

'QUALITY OF LIFE' TRANSPORT INDICATORS UNDER A SINGLE OUTCOME AGREEMENT

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1. INTRODUCTION

Under the Single Outcome Agreement, the Government's purpose is "to focus the Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth".

This paper develops 'Quality of Life' Indicators for Transport under the Government's Strategic Objectives: Wealthier and Fairer; Smarter; Healthier; Safer and Stronger; Greener; to allow the appraisal of multi-modal transport schemes in line with the requirements of the Single Outcome Agreement (SOA) between the Government and COSLA.

These objectives are developed around Travel Cost, Travel Time, Safer Travel, Active Travel and Greener Travel 'Quality of Life' indicators on a seven point scale from A-G and beyond, which allows for objective appraisal and target setting in line with the requirement of the SOA. The links with the Scottish Transport Appraisal Guidance (STAG) are also explained.

The paper develops a number of examples of the application of this methodology to demonstrate the performance of different modes of transport ranging from walking to air travel, for a variety of short, medium and long distance journeys.

The methodology also allows a 'Quality of Life' score to be attached to the appraisal of each modal option to allow an analysis of the benefits of alternative transport choices for a given journey. A sensitivity test of different weightings of the Government's objectives is also included to identify the impact of the different weightings on the results.

The technique could be used to assess existing transport options as part of a Smarter Choices project involving Individualised Travel Marketing, through to a multi-modal scheme evaluation for a major transport investment.

By including transport indicators across all the Government's SOA strategic objectives, a balanced decision can be taken on the best form of investment in line with the Government's aims for sustainable economic growth. Because of the cross-cutting nature of this approach, it will also allow transport schemes to be judged more favourably against competing investment proposals from other sectors.

2. SINGLE OUTCOME AGREEMENT

The Scottish Government and COSLA, on behalf of all local authorities in Scotland, are signed up to a Single Outcome Agreement (SOA), to deliver public services through increasing sustainable economic growth.¹ The second annual round of SOAs is now in preparation, and this paper looks at how transport relates to the key Government Strategic Objectives of: Wealthier and Fairer, Smarter, Healthier, Safer and Stronger, and Greener.

The first observation is that transport cuts across all of the above five strategic objectives. However, as transport is not identified specifically as a key strategic objective then in practice it has missed out in being picked up in Council SOAs as being influential across all these objective areas. This presents both a challenge and an opportunity.

The SOA Strategic Objectives are ultimately expressed as National Indicators and Targets, and it is with this purpose in mind that the following framework has been developed. It is also recommended that outcomes should focus on people's "Quality of Life" and on supporting social, economic or environmental conditions. Outcomes should be supported by one or more robust and measurable indicators, with short, medium and long term targets over 3 years, 10 years and 20 years.

Of the 45 number national indicators and targets suggested, only two relate directly to transport: Indicator 4: Reduce the proportion of driver journeys delayed due to traffic congestion and Indicator 36: Increase the proportion of journeys to work made by public or active transport.

3. 'QUALITY OF LIFE' INDICATORS

Taking each of the Government Strategic Objectives in turn, a Transport 'Quality of Life' Indicator has been identified, to allow the measurement of the transport contribution under each of these headers.

3.1 Wealthier and Fairer

This is best represented by the twin transport economic and social indicators of Travel Cost and Travel Time, with a lower cost of travel or shorter journey time giving a comparatively higher 'Quality of Life' outcome, and higher cost or longer journey time giving a lower 'Quality of Life' outcome.

3.2 Smarter

This is best represented by the Smarter Travel Choices agenda which is being rolled out in seven pilot towns in Scotland.² This is not a quantitative indicator as such, but represents the objective of pursuing 'softer' measures to encourage a culture change to encourage the use of more sustainable transport choices, for the journeys we make on a day-to-day basis. The objective here is to reinforce the provision of Sustainable Transport Choices,

with the publicity, marketing and information to encourage the wider use of these transport options.

3.3 Healthier

This is best represented by a health indicator based on the level of Active Travel³ being included in our day-to-day activities, with a high level of active travel leading to greater physical exercise and a higher 'Quality of Life' outcome and a low level of active travel leading to less physical exercise and a lower 'Quality of Life' outcome. In this case the active travel for the whole day has to be accounted for on a cumulative basis. This allows the Government's target of 30 minutes exercise per day for adults and 60 minutes exercise per day for children to be measured and evaluated within the framework assessment method.⁴

3.4 Safer and Stronger

This is best represented by a Safer Travel indicator based on the average accident rate for a particular mode of transport on a particular part of the transport network. Again a journey by a safer mode of transport, over a safer part of the network, for a shorter distance, will lead to a higher 'Quality of Life' outcome, and a journey by a less safe mode of transport, over a less safe part of the network, over a longer distance, will lead to a lower 'Quality of Life' outcome.

3.5 Greener

This is best represented by a Greener Travel indicator based on the level of CO₂ emissions, with transport modes with lower emissions and journeys over shorter distances giving a high 'Quality of Life' value, and transport modes with higher emissions and over longer distances giving a relatively lower 'Quality of Life' outcome. Transport currently accounts for about a quarter of CO₂ emissions from all sources in the UK, excluding any allowance international air travel.⁵

4. LINK TO SCOTTISH TRANSPORT APPRAISAL GUIDANCE

The Scottish Transport Appraisal Guidance (STAG) recommends the development of a limited number of overarching transport planning objectives on which to develop a scheme appraisal framework.⁶ In this case the overarching transport planning objectives are:

- 1) To increase wealth by encouraging cheaper travel choices
- 2) To achieve fairness by identifying shorter journeys and journey times
- 3) To achieve an increase in sustainable travel use by rolling out a smarter choices campaign
- 4) To encourage active travel to improve health
- 5) To encourage safer travel choices to reduce accidents
- 6) To encourage greener travel by choosing sustainable travel options

Thus covering all the Government's overarching objectives within the Transport Sector.

At Part 1 Initial Appraisal, STAG recommends the evaluation of each of the planning objectives over a seven point scale: +3, +2, +1, 0, -1, -2, -3.

In this case, the 'Quality of Life' values for each planning objective have been defined from A to G representing the STAG values from +3 to -3, with the zero value being the average value for this particular indicator.

The 'Quality of Life' values for each objective are given in the following table. To move from one Quality of Life level to the next involves either a doubling or halving of the objective value. Also, by defining the absolute values of each objective for each Quality of Life level, then any analysis of a transport network will lead to the same results, whoever carries out this assessment. In terms of setting targets for future years, then different Quality of Life levels can be chosen to target future achievements.

Objective	Quality of Life (QoL)						
	A	B	C	D	E	F	G
1. Travel Cost (pence/mile)	2½	5	10	20	40	80	160
2. Travel Time (mins)	2½	5	10	20	40	80	160
4. Active Travel (mins/day)	120	60	30	15	8	4	2
5. Safer Travel (PIA/10 ⁹ pkm)	35	70	140	280	560	1120	2240
6. Greener Travel (CO ₂ g/pkm)	16	32	65	130	260	520	1040

Objective 3: The effectiveness of the roll out of a smarter choices travel campaign can be measured by the combined outcome of the above five objectives over the geographic area covered by the initiative.

In the above table the average values (QoL level D) are 20 pence/mile for travel cost, 20 minutes for travel time, 15 minutes for active travel/day, 280 Personal Injury Accident / 10⁹ person kilometres for safer travel and 130 grammes CO₂/person kilometre for greener travel. The QoL levels A-G largely cover the range of different travel modes for average length journeys, as will be shown in the next section. The average journey distance is 8 miles⁷, which needs to be allowed for where the measurement indicator is based on distance rather than time, as shown in the examples of different journeys covered later within the paper.

5. MULTI-MODAL ASSESSMENT FRAMEWORK

5.1 Travel Cost by Travel Choice

Travel Choice	Cost of travel (pence/mile)	Quality of Life
Walk Cycle Run	1¼	A+
Low Cost Coach	2½	A

Travel Choice	Cost of travel (pence/mile)	Quality of Life
Inter-City Coach	5	B
Rail Bus Low Cost Air 4x Occup Car 2x Occup Small Diesel Moped 2x Occup Motorcycle	10	C
2x Occup Car Small Diesel, Air Motorcycle, Rail Bus	20	D
1x Occup Car Air Short Bus trip	40	E
Taxi 4x4 Air	80	F

The cost of travel is lowest for the active travel modes of walking and cycling. Bus and rail travel costs are dependant on the number of passengers carried, the type of ticket purchased and all related to the average cost/passenger of running the service, allowing for any government subsidies. Car travel cost/person depends on the type of car and the number of occupants carried. Interestingly car users tend to base their perceived cost of travel on the fuel price alone (average 12 pence/mile whereas the actual average cost per mile can be up to four times this figure when all cost of owning and keeping a car on the road are taken into account. The average marginal cost of using a car is about 25 pence/mile. Air travel again depends on the cost of provision/person and the type of ticket purchased and the quality of service provided. Of all the modes of transport, only air travel does not pay tax on the fuel used.⁸

5.2 Travel Time by Travel Choice

Travel Choice	Time to Travel 8 miles (minutes)	Quality of Life
Air	1¼	A+
High Speed Rail	2½	A
Inter-city Rail	5	B
Rail Express Bus Inter-Urban Car	10	C
Bus Light Rail Urban Car	20	D
Cycle	40	E

Travel Choice	Time to Travel 8 miles (minutes)	Quality of Life
Local Bus		
Run	80	F
Walk	160	G

Travel time is currently one of the main factors influencing people's choice of travel, which is why air travel is so popular, as it allows business and holiday travel over long distances in a reasonable time. The current cost benefit analysis system for transport takes this factor as its major indicator.⁹ Here an eight level hierarchy allows all the various modes of transport to be covered from walking at 3mph up to air travel at an average speed of nearly 400mph. An average journey speed of 24mph allows a 20 minute journey over a distance of 8 miles (QoL level D). From the Scottish Transport Statistics each person on average makes around three one-way trips of this distance every day.

However, averages can be misleading, as 40% of all trips are less than two miles and 70% of all trips less than six miles long, which can be undertaken by the active travel modes of walking and cycling respectively.¹⁰

5.3 Active Travel by Travel Choice

Travel Choice	Exercise per day (minutes)	Exercise per one-way trip (minutes)	Quality of Life
Walk Run Cycle	120	60	A
	60	30	B
	30	15	C
	15	7½	D
	8	4	E
	4	2	F
	2	1	G

As can be seen from the table, the amount of exercise taken is subject to a law of diminishing returns as you need to double the amount of exercise taken to get to next higher level of Quality of Life.

If the only exercise is walking to and from the car then the amount of exercise per day for this activity is very low. If the journey is by public transport with a walk/cycle ride at each end then the amount of exercise/day increases dependent on the distance to and from the stops at each end of the journey. If the journey is solely by walking or cycling then the maximum health benefit is being derived from daily travel. If other exercise is taken during the day then this needs to be added to the exercise taken while travelling.

5.4 Safer Travel by Travel Choice

<i>Travel Choice</i>	<i>Personal Injury Accidents per 10⁹ person km</i>	<i>Quality of Life</i>
Air	2.19	A++++
Rail	17.5	A+
Motorway	70	B
Bus	140	C
Car	280	D
Walk	560	E
Cycle	1120	F
Motorcycle	4480	H

Statistically, air travel is very safe, although this does not mean that everyone feels safe when flying. Rail and bus travel are the next safest modes of travel, with car travel around the average (QoL level D) and the vulnerable modes of walking and cycling increasingly unsafe on average. Motorcycle use is a particular problem with respect to its road safety performance¹¹. For all the modes of travel there is a wide range of variation in the level of safety. For instance off-road cycling and walking are at QoL level A. It is only when the active modes come into contact with vehicular traffic, particularly at junctions and crossings, that the safety level is reduced, which needs to be addressed through design and segregation measures. For vehicular travel the use of motorways leads to a higher level of safety (QoL level B), but as low as level E for urban networks.

5.5 Greener Travel by Travel Choice

<i>Travel Choice</i>	<i>CO₂e g/person km</i>	<i>Quality of Life</i>
Cycle	4	A++
Walk	16	A
Inter-City Coach		
Express Bus	32	B
Commuter Rail		
Electric Car		
Local Bus	65	C
Inter-City Rail		
4x Occup Car		
2x Occup Small Diesel		
Moped		
2x Occup M/cycle		
2x Occup car	130	D
1x Occup Small Diesel		
Motorcycle		
Slow Ferry		
Air Long Haul	260	E
1x Occup Car		

Travel Choice	CO₂e g/person km	Quality of Life
Air Domestic UK Fast Ferry	520	F

Cycling is by far the greenest travel mode, equivalent to 1,600 miles/gallon in terms of equivalent energy use. Air and fast ferries are at the other end of the table with a very high energy use. In the case of air the equivalent CO₂ impact is higher because of the pollution and water vapour emitted in the upper atmosphere according to evidence accepted by the Intergovernmental Panel on Climate Change (IPCC).¹² Again car and public transport carbon emissions/person depend on the number of passengers being carried, as well as the fuel efficiency of the vehicle and the type of fuel being used.

6. APPRAISAL OF SHORT, MEDIUM AND LONG JOURNEYS

To illustrate the framework assessment method, the following journeys are given as worked examples to help evaluate the merits of the different modes of travel against the Government's key strategic objectives:

- Local journey: Falkland to Glenrothes (6 miles)
- Regional journey: Glenrothes to Edinburgh (30 miles)
- UK Domestic journey: Glenrothes to London (450 miles)

6.1 Points Score

In order to evaluate the modes of travel we need to be able to assign a consistent points score to each of the Quality of Life levels:

Quality of Life	Points Score
A+	0.0625
A	0.125
B	0.25
C	0.5
D	1
E	2
F	4
G	8
H	16
I	32
J	64
K	128
L	256

The average value (QoL level D) is assigned a consistent score of one point and the points score doubles for every decrease in QoL level and halves for every increase in QoL level. The points score assumes an average trip length of eight miles, therefore for objectives measured by distance, i.e. Travel Cost, Safer Travel and Greener Travel, the points score need to be factored by: trip

length (miles)/8. As a further step the points score can be given an appropriate weighting or even a monetary value to allow a full cost benefit analysis to be undertaken.

6.2 Local Journey: Falkland to Glenrothes (6 miles)

Objective	Mode of Travel									
	Cycling (Existing)		Cycling (Improved)		Bus		Car		Car Share (1 +1)	
	QoL	Score	QoL	Score	QoL	Score	QoL	Score	QoL	Score
Travel Cost	A+	0.05	A+	0.05	D/E	1.5	D/E	1.5	C/D	0.75
Travel Time	D/E	1.41	D/E	1.41	D/E	1.41	C	0.5	C	0.5
Active Travel	B	0.25	B	0.25	D	1.0	F	4.0	F	4.0
Safer Travel	E/F	3.0	D/E	1.41	B/C	0.38	C/D	0.75	C/D	0.75
Greener Travel	A++	0.02	A++	0.02	B/C	0.38	D	1.06	C	0.53
Total Score		4.73		3.14		4.67		7.81		6.53
Rank		3rd		1st		2nd		5th		4th

Travel cost, safer travel and greener travel scores and quality of life levels are all adjusted by 6 miles/8 miles to allow for a shorter than average journey for those objectives where distance is involved.

In this example, cycling on the 'existing' network involves just over a mile along the busy A92 trunk road dual carriageway (22,500 veh/day). The 'improved' network involves the provision of an off-road cycle track in the grass verge along this section of dual carriageway. The calculation of on-road cycling level of service/quality of life is based on a method taking account of the speed of traffic and the volume of traffic. This can be accessed on the 'Paths for All Partnership' website, Practice Note 3 in a paper entitled 'Using the Scottish Transport Appraisal Guidance to Evaluate Sustainable Travel Projects'.¹³

For car use the average running cost for a car of 25 pence per mile is used, which is less than the average cost per mile of 40 pence but about double the fuel cost. This assumes the decision to purchase a car has already been taken, so the marginal cost of using the car is all that needs to be taken into account.

The results show that for a journey on inter-urban and urban roads over a six mile distance, which in Fife is a distance that covers two-thirds of all journeys made, the best travel choice is cycling (improved) if all the Government's strategic objectives are taken into account and given equal weighting. Cycling scores well (i.e. low score) on travel cost, active travel and greener travel, scores the same as bus and higher than car for door to door travel time and

has the highest score of the travel choices for safer travel, as the route largely uses existing trafficked routes. The provision of more off-road cycle tracks would further improve cycling's performance on short journeys up to six miles. Bus is the next best travel choice with its worst performance under travel cost and travel time. Driver-only car use is the least acceptable alternative, scoring best on travel time but worst on active travel, travel cost and greener travel. Car sharing helps reduce the travel cost and greener travel scores but still underperforms against the cycling and public transport options.

6.3 Regional Journey: Glenrothes to Edinburgh (30 miles)

Objective	Mode of Travel									
	Express Bus		Rail with Car access		Rail with Cycle access		Car		Car Share (1 +1)	
	QoL	Score	QoL	Score	QoL	Score	QoL	Score	QoL	Score
Travel Cost	E/F	3.28	F/G	4.94	F/G	4.94	F/G	4.69	E/F	2.35
Travel Time	E/F	3.75	E/F	3.3	E/F	3.3	F	4.0	F	4.0
Active Travel	C/D	0.8	E	2.0	C	0.5	E	2.0	E	2.0
Safer Travel	E	1.88	B	0.25	B	0.24	F	3.75	F	3.75
Greener Travel	D	0.94	D	0.94	D	0.94	F/G	5.29	E/F	2.64
Total Score		10.65		11.43		9.92		19.73		14.74
Rank		2nd		3rd		1st		5th		4th

For a journey of 30 miles, the Quality of Life levels are lower and the point scores higher than for the shorter journey in Example 1, with the exception of Active Travel (which is based on the level of physical exercise by walking or cycling in accessing and egressing the main motorised forms of transport).

It is assumed in this example that car parking is free at the destination in Edinburgh city centre. Any car parking charges would need to be added 50/50 to the trip to Edinburgh and the return trip from Edinburgh, and would further increase the score for the car-based options.

The rail with cycle access is based on cycling the two miles from Glenrothes town centre to Markinch railway station, for which an off-road safer cycle route is already available.

The results show that rail travel with cycle access is the best travel choice if all the Government's strategic objectives are taken into account and given equal weighting. This option scores well on travel time, active travel, safer travel and greener travel and is not far behind on travel cost except for car sharing where free parking has been assumed. Express bus and rail with car access also performs nearly as well as alternative sustainable travel choices. Driver-only car use is the worst choice for all objectives except travel cost; the need

to pay for parking in Edinburgh could make it the worst choice in all categories, depending on the length of stay and charging rate. Car sharing narrows the gap somewhat, but even with four people in the car it would remain in fourth place.

6.4 UK Domestic Journey: Glenrothes to London (450 miles)

Objective	Mode of Travel									
	Express Coach		Rail		Car		Car Share (1 +1)		Air	
	QoL	Score	QoL	Score	QoL	Score	QoL	Score	QoL	Score
Travel Cost	H	15.81	I/J	35.94	J/K	70.31	I/J	35.16	I/J	47.5
Travel Time	I/J	33.75	H/I	19.5	H/I	27.0	H/I	27.0	H	17.25
Active Travel	C/D	0.71	C/D	0.71	E	2.0	E	2.0	C/D	0.71
Safer Travel	H	14.06	F	3.51	H/I	22.5	H/I	22.5	E/F	3.07
Greener Travel	G/H	10.13	I	28.13	J/K	79.3	I/J	39.66	J/K (K/L)*	80.4 (152.76)*
Total Score		74.46		87.79		201.11		126.32		148.93 (221.29)*
Rank		1st		2nd		5 th (4 th)*		3rd		4 th (5 th)*

* Figures shown in brackets allow for a higher CO₂e value for air travel (a 1.9 times increase) due to the effect of nitrous oxides and vapour trails in the higher atmosphere (IPCC).

For a journey of 450 miles, the Quality of Life levels are lower and the points score higher than for the shorter journeys in the previous examples, with the exception of active travel which is utilised in accessing by walking the different modes of travel for each of the examples shown.

Free parking in London has been assumed for the car options.

The results show that Express Coach is the best travel choice if all the Government's strategic objectives are taken into account and given equal weighting. This option scores best for travel cost and greener travel with its worst performance in the travel time objective (11 hours 15 minutes). Rail is the next best and is a safer and quicker (6 hours 30 minutes) option than express coach. Car share also performs quite well benefiting from the better safety of motorway use for most of the journey distance. Driver-only car use and air travel perform badly against the other three options and if the IPCC recommended correction to the CO₂e value for domestic air is used, then air is three to two and a half times worse than the more sustainable alternatives of express coach and rail.

7 SENSITIVITY TESTING

It is helpful at this point to consider what impact the use of different weightings of the travel objectives might have on the results.

At the 'Active Travel National Networking Event' held on 2 June 2008 at the Perth Concert Hall, a workshop session was held which helps inform this process. Delegates in the workshop were asked to use sticky notes (as many as they required) to identify the factors that influence their travel choices. The results of this exercise gave the following weightings for the five travel objectives being considered:

	Weighting
Travel Cost	1.7
Travel Time	2.2
Active Travel (Health)	0.67
Safer Travel	0.33
Greener Travel	0.22

Using the previously discussed 'Equal Weighting of Government Objectives' gave the following results.

	Best	Next Best	Medium	Next Worst	Worst
<i>Local Journey</i>	Cycling (improved)	Bus	Cycling (existing)	Car share	Car
<i>Regional Journey</i>	Rail with cycle access	Express Bus	Rail with car access	Car share	Car
<i>UK Domestic Journey</i>	Express Coach	Rail	Car share	Air/Car	Car/Air

Using the 'Alternative Weighting of Government Objectives' given in the table above gives the following results.

	Best	Next Best	Medium	Next Worst	Worst
<i>Local Journey</i>	Cycling (improved)	Cycling (existing)	Car share	Bus	Car
<i>Regional Journey</i>	Express Bus	Car share (free parking)	Rail with cycle access	Rail with car access	Car
<i>UK Domestic Journey</i>	Express Coach	Rail	Car share	Air	Car

Although the weightings are dramatically different from an equal weighting of 1.0 for each objective, the results do not vary that significantly in order of Best to Worst travel choices for the three different lengths of journey.

For the local journey, bus is relegated to fourth place because of the higher weighting on travel cost. For the regional journey, rail is less competitive, again because of the higher weighting on travel cost. For the UK domestic journey the only small change is that air establishes itself ahead of the car, irrespective of the IPCC weighting on CO₂ emissions. This is because of the considerably lower weighting applied to greener travel.

Finally, how can we explain that the current modal choices for transport in the UK do not always follow the analysis and results emerging from this paper? This is possibly explained by taking just one of the objectives 'Travel Time' and seeing what results are obtained using this single objective.

	Best	Next Best	Medium	Next Worst	Worst
<i>Local Journey</i>	Car/Car share		Bus/Cycling		
<i>Regional Journey</i>	Rail with car/cycle access		Express bus	Car/Car share	
<i>UK Domestic Journey</i>	Air	Rail	Car/Car share		Express Coach

For the regional journey the results are not that different. However this is because public transport is currently the dominant choice for trips to Edinburgh city centre, due to rail having its own designated track and the on-road bus priority measures already introduced between Fife and Edinburgh city centre.

For local journeys the current situation is replicated with the majority of trips by single occupancy car with some car sharing, especially for the journey to and from work, and bus and cycling having low and very low modal shares respectively.¹⁴

For the UK Domestic journey, again the current situation is replicated: air travel continues to grow, with rail use also increasing, and the ever decreasing reliability in motorway travel, caused by congestion and road works, affects the car and express coach options in terms of increasing journey times.

8 CONCLUSIONS

This paper has demonstrated how, in the transport sector, the Government's purpose and key strategic objectives can be taken forward and measured within a SMART evaluation framework.

This methodology is compatible with the principles laid out in the Scottish Transport Appraisal Guidance (STAG). In addition the methodology could be

used to help evaluate the success of the Smarter Choices, Smarter Places initiatives currently being rolled out in seven towns and cities within Scotland.

Sustainable economic growth can be achieved in Scotland by increasing emphasis on active travel through walking and cycling for shorter trips; and for regional journeys through public transport provision, including bus priorities, bus rapid transit and park and ride for both bus and rail. The provision of high occupancy vehicle lanes on the strategic network to encourage bus/coach use and car sharing can also be recommended and at the UK domestic level a strong policy argument could be made for the provision of a high speed rail network, to reduce the use of air for journeys of this distance.

There is further work required to investigate the definition of cost values for the various objectives, to allow the incorporation of the methodology within a STAG Part 2 appraisal, including full cost benefit analysis.

What has been achieved so far is a simple methodology for looking at the widespread benefits of transport modes, to achieve the Government's aims. By assigning values to the Quality of Life levels for each of the objective areas, an objective multi-modal evaluation can be carried out. It should also be noted that the methodology can equally be applied to the existing network and does not need an improvement scheme to compare against the existing situation.

Notes

¹Single Outcome Agreement

<http://www.scotland.gov.uk/Topics/Government/local-government/SOA>

²Smarter Choices, Smarter Places

<http://www.scotland.gov.uk/Topics/Transport/sustainable-transport/home-zones>

³Active Travel

<http://www.sustrans.org.uk/default.asp?sID=1089735305687>

⁴UK Physical Activity targets

<http://www.heartstats.org/datapage.asp?id=1016>

⁵How can we reduce carbon emissions from transport? Tyndall Centre for Climate Change Research Technical Report 15 (2004)

www.tyndall.ac.uk/research/theme2/final_reports/it1_7.pdf

⁶Scottish Transport Appraisal Guidance

<http://www.transportscotland.gov.uk/stag/home>

⁷Scottish Transport Statistics: No 27 – 2008 Edition

<http://www.scotland.gov.uk/Publications/2008/12/22091243/168>

⁸Air travel and climate change

<http://www.independent.co.uk/news/uk/politics/revealed-airlines-16310bn-government-fuel-subsidy-842770.html>

⁹Centre for Transport and Society and Centre for Mobility Research

<http://www.transport.uwe.ac.uk/research/projects/travel%20time%20use%20-%20final%20report.pdf>

¹⁰SHS Travel Diary results 2005/2006

<http://www.scotland.gov.uk/Resource/Doc/933/0059157.xls> Table 3

¹¹Road Casualties Great Britain 2007

<http://www.dft.gov.uk/pgr/statistics/datatablespublications/modal/tsgbchapter1passtrans1861.pdf> Table 1.7

¹²IPCC Aviation and the Global Atmosphere

<http://www.grida.no/climate/ipcc/aviation>

¹³Using the Transport Appraisal Guidelines to Evaluate Sustainable Travel Projects

http://www.pathsforall.org.uk/cms_uploads/STAGPracticeNoteFINAL.pdf

¹⁴Fife Local Transport Strategy 2006-2026

http://www.fifedirect.org.uk/uploadfiles/publications/c64_LTS_4.2.pdf