

Glasgow Airport Strategic Transport Appraisal Part 2

Executive Summary



Executive Summary: Glasgow Airport Strategic Transport Appraisal – Part 2 Appraisal Final Report

1.1 Introduction

Glasgow Airport Limited, Transport Scotland, Glasgow City Council and Renfrewshire Council jointly commissioned AECOM to undertake an evidence-based and objective-led transport appraisal of improvements to strategic surface access to Glasgow Airport. The transport appraisal built upon the objectives established within the Glasgow Airport Strategic Transport Network Study carried out in 2011 by MVA consultancy¹. The transport appraisal has been undertaken in accordance with Scottish Transport Appraisal Guidance (STAG)².

This document provides an Executive Summary of the Glasgow Airport Strategic Transport Appraisal study, and is supported by a STAG Part 1 Technical Report, and a STAG Part 2 Technical Report.

1.2 The findings in this study – a commentary

The findings in this study must not be taken out of context – they are a result of an internally consistent approach which was developed for the purposes of assessing the performance of alternative transport interventions serving Glasgow Airport. Care should therefore be exercised when making direct comparisons with the outcomes of previous studies. Moreover, impacts on modal shift should only be viewed in relation to the baseline modal share presented.

This study has not included an analysis of the wider economic benefits of any of the transport interventions. It is reasonable to assume that some wider economic benefits would occur as a result of investment in transport infrastructure in this economically-important part of Scotland.

This study has not quantified the impact on non-Airport rail travellers from any scheme which runs on the rail network. If capacity is constrained on the rail network, any new demands on the rail network may impact upon commuter rail services in particular. Economic benefits attributed to options in this study should therefore be viewed with this in mind.

The options assessed in this study have been selected to be indicative of the mode they represent, with a key focus on the journey times they provide to the user, the overall cost to the user, and the impact that this has on modal choice. However, as agreed within the scope of the study, no detailed design or operational assessment has been carried out in this study, and this will be required in the future to identify the preferred option within any modal option taken forward.

Finally, the STAG process does not recommend preferred options. The STAG process provides a multi-criteria framework within which the relative performance of transport interventions is assessed. This information is then used by decision-makers.

1.3 Identifying the Problems to be Addressed and setting Transport Planning Objectives

A number of key issues and opportunities regarding surface access to Glasgow Airport have been identified:-

- A high level of dependence on cars and taxis/private hire vehicles for access to and from the airport.
- The airport is currently heavily dependent upon the strategic road network for access by staff and passengers.
- There is evidence of congestion, delays and reduced operational efficiency on key parts of the strategic network serving Glasgow Airport which are predicted to be exacerbated over time as demand increases, affecting both private cars and bus services.
- There is scope to encourage modal shift to public transport by implementing measures to make public transport more attractive to staff and passengers.

¹ MVA Consultancy now re-named *Systra*. Glasgow Airport Strategic Transport Network Study, 2011

² <http://www.transportscotland.gov.uk/analysis/scottish-transport-analysis-guide/STAG>

- However, the distribution of surface access trips to and from the airport, and the timing of these trips, tends to place a practical limit on the extent of modal shift that can be achieved.

Through a combination of stakeholder engagement and a review of information and evidence, a set of Transport Planning Objectives were agreed for the study. These objectives have been used to express the specific outcomes for the appraisal, and were used to help assess the performance of options developed within the appraisal. The agreed Transport Planning Objectives for this study are shown below.

1. Increase the modal share of public and active transport modes for passengers and employees to and from Glasgow Airport.
2. Improve journey times to and from Glasgow Airport for public and active transport modes such that they are increasingly competitive with the private car.
3. Improve journey time reliability to and from Glasgow Airport via the M8.
4. Improve quality and satisfaction of public transport experience to and from Glasgow Airport for passengers and employees.

1.4 The transport interventions appraised in this Study

To meet these objectives, a long list of transport interventions was developed following input from the client team, the study team and from input obtained from the stakeholder workshops. A long list of over 80 interventions was generated at the Pre-Appraisal stage. It was necessary to sift this list of interventions to produce a focused set of interventions which responded to the emerging Transport Planning Objectives. A sift was therefore carried out using the criteria of outline feasibility; scope (to ensure interventions were directly related to the study area and issues being examined); grouping and synergies, to ensure compatible interventions which worked well together were grouped appropriately,

This shortened list was then appraised in the Part 1 appraisal. As per STAG guidance, an appraisal of the interventions' performance was then carried out against the study's Transport Planning Objectives; STAG criteria of environment, safety, economy, integration, accessibility and social inclusion; and deliverability issues of feasibility, acceptability and affordability.

As a result, a finalised list of options was selected for more detailed appraisal in Part 2. The options were also further developed during the Part 2 Appraisal stage. They are set out in the following table, together with the key parameters assumed for each.

It should be noted that Paisley Gilmour Street has been assumed as the point of interchange on the rail network for all relevant options considered in this study. Under present day timetabling, this station offers greater potential for passengers travelling on the Ayrshire and Inverclyde lines to interchange with any transport service to the Airport.

Table 1: Options Considered in Part 2 Appraisal

Option	Description	Key characteristics / assumptions
Making Best Use Package	A short term, low cost package of measures, focused on making the best use of existing infrastructure and services.	Improved cycling and pedestrian corridors on Abbotsinch Road and Inchinnan Road. Improved public transport infrastructure such as bus stops and information. Promotion of taxi-sharing. Improved marketing and information on sustainable transport options. Trial Demand Responsive Transport scheme, focusing on employees living within 10 miles of the Airport.
Airport to Paisley	A dedicated Shuttle Bus service running between Paisley Gilmour	Dedicated, branded and high quality Airport shuttle bus, with luggage space. Assumed to

Option	Description	Key characteristics / assumptions
Gilmour Street Shuttle Bus	Street and Glasgow Airport.	run at 10 minute headway (6 per hour).
Better Bus Package	A combination of new bus services and bus priority measures.	<p>A package of measures which would include:</p> <p>A new limited stop service from Glasgow to the Airport using Fastlink infrastructure via Renfrew.</p> <p>A new limited stop service to Clydebank from the Airport (which is currently served by bus but with a long journey time due to multiple stops).</p> <p>Improvements to the existing Airport to Glasgow City Bus, by using elements of Fastlink close to Glasgow city centre to avoid peak congestion on the M8.</p>
Personal Rapid Transit (PRT) / people mover	An elevated people-carrying system from an interchange point at Paisley Gilmour Street to Glasgow Airport. Elements of a concept proposal provided to Glasgow Airport by Ultra Global Ltd have been used.	Automated people-carrying pods running on demand, on an elevated guideway to the Airport. Potential for multiple stops in the Airport campus. Ultra Global Ltd concept proposal states pods can carry four people with luggage.
Tram train	A tram-train service, running on rail from Glasgow Central via interchange point at Paisley Gilmour Street to Glasgow Airport on a new spur south of the M8.	15min interval service between Glasgow Central and Airport. Stopping at Paisley Gilmour Street only.
Heavy rail	Heavy rail service running from Glasgow Central via interchange point at Paisley Gilmour Street to Glasgow Airport on a new spur across St James Park.	15min interval service between Glasgow Central and Airport. Stopping at Paisley Gilmour Street only..
Managed motorways	Variable speed limits and variable message signs to smooth traffic flow.	Implementation of variable speed limits and variable message signs on a 15km section of the M8 between junctions 28A and 19.

1.5 Approach taken to Part 2 Appraisal analysis

A key analytical tool used to differentiate the potential impacts of these transport interventions within the Part 2 Appraisal were two bespoke, modal share models. These models were developed specifically for the assessment of the GARL (Glasgow Airport Rail Link) project, and were therefore deemed to be relevant to this study. Strathclyde Partnership for Transport gave their permission for these models, appropriately updated, to be used in this study.

The two models are called GLAAM (Glasgow Airport Access Model) Model, which focuses on airport passenger journeys; and GLEAM (Glasgow Airport Employee Model) Model, which focuses on employee journeys.

In summary, these models are designed to predict patronage and model the impacts of transport interventions on mode choice for air passengers and Airport employees. Important inputs to these models are:

- Forecast Airport Passenger and Employee levels up to 2037 – these forecasts were agreed during this study, and took into account both Glasgow Airport and UK Department for Transport passenger forecasts. As a sensitivity test in the analysis, a higher level of passenger demand was assessed to gauge the impact on results.

- Baseline journey times and travel costs, by mode, for journeys to the Airport from a set of zones covering the whole of the UK.
- An understanding of how journey times may change in the future on the surrounding transport network - this was extracted from CSTM12 (Central Scotland Transport Model 2012), supplied by Transport Scotland for use in this study.

The transport options being assessed were then represented in the GLAAM and GLEAM models through modifications to travel times by the mode in question. These generated modified mode shares and outputs suitable for input into the DfT's economic appraisal software TUBA, which allowed the calculation of a cost/benefit analysis for the airport-related trip making.

The impact of the schemes on non-airport travellers, such as existing users of the rail network in the study area have not been quantified in this appraisal, therefore have largely been addressed qualitatively. The overall transport appraisal cannot be considered complete without quantified analysis of the impact of any rail related scheme on non-Airport rail users.

1.6 Summary performance of options on modal shift

Overall, the options with the greatest potential for modal shift of passenger trips from our modelling are those which present a competitive journey time where interchange is minimised, or eradicated completely, particularly from Glasgow City Centre to the Airport. In this sense, fixed link schemes perform better in terms of modal shift. Based on previous research, Airport passengers have been attributed with a higher value of time in this study – air passengers tend to have a time-bound journey, and any delay in travel time can have significant consequences (a missed flight). This issue is reflected in the modal share models through a high level of cost associated with interchange.

The baseline modal share for journeys by passengers and employees to the Airport was developed based on Civil Aviation Authority survey data. Due to the make-up of this survey data, there are alternative ways to analyse and interpret it. The principal method used in this study to establish a baseline modal share therefore, was to focus on the transport mode recorded for the last-leg of any journey to the Airport. In this study, this is referred to as a "Low" scenario. To take account of an alternative approach to interpretation of CAA data, a "High" baseline scenario was produced, which categorises journeys in CAA by main mode (and typically increases the modal share attributed to rail).

The headline results from the modal share modelling are shown below, for Airport Passengers.

Table 2: Share of all public transport (bus, rail and coach) trips by Airport Passengers per transport option assessed

Mode split	Do Minimum (baseline)	Shuttle bus	Better bus package	PRT	Heavy rail	Tram-train
Central Passenger Forecast Growth, Low Scenario 2037						
PT	10%	11%	10%	11%	13%	13%
Of which Bus	6%	5%	6%	5%	5%	5%
Of which Rail	4%	5%	4%	5%	8%	8%
All other transport	90%	89%	90%	89%	87%	87%
Central Passenger Forecast Growth, High Scenario 2037						
PT	12%	12%	12%	13%	16%	16%
Of which Bus	5%	5%	5%	5%	4%	4%
Of which Rail	6%	7%	6%	7%	11%	11%
All other transport	88%	88%	88%	87%	84%	84%

A number of sensitivity tests were carried out in this study. These tests were driven by the need to understand the impacts of:

- Changes in fare levels, and how sensitive options are to these – to test this issue, fare levels were changed on the Bus Shuttle option to zero-fare, and a fare was increased in one of the fixed link options (PRT).
- Changes to peak hour operations for options which require to run on the mainline rail line – this study has not assessed the wider impact of rail-based interventions on existing rail services and passengers. The rail line towards Glasgow Airport is currently operating close to capacity, and peak times are particularly busy with commuter rail services. Therefore, a test was developed to operate a rail-based intervention during off-peak hours only, to assess the impact of a limited operation.
- Larger growth in passenger levels, taking into account the different forecasts for passenger growth presented by the UK Department for Transport and Glasgow Airport.
- Lower values of time – through the developed of GLEAM and GLAAM, Stated Preference surveys were carried out, and as a result of these, higher values of time were attributed to airport passengers. These values of time have been applied in this study, both in terms of modal share forecasting and in economic analysis. These higher values of time are however, non-standard. A sensitivity test using standard values of time as set out within both STAG and WebTAG guidance was therefore carried out to demonstrate how the economic benefits would change.

In terms of the sensitivity analysis carried out in this work, a number of conclusions were drawn:

- An increase in the fare will reduce the demand for options, as they increase the cost to the user and make it less attractive. This is notwithstanding the need to be balance fare levels with the requirement to make any option commercially viable.
- If capacity on the rail network limits the operation of tram-train (and indeed any heavy rail scheme) between Glasgow Central and Paisley Gilmour Street in the peak periods, the modal shift potential will reduce. This reflects the fact that the morning and evening peak demand will not gain the same journey time benefits as the inter-peak levels of demand, and so the mode will not be as attractive in these periods.

- Passenger forecasts do not have an impact on modal share, but will increase the levels of passengers using interventions, which produces a higher level of economic benefits.
- The use of standard Values of Time from WebTAG reduce the economic benefits for all options, as the core Values of Time used in this study are based on research which showed that air passengers place a higher value on time than other types of travellers.

The table below provides a summary of key findings for each option (and option variation in terms of sensitivity testing) in terms of cost estimates, impact on modal share by public transport, and Benefit-Cost-Ratio (BCR). It should be noted that the BCR does not take account of any disbenefits to non-Airport rail users from any new Airport-rail services using general rail capacity in the West of Scotland.

Table 3: Summary findings

Option	Capital Costs (2013 prices)	Increase in PT mode share 2037 - range	BCR range (using non-standard values of time)
Shuttle bus	£3.3m	+0.2% low +0.2%high	(-)22.25 ³ low (-)9.35 high
Shuttle bus (reduced to zero fare)	£3.3m	+0.7% low +1.0% high	2.87 low – 3.24 high
Better bus package	£11.6m	+0.1% (low and high)	0.57 low – 0.56 high
PRT	£71.7m	+0.6% low- +0.9% high	1.23 low – 1.70 high
PRT (increased fare)	£71.7m	+0.3% low- +0.5% high	1.20 low – 1.87 high
Heavy rail	£207.4m	+2.9% low +4.0% high	0.88 low – 1.43 high
Tram train (core option)	£92.4m	+2.8% low +3.9% high	2.26 low – 4.68 high
Tram-train (limited running during peak option)	£92.4m	+0.6% low +0.9% high	1.52 low – 2.50 high

³ It should be noted that a negative BCR value does not indicate the option tested will not generate benefits. A negative BCR value means the money the scheme generates in revenue is more than the investment and operating costs. Revenue is input as a negative cost in the economic analysis tool used.

1.7 Performance against Transport Planning Objectives

The following table summarises the outcome of the assessment against the transport planning objectives. In appraisal terms, 0 is a neutral score indicating no impact, +1 to +3 indicate increasing levels of beneficial impacts, whilst -1 to -3 indicate increasing levels of detrimental impact.

Table 4: Performance against Transport Planning Objectives

Option	Increase the modal share of public and active transport modes for passengers and employees to and from Glasgow Airport		Improve journey times to and from Glasgow Airport for public and active transport modes such that they are increasingly competitive with the private car		Improve journey time reliability to and from Glasgow Airport via the M8		Improve quality and satisfaction of public transport experience to and from Glasgow Airport for passengers and employees	
Making best use of	+1	Targeting employees in particular, although unlikely to have significant modal shift impacts on passengers	0	Broadly neutral impact on journey times	0	This intervention is not designed to have a significant impact on journey time reliability on the M8	+1	Measures are good practice and designed to improve the quality of the public transport experience, particularly through better information
Shuttle Bus	+1	+0.2% (low and high) modal shift from GLAAM, to rail (up to +1.0% with zero fare)	+1	Average 8 minute generalised time journey time saving depending on journey purpose and time period	0	This intervention is not designed to have a significant impact on journey time reliability on the M8	+1	Through a bespoke Airport shuttle bus designed to a high specification, this may have a positive impact on users.
Better bus package	0	+0.1% (low and high) modal shift from GLAAM, to bus	+1	Up to 6 minutes generalised time journey time saving depending on origin zone, journey purpose and time period	+1	Measures to enhance peak journey time of Airport buses via Fastlink infrastructure from M8	+1	Through quality bus vehicles and services, may have a positive impact on users.
Tram train	+2	+2.8% low-3.9% high modal shift from GLAAM, to rail (including abstraction from bus)	+2	Average 12-17 minute generalised time journey time saving depending on origin zone, journey purpose and time period	0	This intervention is not designed to have a significant impact on journey time reliability on the M8	+2	Opportunity to enhance infrastructure and services for Airport passengers in particular.
PRT	+1	+0.6% low/+0.9% high modal shift from GLAAM, to rail (including abstraction from bus)	+2	Average 13-14 minute generalised time journey time saving depending on journey purpose and time period	0	This intervention is not designed to have a significant impact on journey time reliability on the M8	+2	Opportunity to enhance infrastructure and services for Airport passengers in particular.
Heavy rail	+2	+2.9% low-4.0% high modal shift from GLAAM, to rail (including abstraction from bus)	+2	Average 13-19 minute generalised time journey time saving depending on origin zone, journey purpose and time period	0	This intervention is not designed to have a significant impact on journey time reliability on the M8	+2	Opportunity to enhance infrastructure and services for Airport passengers in particular.
Managed Motorways	0	Neutral impact.	0	Main impacts may be on smoothing of traffic flow as opposed to improving journey times.	+1	Main impacts may be on smoothing of traffic flow as opposed to improving journey times	0	Neutral impact.

1.8 Summary of Appraisal Outcomes and deliverability challenges

In addition to an assessment of each option's performance against the Transport Planning Objectives and modal shift, each of the interventions was subject to an assessment against the STAG criteria of Integration, Accessibility and Social Inclusion, Economy and Safety. The results of this assessment are contained within the Main Technical Report.

This section therefore provides a summary of the performance of each option, and deliverability issues. Overall, the findings of this transport appraisal indicate the relative performance of each of the transport options in delivering modal shift for Airport surface access trips, and assesses each option in terms of performance against the Transport Planning Objectives, STAG appraisal criteria, and an assessment of implementability. It is important to note that the transport appraisal process as set out within STAG does not recommend a preferred option. The relative performance of options within a multi-criteria assessment is designed to help decision-makers, by providing them with evidence to make an informed judgement on any future investment decisions.

Making best use of package

Most elements of this package are viewed to be relatively low-cost interventions that could be implemented in the short term. The exception may be the DRT service for employees, which carries a higher level of risk in terms of deliverability. There are few examples of commercially viable DRT services, as they tend to have high operating costs relative to a low number of passengers. However, further feasibility work could be undertaken, for early morning and late evening trips by employees (subject to securing drivers who are willing to work these hours). Improvements to active travel networks to the Airport from Renfrew and Paisley are likely to benefit wider users and communities in these areas which are subject to ongoing regeneration initiatives, and may have health impacts if they promote higher levels of walking and cycling.

Shuttle Bus from Airport to Paisley Gilmour Street

Whilst this option does not generate significant modal shift, it does achieve low levels with relatively minimal investment costs. A new shuttle bus from Paisley Gilmour Street to the Airport is a more flexible option than a fixed link, and relatively simple to deliver. Furthermore, the option tested in this study with a £2.50 fare (as opposed to the zero-fare option) does not require subsidy.

Furthermore, there is opportunity to introduce targeted bus priority measures to improve the reliability and journey times for the bus service.

Overall, the Shuttle Bus is a strong option for short-term improvements to public transport. There are few risks to implementation, operating costs are low and public acceptability is expected to be high. However, it is unlikely to create significant modal shift in the longer term due to the need for interchange, particularly in comparison to the offer of the existing Airport to City Centre Bus Service.

PRT / People Mover

This option would provide a quality passenger link which would involve minimal waiting times as it runs on demand. It could also bring a non-quantifiable "prestige" benefit to Glasgow Airport, as the technology is not widespread in the UK currently. Due to the fact that some PRT solutions are able to run to a number of different terminal points, such technologies could provide a wider network of links in and around the airport campus or surrounding developments.

However, investment costs and operating costs for the indicative option considered by this study are significantly higher than the bus shuttle. Whilst the service is high profile, and truly "on-demand", a PRT scheme may not offer significant benefits over and above a well-run, reliable bus shuttle running at a high frequency. Any people-mover scheme must run over a short distance, by its very nature, and can therefore only ever serve as a connection from an interchange point.

Financially, the scheme as tested in this study requires a subsidy, for both the lower and higher fare options assessed. This is largely due to the scale of the cost relative to the low level of modal shift (and therefore demand) generated by a scheme which requires interchange, a characteristic that reduces its attractiveness to users in our methodology. There are also potential issues over the visual impact of an elevated structure in the area which would extend outwith the airport boundary and close to residential and business properties. These may not be insurmountable, but require further exploration.

Tram train

This option is essentially light rail, but with the capacity to run on both the conventional rail network, and on-street tram tracks (hence tram-train). The technology is currently relatively new to the UK, and therefore carries a technical risk. Along with the heavy rail option tested in this appraisal this option provides the greatest potential for modal shift in this study. This is because it enhances journey times for all trips travelling through Glasgow City Centre to the Airport, and minimises the need for interchange for many airport trips. It would potentially offer a high quality and prestigious link to Glasgow Airport.

As is common with any new rail intervention however, abstraction from existing bus services will contribute significantly to its success, in this case potentially the Airport to City Centre Shuttle.

A key risk to this scheme is the potential lack of capacity to run this service on the rail network during peak periods (due to lack of available paths on the rail network between PGS and Glasgow Central). Should this be the case, the service could run a limited shuttle operation between the local rail interchange point (assumed in this study to be Paisley Gilmour Street to maximise interchange potential with local rail services) and Glasgow Airport. Analysis shows that this reduces the attractiveness of this option. A further risk to the deliverability of this option is the introduction of light rail rolling stock to the mainline rail network, which requires further exploration.

If the service is assumed to run to its full potential without any additional capacity provided on the rail network (i.e. displace existing rail paths on the network), this in turn would impact upon existing rail users, with associated disbenefits which would impact upon the forecast economic benefits.

Overall, the capital costs for tram-train are much lower than for heavy rail. The environmental impact may be less due to the nature of the infrastructure required for tram-train rolling stock. A potential route alongside the M8 may also minimise visual and landscape impacts.

Heavy rail

This option offers almost the same benefits as a tram-train option, but at a significantly higher cost. The technology risk of running tram-trains on the rail network do not apply to this option, although the same issues apply in terms of the potential reduction in benefits once the issues of capacity on the rail network are taken into account.

There are significant risks to implementing this option including disruption to industrial and recreation areas, land requirements and issues associated with the re-provisioning of facilities for affected parties.

Better Bus Network

This option, as designed for this study, has performed relatively poorly in this appraisal. This is largely due to the cost implications of new services which this option has tested, the minimal journey time improvements afforded, and the fact the services tested have longer journey times than the existing bus service options from Glasgow city centre (the express Airport service). However, this demonstrates a number of issues to consider in the future:

- For any bus-based option to be a competitive choice to the car or taxi in the context of Glasgow Airport, it needs to offer significantly enhanced journey times. This suggests express / limited stop services, similar to the existing Airport express service (500). However, public transport operators have commented during consultation on this study that commercial services are difficult to sustain, given the diverse levels of demand

generated by the Airport (a dispersed passenger catchment which is not aligned to a traditional commuting peak).

- Therefore, further work should be carried out to explore enhancements to support bus priority for existing services, particularly where they are affected by congestion (M8, and potentially within Paisley during peak hours). Lower cost investments in bus priority measures could enhance journey time reliability, a key issue for airport passengers.
- In particular, there is a key opportunity to explore alternative routes for the existing 500 Airport bus service into the city centre during peak periods, to avoid congestion, and take advantage of any bus priority provided by Fastlink.

Managed motorways

The option assessed in this study has not been subject to quantitative modal shift appraisal, as measures may not have a significant impact on reducing journey times. Managed motorways interventions are largely aimed at smoothing traffic flow, and would typically help to maintain journey time reliability. Hard shoulder running would provide an opportunity for a bus lane on the M8, but Transport Scotland has indicated this is not currently being considered. There are specific feasibility issues in providing hard shoulder running on the approach to Glasgow, due to the layout of junctions and other physical constraints. This option is therefore restricted in terms of what it can provide in relation to bus priority in particular.

1.9 Next steps

The multi-stakeholder client group for this study has accepted the results of the appraisal. Each of the client organisations will make use of the study findings in the future as they jointly consider future options for strategic surface access for the airport. Furthermore, some elements of this appraisal may inform revisions to the Glasgow Airport Surface Access Strategy, the Glasgow Airport Master Plan and other related strategy documents for the area.