into the following destinations:

- Glasgow
- Edinburgh
- Aberdeen
- Inverness.

Dundee, Stirling and Perth are located within these corridors and are factored into these forecasts.

Interurban demand has been forecast using inter peak data from TMfS, and reflects Transport Scotland's policy (as expressed in the ScotRail franchise agreement) to apply an RPI-1 per cent growth to off-peak ticket prices over the course of the current ScotRail franchise.

4.3 Progress since publication of the Draft Scotland Market Study

4.3.1 What has changed?

Since the publication of the Draft for Consultation, more work on scenarios (particularly Market Size-related) has been completed and separate congestion scenarios incorporated into the model to enable differential growth by RTP region

More significantly, the base data has been improved by incorporating "Flexipass" and SPT Zonecards into the dataset.

4.3.2 Impact of changes

Glasgow, congestion levels under the PGS scenario have been revised on the basis of modelling evidence provided by TS. However, the main impact is likely to be the revision to the base data resulting from the incorporation of SPT Zonecard demand into the base.

Compared to the PGS scenario presented in the draft, demand in Edinburgh grows more strongly in the 'PI' scenario as planning constraints are assumed to be less restrictive.

In Aberdeen, the development of other scenarios and the assumptions they make about the potential growth of the energy industry leads to high variability of modelled demand growth

Inter urban growth is likely to be significantly reduced in 2023 as a result to corrections made to fuel price scenarios and a reduced high-growth population scenario.

4.4 Limitations & further development

The following limitations and opportunities for further work have been identified:

4.4.1 Limitations of Scope

The models we developed for the SMS were specifically designed to inform strategic choices for rail industry planners and funders in a simple and flexible way.

The model therefore focusses on modelling those factors that are:

- known to significantly affect rail demand
- able to be modelled in a transparent way
- relatively quick and easy to run.

In the interests of model parsimony, some variables have been omitted (for example, car ownership, destination choice) and these omissions introduce a certain degree of bias into the modelling.

4.4.2 Limitations of Data

All models are combinations of theory and data. Poor quality data will undermine confidence in the model outputs and the conclusions drawn from it.

The fact that the model draws so heavily on the cost data drawn from TELMOS means that any weaknesses in TELMOS will inevitably be transmitted into this model. However, TELMOS has been subject to a significant amount of quality assurance itself which provides us with reassurance in this respect. Where areas of weakness in TELMOS have been identified (for instance in terms of parking cost inflation), these weaknesses have been acknowledged, sensitivity tests carried out and discussions initiated with TS to improve this data in future.

In terms of its impact on the 2023 forecast, base data quality is potentially a more significant problem than modelled growth. In this regard, the approach taken to establishing the base data position (MOIRA/LENNON) has been a compromise, and one that we have had to supplement with further assumptions to take account of the omission of certain ticket types: the SPT Zonecard and ScotRail Flexipass.

The installation of on-train counting equipment on all ScotRail trains by 2018/19 will – once these have been validated – provide us with a much improved understanding of the base position than we currently have.

4.4.3 Limitations of Assumptions

Most of the assumptions we have made follow standard transport modelling practice, but a certain number of ad hoc assumptions have been made relate to assignment of demand to stations on the network. Whilst this is straightforward for most pairings (or any assignment errors have no effect on the substance of the forecasts), This inevitably introduces an element of subjectivity into the model

4.4.4 Limitations of Modelling

Research carried out as part of the 2013 Market Studies suggest that city centre employment is the primary driver of demand in AM Peak Commuter markets and residential population is the primary driver of demand for leisure flows. Clearly, as surveys of journey purpose have established, the real world is more complicated than these simplifying assumptions suggest.

4.4.5 Limitation of Interpretation

A strength of using the corridor-based approach we have adopted is that it should provide both Network Rail and funders with a more nuanced picture of demand in Scotland. However, this richer picture of requires careful interpretation (i.e. there is a risk of over-interpretation).

Finally, the presentation of scenarios is very important. Delays in producing the modelling results prior to publication of the draft for consultation document meant that only the results from PGS scenario were presented. Inevitably this was interpreted as a ‘central case’ forecast in the media and by some stakeholders because no results from the other scenarios had been published at that time.

4.4.6 Limitation of Resources

In terms of developing the models themselves, the sheer volume of data meant that the model had to be developed in Access 2010, which was resource intensive. Given that this was the case, it is important that the modelling framework we developed for this Market Study is carried forward to underpin future Scotland market studies

4.4.7 Next Steps

The final Scotland Route Study is due to be published in July 2016. The work contained within it will then form the basis of Initial Industry Plan (IIP), which is due to be published in September 2016. Once the Scotland Route Study has been established, the demand growth rates will be the standard growth rates used in rail appraisals until the next Scotland Route Study is published (probably in 2021)

5 Conclusions

The railway exists to improve people’s access to employment and services and to improve their quality of life. For funders it exists to help them deliver a higher performing economy and improved quality of life for the people of Scotland including those who do not use rail.

Understanding both how rail supports both user and non-user requirements, and understanding how, where and why these requirements are likely to change in the coming decades is therefore critical to help the rail industry and its funders plan for the future in a way that delivers good value for money whilst remaining robust and flexible in the face of social and economic change.

The SMS (in combination with the other Market Studies), the SRS and the forthcoming Initial Industry Plan are central to the rail industry's response to this challenge.

The approach taken to forecasting demand in the SMS is not new: scenario-based planning has been around in one form or another for decades in the oil industry, and the broad modelling framework has been employed across the other market studies. However, the coverage of the modelling that supports the SMS, combined with the development of forecasts at a corridor level, is a new development for the Scottish rail industry.

While the approach taken has been enabled by using TMFS and CSTM cost data and would be difficult to apply at a UK-wide level without significant investment, the approach adopted for the SMS works well in a Scottish context. It may well have a broader application across the GB as railway funding becomes increasingly devolved to bodies such as Transport for the North and the Welsh Government.

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