

# 1. EXECUTIVE SUMMARY

## 1.1 Introduction & Background

- 1.1.1 Following detailed investigation of options for Rail Links to Glasgow and Edinburgh Airports (RLGEA)<sup>1</sup>, undertaken by Sinclair Knight Merz (SKM) and published in February 2003, a consortium led by Scott Wilson and Halcrow were appointed on 18th December 2003 to carry out further design on the preferred route for the Edinburgh Airport Rail Link to facilitate the promotion of the scheme through the Private Bill process.
- 1.1.2 An initial eight alternative route alignments were identified by SKM for the Edinburgh Airport Rail Link (EARL), the SKM appraisal identified the Runway Tunnel option as being the most attractive when judged against Planning and Government Objectives. This became the preferred option, on which further design work was commissioned from Scott Wilson/Halcrow.
- 1.1.3 In the course of this further work, a public consultation exercise was undertaken giving the general public an opportunity to comment on the option under consideration. In the course of this consultation a number of members of the public suggested that a more cost effective scheme could be produced simply by building a new station at Turnhouse and providing some sort of linkage to the airport terminal. As a result of this a feasibility study was commissioned by **tie** Ltd, which concluded that whilst it is technically feasible to build a station at Turnhouse, a number of problems remain to be solved.<sup>2</sup>
- 1.1.4 In order to help decide between the relative merits of the Runway Tunnel option and the Turnhouse Station options, it was agreed to carry out an initial appraisal to STAG Part 1 level, the results of which are reported here. This approach has the added advantage of ensuring a clear audit trail and an ability to demonstrate that the selected alignment best meets the project objectives.

## 1.2 Pre-Appraisal Process

- 1.2.1 Before proceeding with an STAG Part 1 appraisal, it is necessary to:
- Set objectives for the study;
  - Analyse existing and potential problems;
  - Generate initial options to address the identified problems;
  - Carry out an initial sift of these options to ensure they all merit further consideration; and
  - Define the options that remain after the sifting, so as to allow an appraisal in sufficient detail at STAG Part 1 level.

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<sup>1</sup> Rail Links to Glasgow and Edinburgh Airports (*Sinclair Knight Merz*, Feb 2003)

<sup>2</sup> Edinburgh Airport Rail Link: Turnhouse Option Report (*Scott Wilson Halcrow JV*, Jan 2005).

### ***Consultation***

- 1.2.2 STAG emphasises the need for consultation at the earliest possible stage in the process, and then throughout the process of developing and appraising options.
- 1.2.3 For the purposes of this study, the following principal stakeholders have been involved in the study process wherever necessary:
- Scottish Executive;
  - **tie** ltd; and
  - BAA plc.

### ***Analysis of Existing and Potential Problems***

- 1.2.4 Before suitable objectives for any STAG-based study can be set it is necessary to understand what transport issues need to be addressed. For EARL these can be summarised as follows:
- Edinburgh Airport is an important access point to Scotland and the Scottish economy (for both business and leisure travellers);
  - Passenger demand at Scottish airports, and Edinburgh Airport in particular, has been growing strongly and is expected to grow by 69% between 2001 and 2010<sup>3</sup>;
  - The surrounding road network in West Edinburgh is becoming increasingly congested;
  - Car parking availability at the airport, for both passengers and staff, is becoming increasingly constrained;
  - Transport to/from the airport needs to be made more sustainable; and
  - Transport solutions to these problems need to be affordable and fit with potential long-term development strategies at Edinburgh Airport.
- 1.2.5 It was in regard to affordability that the Turnhouse Option was suggested during public consultation.

### ***Objectives***

- 1.2.6 STAG differentiates between Planning Objectives and Government Objectives.

#### *Planning Objectives and Criteria*

- 1.2.7 Planning Objectives are study specific, and should be established at an early stage in the Pre-Appraisal Process through consultation with the key stakeholders. Each option is then assessed against the Planning Objectives to ensure there is a reasonable match between the outcomes of the option and the objectives of the study.
- 1.2.8 SKM's report<sup>4</sup> identified three Planning Objectives. However following discussions with the Scottish Executive, it was agreed that they were not sufficiently scheme-specific to assist in the development and assessment of the Alternative Options, and it was decided to supplement them with a more focused set of *Planning Criteria*.

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<sup>3</sup> SKM (February 2003), page 83 (Table 4.1)

<sup>4</sup> SKM (February 2003)

1.2.9 In summary the following Planning Objectives and Criteria were established:

***Planning Objectives***

- 1. Operating costs should, at least, be covered by revenues, or be supported by third party contributions based on other benefits;***
- 2. Public Sector contributions to capital costs should, at least, be matched by benefits to non-public transport users, such as the relief of road congestion;***
- 3. Options should be compatible with potential long-term development strategies being considered at each airport as part of the UK strategy for air transport;***

1.2.10 ***Planning Criteria***

- 4. To serve and expand the airport's catchment area;***
- 5. To encourage modal shift and increase the percentage of passengers accessing the airport by public transport and in so doing, mitigate the impact of long distance travel on local and global travel and the transport network as much as possible;***
- 6. To reduce congestion on motorways and major roads near the airport;***
- 7. To reduce pressure on car parking at the airport;***
- 8. To support the Scottish economy; and***
- 9. Airports should contribute to increased surface needs on the basis of achieving sustainable travel and no detriment to the transport network.***

***Government Objectives***

1.2.11 STAG Part 1 appraisal requires an “*initial view of the proposal against the Government's five objectives ...*”<sup>5</sup>, which in summary are:

- Environment;
- Safety;
- Economy;
- Integration; and
- Accessibility and Social Inclusion.

***Option Identification***

1.2.12 4No. options for a station location around Turnhouse<sup>6</sup> and 3No. forms of linking the station to the airport terminal were identified, viz.:

- Surface-level shuttle buses (initially these were proposed to operate directly across the runway, however this was perceived to be impractical and the current concept relates to a circuitous public road route);
- Sub-surface pedestrian tunnels (with travellators); and
- Sub-surface driver-less shuttles<sup>7</sup>.

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<sup>5</sup> Scottish Transport Appraisal Guidance: Executive Summary, paragraph 33 (*Scottish Executive*, September 2003)

<sup>6</sup> *ibid*, Chapter 3

<sup>7</sup> *ibid*, section 3.10

1.2.13 For the purposes of assessing the Turnhouse options against the Runway Tunnel alignment recommended by SKM it was assumed that the precise station locations would not be material at this stage, but that the ease of interchanging between any station at Turnhouse and the airport terminal would be crucial, and it was decided to concentrate the Part 1 appraisal on this issue.

1.2.14 Otherwise all assumptions for the Runway Tunnel alignment would apply equally to the Turnhouse options.

1.2.15 Of the three Turnhouse Options, surface-level shuttle buses were likely to be the simplest means of interchange as they required minimal additional infrastructure, whilst the driver-less shuttles would require the most complex infrastructure. One other fundamental challenge for both sub-surface options was the need to cross the Gogar Burn at which point both options assumed a change from traveller/shuttle to a walking route to complete the journey to the airport terminal. This point would also require a change of level, the walking taking place on the surface and constituting around half of the overall distance to be covered - the total approximate direct distance between a station at Turnhouse and the airport terminal is at least 1.2 km (over ¾ mile).

### 1.3 Potential Impact of Turnhouse Options on EARL Patronage

1.3.1 Despite the largely qualitative nature of the scoping carried out for a STAG Part 1 appraisal, it was desirable to have some idea of the likely impact of each of the Turnhouse Options on travel patterns for EARL. Detailed demand modelling work for the Runway Tunnel option was still underway at the time this report was written, and in any case detailed modelling of demand for the Turnhouse Options was outwith the work generally associated with STAG Part 1. It was therefore decided to give a general outline of the magnitude of likely changes to patronage resulting from the options being considered. The comparison took place using the methodology set out in the Passenger Demand Forecasting Handbook (PDFH)<sup>8</sup>. This was related to the concept of Generalised Journey Time (GJT). The results of adopting this methodology can be summarised as follows:

**Table 1: GJT Indices (Restricted Catchment Area)**

	Runway Tunnel option	Turnhouse Options		
		Bus Shuttle	Travellator	Driverless Shuttle
Total Journey Time City Centre – Airport Terminal	16	41	36	32
Total Weighted Journey Time	19.76	70.96	53.36	47.04
Service Interval Penalty	7.5	7.5	7.5	7.5
Interchange Penalties <sup>a</sup>	6	6	6	12
Total Generalised Journey Time	33.26	84.46	66.86	66.54
<b>Index (Runway Tunnel = 100)</b>	<b>100</b>	<b>254</b>	<b>201</b>	<b>200</b>

<sup>a</sup> the Interchange Penalties are for any interchange required. This converts to an equivalent time effect (see page 31 of PDFH, version 4, August 2002)

<sup>8</sup> Passenger Demand Forecasting Handbook, Version 4 (Passenger Demand Forecasting Council, August 2002), Chapter B3

- 1.3.2 The difference between “Journey Time” and “Generalised Journey Time” should be clearly noted. **Journey Time** simply measures the total length of time to travel from A to B (in this case from Waverley Station to the Airport Terminal Building), including all necessary waiting, walking, etc. **Generalised Journey Time** represents a traveller’s perception of how long a journey takes, and weights various activities more onerously than others (e.g. it takes account of a preference to minimise walking and waiting, and to use trains rather than buses). It also takes into account the fact that passengers prefer to minimize the need to interchange, as reflected in the penalty included in Table 1.
- 1.3.3 Table 1 provides an indication of the respective impact of the three Turnhouse Options based on journey times from Edinburgh City Centre. This is taken as representative for the Edinburgh and Lothians area which surveys suggest accounts for 65% of the passenger movements.
- 1.3.4 In order to test the impact on journeys to/from medium range and more-distant zones a supplementary analysis was initiated; this was intended to reflect the relative smaller impact, of the Turnhouse interchange concept, on medium and longer distance trips (outwith Lothians) which account for some 35% of all surface access trips. This modified analysis is summarized in Table 2.

**Table 2: GJT Ratios for Edinburgh and Lothians and remaining external Origins and Destinations**

	Percentage of Trips	Bus Shuttle	Travellator	Driverless Shuttle
Edinburgh	65.1	1:2.54	1:2.00	1:2.00
Other OD's	34.9	1:1.74	1:1.48	1:1.45
Weighted Average Ratio Tunnel:Turnhouse		1:2.24	1:1.81	1:1.80

- 1.3.5 The simple analysis set out above suggests that each of the Turnhouse Options is likely to reduce the overall demand for EARL compared to the current Runway Tunnel option. The “worst” Turnhouse Option would be the bus shuttle, which would reduce demand, significantly. Whilst these figures are insufficiently defined to produce “absolute” estimates of demand they are grounded in industry-standard methodology and are sufficient to inform the outline STAG Part 1 appraisal of each option against the objectives.
- 1.3.6 The STAG Part 1 appraisal then took pace, informed by these findings, and following the order and approach recommended by STAG.

## 1.4 Environment

- 1.4.1 The approach to the environmental appraisal follows guidance in STAG and includes:
- Collection of baseline data including that from current relevant areas of environmental assessment in the area, information from consultees and data collected from site;

- An assessment of the likely environmental effects and the magnitude of these effects; and
- An appraisal of the likely significance of the effects and options for mitigation to remove or reduce these effects.

1.4.2 Appraisal took place against the following standard sub-headings:

- Noise & Vibration;
- Air Quality;
- Water Quality, Drainage & Flooding;
- Geology, Agriculture & Soils;
- Biodiversity;
- Landscape & Visual; and
- Cultural Heritage.

1.4.3 Taking account of the impacts of the options on all the aspects set out above, the environmental appraisal is set out in Table 5, and it would appear that the Turnhouse options are generally environmentally beneficial, because of less adverse impacts on the environment (apart from on air quality, which will be worse under the Turnhouse options).

## 1.5 Safety

1.5.1 This is generally assessed under two sub-heading, accidents and security. It is likely that EARL will reduce the overall need to use cars for travel, with a positive impact on accident rates providing that congestion remains similar to before. Given the magnitudes of modal shift anticipated, the impact will be greatest for the Runway Tunnel option, and decline in impact for the Turnhouse options in line with their deteriorating impact on demand.

1.5.2 Regarding security it was considered that the Runway Tunnel offered an opportunity to interchange within the airport terminal facilities, and required very little in the way of security provision. This was not the case with the long access routes required between the terminal at a station at Turnhouse. Given these considerations the options were assessed as shown in Table 5.

## 1.6 Economy

1.6.1 STAG requires appraisal of economic impacts under two sub-headings:

- Transport Economic Efficiency (TEE); and
- Economic Activity and Location Impact (EALI).

### ***Transport Economic Efficiency (TEE)***

1.6.2 The TEE appraisal is effectively a Cost Benefit Analysis (CBA) process. The impact on passenger demand (and hence likely revenues) has already been explained. Clearly all three of the Turnhouse options have significant impact on demand when compared to the Runway Tunnel option, and it is not inconceivable that total demand for EARL (air passengers and airport employees) could be reduced by more than half under the “worst case” options.

1.6.3 Table 3 below summarises the predicted capital costs of the various options under consideration.

**Table 3: Capital Cost Estimates**

	Runway Tunnel option	Turnhouse Options		
		Bus Shuttle	Travellator	Driverless Shuttle
Estimated Cost ( <i>millions</i> )	£500	£114	£321	£415

1.6.4 By comparing Tables 1, 2 and 3 it can be seen that the Bus Shuttle option involves the least overall capital cost; however it has the worst impact on usage and revenue. It also has considerable long-term costs associated with vehicle replacement, operation, maintenance, staffing and low/insignificant on-bus revenue. This means that the overall value-for-money (across the life of the scheme) is likely to be lower than the Runway Tunnel option.

1.6.5 There are some elements that are treated as annual costs in the Runway Tunnel alignment, principally the leasing costs of upgraded rolling stock. If the Turnhouse options reduce this requirement for upgraded stock then this might be expected to have a positive impact on operating expenditure. This has not been specifically assessed for this appraisal, however it is expected to be broadly neutral for the following reasons:

- There is no net increase in quantity of rolling stock, simply an upgrading within the existing fleet strength;
- There will be some operating cost savings from introducing more modern rolling stock, which may mitigate any increased leasing costs; and
- There will be a reduction in “wider benefits” for the whole ScotRail network if rolling stock is not upgraded.

#### ***Economic Activity and Location Impact (EALI)***

1.6.6 STAG incorporates EALI analysis to describe the “*impacts of transport investment on the economy, using the “measuring rods” of income and/or employment.*”<sup>9</sup> EALIs may occur as a net impact at the Scotland level, and as gross impacts for particular areas and/or groups in society.

1.6.7 Although net impacts are unusual it is considered possible that improved access to/from Edinburgh Airport will result in a moderate increase in foreign visitors to Scotland (for business and/or leisure), and for the Turnhouse options this would be anticipated to be in proportion to the predicted changes in demand for EARL.

1.6.8 However of more relevance are the regional and local impacts of EARL. Regional businesses in Edinburgh and the Lothians will benefit from improved access to other markets. These impacts are likely to be strongest for the Runway Tunnel option, and deteriorate in line with the reduction in demand set out above. Improved interchange opportunities may also offer benefits for Fife.

1.6.9 At a local level, impacts will differ between options. There will be local benefits for the Turnhouse area as a new station in the area will offer

<sup>9</sup> STAG (September 2003), section 8.7.1

improved local accessibility. However the proposed routing via Turnhouse would preclude the offering of a link between Edinburgh Airport and Edinburgh Park, which is likely to more than outweigh any local benefits derived from a station at Turnhouse.

**Overall Assessment for Economy**

1.6.10 Taking account of the impacts of the options on both TEE and EALIs set out above, their appraisal for STAG Part 1 purposes is shown in Table 5.

**1.7 Integration**

1.7.1 In appraising Integration STAG requires the consideration of:

- Transport integration;
- Transport land-use integration; and
- Policy integration.

1.7.2 Transport integration is generally measured within the TEE appraisal, but there are times when the CBA process does not include all potential benefits/disbenefits. It was considered that the “physical linkage” between stages of a journey would differ significantly for the various options, and the following standards were adopted:

**Table 4: Standards for Interchange Quality**

Indicator	Poor standard	Moderate standard	High standard
Physical linkage for next stage of journey	Physical linkage impossible without use of more than one bridge or subway. Need to change to a physically separate terminal.	Physical linkage possible with the use of a single bridge or subway. No need to change to a physically separate terminal.	Physical linkage possible without use of bridge, subway or changing to a physically separate terminal.

1.7.3 Based on this standard, it appeared reasonable to conclude that the Runway Tunnel option would result in physical linkage of a moderate standard (only requiring a straightforward change of level from the sub-surface station), whilst all the Turnhouse options would be poor as they required changes to a physically separate terminal. However these disbenefits were anticipated to be of a relatively small scale.

1.7.4 Transport land-use integration and Policy integration were appraised by reviewing each option against relevant public documents such as Structure Plans, Local Plans, national transport targets and regional/local transport strategies.

1.7.5 Taking account of the impacts of the options on all aspects of integration set out above, they were assessed as shown in Table 5.

**1.8 Accessibility & Social Inclusion**

1.8.1 STAG requires the consideration of two aspects as part of the Accessibility and Social Integration Government Objective, viz.:

- Community accessibility; and
- Comparative accessibility.

- 1.8.2 It further advises that “*the scope and detail required in the accessibility analysis needs to be commensurate with the planning objectives*”<sup>10</sup>.
- 1.8.3 For community accessibility it was concluded that whilst the Runway Tunnel option would have major benefit for network coverage, the Turnhouse options were likely to have only moderate benefits for public transport network coverage as they would not offer opportunities to interchange with Tramline 2 at the airport. Construction of the lines associated with both the Runway Tunnel and the Turnhouse options would cause severance of walking and cycling routes, although in most cases the number of people affected would be small. It was anticipated that the Runway Tunnel option would result in minor disbenefits for local accessibility, whilst all the Turnhouse options would result in moderate disbenefits for local accessibility (predominantly the potential impacts around Turnhouse and the northern links to the Dalmeny chord).
- 1.8.4 Some adverse impacts on accessibility for mobility impaired passengers were anticipated with the Turnhouse options as they incorporate changes of level and long stretches of walking and/or traveller. However building a station at Turnhouse would create a new catchment area for heavy rail that is largely untapped by existing stations, albeit containing relatively low population density.
- 1.8.5 Taking account of the impacts of the options on all aspects of accessibility set out above, their outline STAG Part 1 appraisal is reported in Table 5.

## 1.9 Cost to Government

- 1.9.1 It is possible to draw some broad conclusions from the outline value-for-money calculations compared to the Runway Tunnel option, which were as follows:
- Turnhouse Station + Bus Shuttle – **worst value-for-money**;
  - Turnhouse Station + Traveller – **poor value-for-money**; and
  - Turnhouse Station + Driverless Shuttle – **poor value-for-money**.
- 1.9.2 As it seems likely that EARL will already require significant public sector funding, then any worsening of value-for-money is likely to mean proportionately more of the funding burden falling on the public sector. However it should be noted that the capital costs of two of the Turnhouse options are anticipated to be considerably lower than those of the Runway Tunnel option, the amount of public sector funding in monetary terms will almost certainly be lower for the Traveller option than the Runway Tunnel.
- 1.9.3 Overall, then, it seems reasonable to conclude that the Bus Shuttle and Traveller options would require less net cost to government than the Runway Tunnel option, but that they would generate significantly less benefits.

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<sup>10</sup> STAG, paragraph 10.1.4

## 1.10 Implementability

1.10.1 STAG implementability assessment is required under four sub-headings:

- Technical Issues;
- Operational Issues;
- Financial Issues; and
- Public Issues.

1.10.2 There are no obvious technical issues associated with any of the three Turnhouse options; whilst the Runway Tunnel option poses more complex challenges it has, to date, been the subject of much more detailed investigations and has a risk management strategy in place to face up to identified challenges.

1.10.3 Operational issues impacting on the railway have been considered by AEA Technology<sup>11</sup>, and there are no obvious operational disbenefits to the Turnhouse options, and it has the advantage of avoiding the need to construct a new junction at Roddinglaw, which would otherwise impact adversely on the Edinburgh – Glasgow mainline.

1.10.4 The driverless shuttle and traveller options are both sub-surface, and hence are less likely to pose safety and security issues at the airport, although they may prove disruptive during construction (but still less than disruption associated with the Runway Tunnel option).

1.10.5 The costs of the bus shuttle and traveller options appear to be lower than the Runway Tunnel option, but it is important to remember that the Turnhouse options have been subjected only to a very high-level study, and that if the bus shuttle option is set aside then the apparent cost savings of the traveller option may prove to be less substantial following detailed investigation.

1.10.6 Public support for any of the options seems likely, although there are more issues posed by the Turnhouse options with their need for new station and 4-track construction adjacent to existing housing and the disbenefits of increased rail services through South Gyle. Travellers to Edinburgh Airport are more likely to prefer the straightforward interchange offered by the Runway Tunnel option than any of the Turnhouse options.

1.10.7 Taking all these issues into account, in terms of implementability all options are feasible, with the bus-shuttle exhibiting the most straightforward concept.

## 1.11 Summary & Conclusions

### ***Appraisal Summary Tables***

1.11.1 The findings are summarised in STAG Appraisal Summary Tables in the main report, and in Table 5 below.

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<sup>11</sup> Edinburgh Airport Rail Link: Train Performance Simulation (MERIT)(AEA Technology, 13<sup>th</sup> December 2004)

### ***Conclusions***

- 1.11.2 Considering the summary table presented below it is clear that the Runway Tunnel option offers positive benefits when assessed against Planning Objectives and Government Objectives, apart from the environmental disbenefits associated primarily with its construction phase. In contrast the Turnhouse options all have either disbenefits or weaker benefits which are likely to offer worse value-for-money than the Runway Tunnel option.
- 1.11.3 The bus shuttle option is simple in concept but would have a particularly-limited impact as an alternative to the Railway Tunnel.

### ***Recommendations***

- 1.11.4 The analysis in this STAG1 Appraisal suggest that the Turnhouse options do not offer any better benefits than the Runway Tunnel option as identified during the original RLGEA study, and in fact in certain aspects they would be more detrimental. This includes their performance against some of the planning objectives and the five main STAG criteria. It would also appear that the Turnhouse options may not provide better overall value-for-money (VfM) compared to the Runway Tunnel option, due to their lower revenue streams and additional running costs over-and-above the rail services. This latter point is particularly relevant since it is not presently identified who would be responsible for the additional operations. This could be further explored in the future depending on stakeholder feedback. Nonetheless it is considered that there are sufficient findings in this appraisal to set aside the Turnhouse options at this stage and continue to develop the Runway Tunnel option.

**Table 5: Summary of Appraisal against Objectives**

	Yardstick	Runway Tunnel (Reference Case)	Turnhouse Options		
			Bus Shuttle	Travellator	Driverless Shuttle
Planning Objectives	Operating costs should, at least, be covered by revenues, or be supported by third party contributions based on other benefits;	✓✓	✗	✓	✓
	Public sector contributions to capital costs should, at least, be matched by benefits to non-public transport users, such as the relief of road congestion;	✗ ✗	○	✗ ✗ ✗	✗ ✗ ✗
	Options should be compatible with potential long-term development strategies being considered at each airport as part of the UK strategy for air transport.	✓✓	✓	✓	✓
Planning Criteria	To serve and expand the airport's catchment area;	✓✓✓	✓✓	✓	✓
	To encourage modal shift and increase the percentage of passengers accessing the airport by public transport and in so doing, mitigate the impact of long distance travel on local and global travel and the transport network as much as possible;	✓✓✓	✓	✓✓	✓✓
	To reduce congestion on motorways and major roads near the airport;	✓✓	✓	○	○
	To reduce pressure on car parking at the airport;	✓	○	✗	✗
	To support the Scottish economy;	✓	○	○	○
	Airports should contribute to increased surface needs on the basis of achieving sustainable travel and no detriment to the transport network;	○	○	○	○
Government Objectives	Environment;	✗	✓✓	✓✓	✓✓
	Safety;	✓	○	✗	✗
	Economy;	✓✓	✗	✗ ✗	✗ ✗
	Integration;	✓✓	✓	✓	✓
	Accessibility/Social Inclusion;	✓✓✓	✓✓	✓	✓
Implementability		✓✓	✓✓	✓	✓
		✓✓✓ ✓✓ ✓ ○ ✗ ✗ ✗ ✗ ✗ ✗	Major Benefit Moderate Benefit Minor Benefit No Benefit or Impact Small Minor Cost or Negative Impact Moderate Cost or Negative Impact Major Cost or Negative Impact		