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PRIORITY ASSESSMENT TECHNIQUES PROJECT

PHASE 2

COMPARISON OF SCHEME RANKINGS USING SIX PRIORITY ASSESSMENT TECHNIQUES

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ABSTRACT

SIMON, D. (1987) Comparison of Scheme Rankings Using Six Priority Assessment Techniques. Working Paper 237, Institute for Transport Studies, University of Leeds.

This paper presents and analyses the results of a quantitative comparison of six priority assessment techniques (PATs) using a sample of six schemes. The PATs were selected as a representative sample of those currently in use in the UK (see Working Paper 230 and Technical Note 190).

The results reveal significant differences in the project rankings between techniques, although these are reduced when problem, solution, or problem and solution oriented PATs are considered separately. The proportion of points allocated to particular objectives for individual schemes varies widely between PATs. Greater standardisation would probably be desirable.

ACKNOWLEDGEMENTS

We wish to record a debt of gratitude to all the local councils who provided us with documentation and advice on their assessment techniques. In addition, Devon County Council and Strathclyde Regional Council made data on a selection of schemes available, while Strathclyde willingly and cheerfully undertook the onerous task of collecting and collating additional data in formats suitable for use in this comparative exercise. Without their help, especially of Mr. I. G. Lawson and Mr. I. Greenshields at Strathclyde, the work reported here would not have been possible.

1. INTRODUCTION

This paper is one of a series produced during the course of an ESRC-sponsored research project, 'Priority Assessment Techniques for Local Transport Improvements', and sets out the results of the main task undertaken during Phase 2, namely a comparison of how a diverse sample of six appraised schemes are ranked by six different techniques. These priority assessment techniques (PATs) were selected as a representative cross-section of those reported to us by a total of 25 county and regional councils across Great Britain (Simon 1986a, 1986b). PATs have been developed since the mid-1970s to provide planners and councillors with some systematic tools for deciding on the optimal allocation of increasingly scarce capital resources among large numbers of diverse, competing scheme proposals.

One of this project's major objectives is to provide a guide to 'good practice' in the development and use of PATs, based on an evaluation of the various existing techniques. Analysis of the reported PATs revealed that there was great diversity of variable definition, comprehensiveness, structure, data requirements, point and weighting methods, and also usage within the planning process.

Accordingly, it could not be assumed that identical or even similar project rankings would necessarily be obtained with the different techniques.

2. METHODOLOGY

Following directly from this conclusion, it was decided to undertake a comparison of how they performed in practice. There were two prerequisites for such an exercise:

i) identification of an appropriate sample of PATs for testing;

ii) obtaining a suitable dataset.

The approach to each will be discussed in turn.

2.1 Sample of PATs: Inclusion of the entire PAT pool was clearly not feasible because of resource and time constraints and considerations of practicability. Fortunately it was also not considered strictly necessary since several distinct types of technique had been discerned (Simon 1986a). A suitable sample could thus be drawn up, giving coverage of most of the sources of difference. Essentially, this required the inclusion of at least one PAT from each of the complexity categories in Table 7 of Working Paper 230 (Simon 1986a). It was, however, recognized that this might require amendment if the local authorities concerned were unable or unwilling to provide the level of documentation and assistance this exercise would undoubtedly need.

Fortunately, all the authorities approached appreciated the potential value of this exercise and were indeed willing to assist as necessary. The sample of six PATs selected was as follows:

a) Gloucestershire (5 factors). Other attributes: point scoring; all variables weighted; objective variables only; evaluates problem severity only; applied to all scheme sizes.

b) South Yorkshire (7 factors). Other attributes: point scoring; some variables weighted; objective and subjective variables; evaluates problem severity and solution efficacy; applied to schemes < £250k.

c) West Sussex (8 factors). Other attributes: point scoring; all variables weighted; objective and subjective variables; evaluates problem severity only; applied to all scheme sizes.

d) West Midlands (12 factors). Other attributes: point scoring; all variables weighted; objective variables only; evaluates problem severity only; applied to all scheme sizes.

e) Strathclyde (39 factors). Other attributes: point scoring; all variables weighted; objective and subjective variables; evaluates solution efficacy only; applied to all scheme sizes.

f) Devon (43 factors) Other attributes: point scoring, all variables weighted; objective and subjective variables; evaluates problem severity and solution efficacy; applied to schemes > £250k.

It is evident from the foregoing that care will be necessary in interpreting the results of the quantitative comparison, because the PATs differ so significantly in nature. Not only are their internal structures divergent (in terms of the number and definition of headings and variables), but they are geared to different scheme size bands. There is some overlap, but the South Yorkshire and Devon PATs are mutually exclusive sizewise. This will have some bearing on the value of numerical comparison, since distortions may well be introduced, but there appeared no way round the problem if this or a similar sample were to be used.

Furthermore, some of the PATs rank problem severity, others solution efficacy and still others a combination of the two. Direct comparison of rankings obtained by the different techniques will need to take this into account, since like may not always be being compared with like.

One other particular problem is that the Strathclyde PAT does not employ fixed or open score ranges in the manner common to the other techniques. It awards only scores of +1, 0, and -1 for significant positive, insignficant or zero, and significant

negative scheme impacts respectively. This clearly precludes direct relative ranking of projects, i.e. a score of 56 is not necessarily superior to one of 55, as would be assumed using the other techniques. In evaluating outcomes, Strathclyde officials take separate account of the unweighted, weighted and cost-related scores, and the number of section heads and variables under which individual schemes have scored. This is deemed necessary since two or more schemes with the same points total may well have very different characteristics and score on different variables.

Finally, it bears noting that the PATs are amended and updated from time to time by their users. In order to ensure uniformity throughout the project, we have therfore had to 'freeze' them in their early 1986 form as communicated to us by the respective officials and for which documentation was made available. These are set out in full in ITS Technical Note 190 (Simon 1986b). Recent changes, such as an improved calculation of traffic performance in the Gloucestershire PAT, are consequently not used here.

2.2 Role of the PATs in the Planning Process: The general point was made in Working Paper 230 (Simon 1986a) that PATs differ significantly in terms of their position and role within the respective authorities' planning processes. Simple, unweighted techniques are normally used only for preliminary problem identification, while more complex, weighted PATs have the potential for use in successive stages of the planning process, ultimately producing final or near-final scheme rankings.

It is important to appreciate the applications of the 6 PATs considered in detail here. This is most clearly expressed in terms of the activities corresponding to successive planning stages, i.e. problem identification; initial sifting of problems and/or potential schemes; and detailed evaluation and ranking. Initial sifting characteristically attempts to discard scheme proposals which, for various reasons, stand little chance of implementation. In some authorities the evaluation of alternative solutions to given problems is subsumed in this exercise, although it more commonly forms part of the detailed evaluation stage, together with comparison of the optimal solutions to each problem.

Probelm-only PATs, however detailed and sophisticated, can by definition, only be used in problem identification and ranking. Solution-only PATs are similarly suited only to sifting of projects and detailed evaluation. Logically, therefore, PATs suitable for use in all planning stages should incorporate both problem ('before') and solution ('after') components, so as to yield a measure of how well proposed schemes alleviate the problems. The following paragraphs provide an outline of each authority's use of their PAT.

a) Devon: Their PAT is used in all three stages, after sorting priorities from the project lists inherited from the

Structure Plan process. It is now also used for 'external' purposes, such as priority justification in TPPs. There appears to be little overt political pressure to doctor figures so as to produce particular outcomes. The factor weights are approved by Council members in committee, and these can be amended with relative ease to reflect policy changes. For example, environmental schemes such as pedestrianisation have been given high priority since control of the Council changed from Conservative to Alliance. Schemes >£250k are assessed on a countywide basis; obtaining a reasonable geographical spread is politically more important for small schemes (<£250k).

b) Gloucestershire: This PAT is used only for problem identification and initial sifting; the output is then discussed with Council members. The PAT does not feature directly in TPP submissions. All schemes are evaluated in a single pool but there is a political need to implement a geographical spread of schemes.

c) South Yorkshire: This former Metropolitan County's PAT was used exclusively for small schemes under £250k. Larger schemes were evaluated on a one-off basis, using a Leitch-type framework. The PAT was designed for initial sifting of proposed schemes, so as to take forward only worthwhile ones. Weights were agreed by Council members. Results were presented in priority bands, to prevent argument over precise scheme scores. Nevertheless, political influences e.g. to obtain a good spread of projects between areas, did have a distinct bearing on the eventual outcome.

d) Strathclyde: As might be expected from its non-cardinal nature, the Strathclyde PAT is geared mainly to sifting proposed projects, rather than their detailed evaluation. Given the different capital funding system in Scotland, and the fact that the Regional Council has responsibility for all road matters except trunk roads, there is less need for external justification of projects. Officers thus seek to implement the highest scoring group of schemes within the top pool, subject to increasingly severe budget constraints, and the need to spread projects between districts. Within each district, the PAT is used to highlight the 'best' schemes. The availability of European Regional Development Fund (ERDF) finance also has a significant effect on which projects are in fact implemented.

e) West Midlands: As with Devon's, this PAT was designed for use at successive stages, and as in Gloucestershire, South Yorkshire and Strathclyde, political and geographical factors were relevant. After abolition of the Metropolitan Counties, most of the West Midlands Metropolitan Districts have continued to use this PAT, although some are currently considering modifications.

f) West Sussex: Their actual construction programme is determined mainly by political and related considerations, rather than PAT output. The PAT, designed for use in conjunction with the County Transportation Model and not run annually, is

essentially a problem sifting device, which also classifies routes for purposes of concentrating investment.

The use of these PATs is summarised in the box below, although there might in fact be some overlap in roles and between planning stages.

PAT Uses

	problem identif.	problem sifting	solution sifting	detailed eval.	TPP subm.	ERDF subm.
Devon	x	x	x	x	x	
Glouc	x	x				
S.Y.	x	x	x	x		
Strath			x			x
W.M.	x	x	x	x		
W.S.	x	x				

2.3 The Database: Both Devon County Council and Strathclyde Regional Council kindly agreed to provide us with their scoring sheets for a sample of 6 projects. It was resolved that the Strathclyde data should be used for three reasons:

- Following the abolition of the GLC and Metropolitan Counties in 1986, Strathclyde are the only council fulfilling the functions of both highway authority and passenger transport authority. They should therefore have broad insights into and more accessible data on different facets of transport planning, etc.

- The council area is large and diverse, covering the entire spectrum of problems from deprived inner city to remote island communities. This would enable us to obtain a useful cross section of schemes from a single authority, with obvious benefits in terms of data uniformity and local knowledge on the part of the officers liaising with us. Comparison of widely different PATs would become an even more ccmplex and hazardous operation if data were derived from a variety of sources and contexts.

- Whereas Devon did not divulge the exact scheme names and localities, Strathclyde were happy to do so. This gave us the added advantage of being able to pinpoint them on maps and visit them for purposes of familiarisation.

As anticipated, initial attempts at comparison using the

Strathclyde data revealed significant compatibility problems in that most of the PATs employed different variables and/or variable definitions, levels of disaggregation and so forth. It was not possible to proceed meaningfully on that basis. In order to remove the possibility that these incompatibilities were due to some peculiarity of the Strathclyde PAT and data format, the Devon data set was tested but similar problems arose (Simon 1986c,d). Consequently it became necessary to seek additional data from Strathclyde, if the PAT comparison was not to be abandoned. In some cases the records already existed and required only modification for the format of one or more PAT; in other cases, however, special data collection exercises were necessary, using appropriate correction factors to standardise the year and season of data collection. The information ultimately provided was for 1985 as base year, with projections to 2000 as design year. Where more recent data were available than appeared on the original SR100 assessment forms for the respective schemes, these were used to ensure base year uniformity.

2.4 The Six Sample Schemes:

i) A70 Welltrees Bridge: Cost (1985): £ 456k. Rural bridge in Cumnock and Doon Valley District. Objective: general improvement of the A70, to eliminate very poor vertical and horizontal alignments and replace a deteriorating bridge.

ii) Canniesburn Rd. from Annan Drive to A809: Cost (1985) £ 1.1m. Bearsden-Milngavie Districts in urban Glasgow. This road forms part of a signficant east-west route and the principal access to Drumchapel Estate, a relatively poor working class area with a population of 30,000. The section in question has poor horizontal alignment and frequent frontage accesses. There is a high proportiojn of through traffic. The scheme is integrally related to others in Drumchapel Renewal Area, including the adjacent scheme (iii) below.

iii) Canniesburn Rd.: Kinfauns Drive to Annan Drive: Cost (1985) £560k. This section of the road has almost continuous frontage access on the south side and frequent access on the north side, where there is also a primary school. Pedestrian-vehicle conflict is a considerable problem, and through traffic constitutes 83% of the total flow. The scheme involves provision of a relief road for through traffic behind the school, and restricting use of the existing road to access and buses.

iv) Balmore Rd. - Balmuildy Rd. Junction: Cost (1985): £ 95k. A rural T-junction on the A879 in Glasgow District. Traffic currently emerging from Balmuildy Rd. is unable to see southbound traffic on Balmore Rd. approaching the junction because of a garden wall on the northeast corner. Considerable delays are also caused by the absence of a northbound right turning lane. The scheme involves 200m of minor widening and junction improvement, to realign the garden wall and provide a right turning lane.

v) Balmuildy Bridge on Balmore Rd.: Cost (1985): £ 780k. Situated near the previous scheme, the existing bridge over the River Kelvin is narrow and approached through a nasty bend, thus causing delays and an accident hazard. The scheme involves realignment, with construction of 500m of new 7.3m carriageway, a new bridge and footway.

vi) Kirkintilloch Town Centre Relief Road: Cost (1985) £ 5.8m. Kirkintilloch, in Strathkelvin District, suffers from severe town centre congestion, with resultant pedestrian-vehicle conflict and accidents. The problem is partly a result of a high volume of through traffic. The scheme involves construction of a 1 km relief road for through traffic and to improve connections from the main industrial areas north of the town to the trunk road network; and pedestrianisation of the existing road as an integral part of comprehensive town centre redevelopment. This is the only one of the six schemes in the current programme, and preliminary work has already begun.

3. RESULTS OF THE COMPARISON

Table 1 sets out the scores and ranks of the 6 schemes using each PAT. Bearing in mind the points about comparability made above, several general conclusions can be drawn.

3.1 Scheme Size and Scores: Irrespective of PAT structure, variable definition and use for problem or solution evaluation, large (and costly) schemes tend to score high points. Thus Kirkintilloch town centre heads all the rankings, while the Balmore Rd. - Balmuildy Rd junction performed very poorly, ranking 6th, 5th, and 4th (twice each) in all cases. There is greater variation between PATs in the intermediate schemes.

3.2 Cost-related Scores: Once cost considerations are taken into account, however, the extreme rankings are reversed in three cases, while some changes also occur in the intermediate ranks. Devon, Gloucestershire and Strathclyde actually derive cost-weighted rankings as a standard part of the PAT procedure. Devon do this by multiplying the weighted total score by a cost ratio in log form i.e. [log 141/log cost]; Gloucestershire divide the total weighted score by the square root of scheme cost; while Strathclyde merely divide the weighted total score by cost in £m. The other authorities do take cost into account during their decision-making process, using the same measure as Strathclyde, but not within the PAT structure as such. When their scores are divided by cost, as shown in Table 2 below, a similar effect is observed, even though in the South Yorkshire case Kirkintilloch actually retains the top rank. Once again, it is in intermediate schemes that the rankings vary significantly between PATs. All six PATs are included in Table 2 for ease of comparison; the question of which cost measure is most appropriate is addressed in section 3.9 below.

THE RANKING EXERCISE

I DEVON PAT

	Welltrees Bridge			Canniesburn Rd - Annan Dr			Canniesburn - Kinfauns - Annan Dr			Balmore Rd - Balmuildy Rd			Balmore Rd Bridge			Kirkintilloch Town Centre		
	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws
a) Traffic																		
Est. Aug 1991 flow	1	2	2	2	2	4	2	2	4	2	2	4	2	2	4	3	2	6
Est. Apr. 1991 flow	1	5	5	2	5	10	2	5	10	2	5	10	2	5	10	3	5	15
Existing Aug cong.	0	1	0	1	1	1	2	1	2	1	1	1	1	1	1	3	1	3
Existing Apr. cong.	0	3	0	1	3	3	2	3	6	1	3	3	1	3	3	3	3	9
Current network impairment	3	3	9	2	3	6	3	3	9	2	3	6	2	3	6	4	3	12
Improvement in network functioning	3	3	9	3	3	9	4	3	12	4	3	12	3	3	9	5	3	15
% HGVs	2	1	2	1	1	1	1	1	1	2	1	2	2	1	2	2	1	2
Route relev. to functional network	3	1	3	3	1	3	3	1	3	3	1	3	3	1	3	3	1	3
Traffic Score	13		30	15		37	19		47	17		41	16		38	26		65
Weighted Section Score	30	2.15	64.5	37	2.15	79.55	47	2.15	101.05	41	2.15	88.15	38	2.15	81.7	65	2.15	139.75
b) Accidents																		
3-yr p.i.a.'s	3	6	18	5	6	30	11	6	66	3	6	18	1	6	6	36	6	216
3-yr peds.	0	2	0	4	2	8	4	2	8	0	2	0	0	2	0	21	2	42
3-yr fatals	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0
3-yr pia reduction	2	3	6	2	3	6	6	3	18	2	3	6	0	3	0	26	3	78
3-yr ped reduction	0	2	0	0	2	0	2	2	4	0	2	0	0	2	0	16	2	32
3-yr fatal reduction	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6	0
Low cost scheme?	4	3	12	4	3	12	4	3	12	4	3	12	5	3	15	4	3	12
Accident Score	9		36	15		56	27		108	9		36	6		21	103		308
Weighted Section Score	36	1.68	60.48	56	1.68	94.08	108	1.68	181.44	36	1.68	60.48	21	1.68	35.28	380	1.68	638.4
c) Highway Characteristics																		
Carriageway std.	2	5	10	2	5	10	0	5	0	2	5	10	3	5	15	2	5	10
Design std. def.	5	5	25	3	5	15	5	5	25	4	5	20	5	5	25	5	5	25
Std. of structures	1	4	4	-	4	-	1	4	4	-	4	-	3	4	12	1	4	4
Std. of footways/ verges	3	1	3	2	1	2	0	1	0	2	1	2	4	1	4	2	1	2
Adequacy of ped. facilities	2	3	6	2	3	6	0	3	0	2	3	6	4	3	12	2	3	6
Network defect	2	2	4	3	2	6	4	2	8	2	2	4	3	2	6	4	2	8
Improvement by scheme	5	1	5	5	1	5	5	1	5	5	1	5	5	1	5	5	1	5
Network improvement	3	3	9	3	3	9	4	3	12	2	3	6	2	3	6	5	3	15
Highway Score	23		66	20		53	19		54	19		53	29		85	26		75
Weighted Section Score	66	1.37	90.42	53.	1.37	72.61	54	1.37	73.98	53	1.37	72.61	85	1.37	116.45	75	1.37	102.75
d) Environment & Conflict																		
Resid: traffic intrusion red.	-	40	-	0	40	0	4	40	160	-		-	-		-	3	40	120
Shopping, ind: ped/veh conflict reduction	-	28	-	-	28	-	-	28	-	-		-	-		-	5	28	140
Sensitive land-use disturbance red.	-	24	-	0	24	0	3	24	72	-		-	-		-	0	24	0
Envir. detriment reduction	0	34	0	0	34	0	-	34	-	0		0	0		0	0	34	0
Noise reduction	-	24	-	0	21	0	2	21	42	-		-	-		-	4	21	84
Parking relief	-	19	-	2	19	38	2	19	38	-		-	-		-	2	19	38
Severance relief	-	21	-	0	21	0	2	21	42	-		-	-		-	3	21	63
Environment Score	0		0	2		38	13		354	0		0	0		0	19		445
Weighted Section Score	0	0.15	0	38	0.15	5.7	354	0.15	53.1	0	0.15	0	0	0.15	0	445	0.15	66.75

DEVON (continued)

	Welltrees Bridge			Canniesburn Rd - Annan Dr			Canniesburn - Kinfauns - Annan Dr			Balmore Rd - Balmuildy Rd			Balmore Rd Bridge			Kirkintilloch Town Centre		
	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws
e) Commercial & Public Transport Undertakings																		
Current pub. tpt delays	1	2	2	2	2	4	2	2	4	1	2	2	2	2	4	4	2	8
Reduction in pub. tpt delays	2	2	4	2	2	4	1	2	2	1	2	2	2	2	4	4	2	8
Scheme incl. bus priority?	0	1	0	0	1	0	4	1	4	0	1	0	0	1	0	4	1	4
Contribute to HGV route?	4	4	16	2	4	8	2	4	8	4	4	16	3	4	12	4	4	16
Pub. Transport Score	7		22	6		16	9		18	6		20	7		20	16		36
Weighted Section Score	22	2.55	56.1	16	2.55	40.8	18	2.55	45.9	20	2.55	51	20	2.55	51	36	2.55	91.8
f) Development & Economy																		
Access to existing devt.?	1	44	44	2	44	88	3	44	132	3	44	132	0	44	0	3	44	132
Reqd. for future devt.?	0	27	0	0	27	0	0	27	0	0	27	0	0	27	0	3	27	81
Facilitate shop service by GV's?	0	23	0	0	23	0	0	23	0	0	23	0	0	23	0	3	23	69
Access to future resid. devt.?	0	21	0	0	21	0	0	21	0	0	21	0	0	21	0	0	21	0
Improve access to town centre devt.?	0	28	0	0	28	0	0	28	0	0	28	0	0	28	0	5	28	140
Facilitate extra-county communic.?	2	41	82	0	41	0	0	41	0	0	41	0	0	41	0	2	41	82
House demol. by scheme	5	25	125	5	25	125	5	25	125	5	25	125	5	25	125	5	25	125
Impact on agric.	5	30	150	5	30	150	5	30	150	5	30	150	5	30	150	5	30	150
Devt/Economy Score	13		301	12		263	13		407	13		407	10		275	26		779
Weighted Section Score	301	0.12	36.12	263	0.12	31.56	407	0.12	48.84	407	0.12	48.84	275	0.12	33	779	0.12	93.48
g) Cost Considerations																		
Scheme cost (£k)	456	-	-	1110	-	-	560	-	-	95	-	-	780	-	-	5800	-	-
Totals (a-f)	65		455 307.62	70		463 324.3	100		988 504.31	68		557 321.08	68		439 317.43	216		1780 1132.93
Rank (Weighted)			6			3			2			4			5			1
Final Cost Weighted Score			248.6			229.2			394.4			348.9			235.9			650
Rank			4			6			2			3			5			1

Key: s - score
w - weight
ws - weighted score
u - unweighted

	Welltrees Bridge			Canniesburn Rd - Annan Dr			Canniesburn - Kinfauns - Annan Dr			Balmore Rd - Balmuildy Rd			Balmore Rd Bridge			Kirkintilloch Town Centre		
	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws
a) Accidents (p.i.a.)																		
3-yr non-fatal	3	1	3	5	1	5	11	1	11	3	1	3	1	1	1	36	1	36
3-yr fatal	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0
			-			-			--			-			-			--
Accident Score			3			5			11			3			1			36
Weighted Section Score	15	4	60	25	4	100	55	4	220	15	4	60	5	4	20	180	4	720
b) Traffic Performance Score	3.8	1	3.8	18.5	1	18.5	6.08	1	6.08	0	1	0	15.3	1	15.3	522.7	1	522.7
Weighted Section Score	1.9	1.1	2.09	9.25	1.1	10.18	3.04	1.1	3.34	0	1.1	0	7.65	1.1	8.42	261.35	1.1	287.49
c) Environment																		
no. schools	0	5	0	0	5	0	1	5	5	0	5	0	0	5	0	0	5	0
no. shops etc.	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	116	1	116
			-			-			-			-			-			---
			0			0			5			0			0			116
Activity Score			0			0			3.5			0			0			10
no. properties																		
0 - 2 m	0	10	0	0	10	0	0	10	0	0	10	0	0	10	0	120	10	1200
2 - 5 m	0	8	0	0	8	0	0	8	0	0	8	0	0	8	0	1	8	8
5 - 10m	0	5	0	0	5	0	0	5	0	1	5	5	0	5	0	0	5	0
10m	0	1	0	31	1	31	76	1	76	1	1	1	1	1	1	0	1	0
			-			--			--			-			-			----
Total			0			31			76			6			1			1208
Property Score			0.0			0.12			0.3			0.02			0.0			4.8
Environmental Score			---			----			----			----			---			---
			0.0			0.02			0.65			.005			0.0			2.3
Weighted Section Score	0	2	0.0	2	2	4	65	2	130	.5	2	1	0	2	0	230	2	460
d) User Restraints																		
roundabouts/ signals	0	1	0	1	1	1	0	1	0	0	1	0	0	1	0	2	1	2
hills	1	1or2	2	2	1or2	2	2	1or2	2	1	1or2	1	0	1or2	0	1	1or2	1
width	2	1	2	2	1	2	1	2	2	0	1	0	1	1	1	0	1	0
visibility	3	1or.5	2.5	2	1or.5	1.5	1	1or.5	0.5	1	1or.5	1	1	1or.5	1	0	1or.5	0
other	0	1or.5	0	4	1or.5	2	5	1or.5	2.5	1	1or.5	.5	0	1or.5	0	10	1or.5	5
			---			---			---			---			-			-
			6.5			8.5			7			2.5			2			8
Restraint Score			1.03			3.4			2.52			1.09			0.92			5.7
Weighted Section Score	20.6	1	20.6	68	1	68	50.4	1	50.4	21.8	1	21.8	18.4	1	18.4	114	1	114
e) Strategic Implications																		
access -																		
journey to work			2			2			2			2			2			2
commercial			2			1			1			2			2			4
local			0			1			2			0			0			4
land release			0			-1			-3			0			0			0
			-			--			--			-			-			--
Strategic Score			4			3			2			4			4			10
Weighted Section Score	40	3	120	30	3	90	20	3	60	40	3	120	40	3	120	100	3	300
Weighted Total			202.69			272.18			463.74			202.8			166.82			1881.49
Rank			5			3			2			4			6			1
Cost Weighted Total			300.17			259.53			619.65			657.97			188.86			781.25
Cost Weighted Rank			4			5			3			2			6			1

Key: s: score
w: weight
ws: weighted score

	Welltrees Bridge			Canniesburn Rd - Annan Dr			Canniesburn - Kinfauns - Annan Dr			Balmore Rd - Balmuildy Rd			Balmore Rd Bridge			Kirkintilloch Town Centre		
	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws
a) Accidents																		
p.i.a. score																		
- before	3			5			11			3			1			36		
- after	1			3			5			1			1			10		
- change	2	3.6	7.2	2	2.2	4.4	6	2.2	13.2	2	3.6	7.2	0	3.6	0	26	2.2	57.2
Accident Score			7.2			4.4			13.2			7.2			0			57.2
b) Traffic																		
car + LG score	1.38	1	1.38	13.55	1	13.55	7.39	1	7.39	0	1	0	7.40	1	7.40	185.99	1	185.99
M + HGV score	.78	1	.78	.94	1	.94	.51	1	.51	0	1	0	.78	1	.78	24.16	1	24.16
bus score	.19	1	.19	9.15	1	9.15	4.99	1	4.99	0	1	0	.38	1	.38	63.11	1	63.11
pedestrian score	-	1	-	-	1	-	-	1	-	-	1	-	-	1	-	-	1	-
cyclist score	-	1	-	-	1	-	-	1	-	-	1	-	-	1	-	-	1	-
Traffic Score			2.35			23.64			12.89			0			8.56			273.26
c) Environment																		
noise																		
- before			0.0			13.95			34.2			0.0			0.0			18.15
- after			0.0			13.95			22.8			0.0			0.0			6.05
- change			0.0			0.00			11.4			0.0			0.0			12.10
other intrusion																		
- before			0.0			2.33			5.7			0.0			0.0			9.08
- after			0.0			0.0			5.7			0.0			0.0			0.0
- change			0.0			2.33			0.0			0.0			0.0			9.08
amenity																		
- before			0.0			0.11			0.46			0.0			0.0			2.63
- after			0.0			0.11			0.12			0.0			0.0			0.0
- change			0.0			0.0			0.34			0.0			0.0			2.63
Environment Score			0.0			2.33			11.74			0.0			0.0			23.81
d) Development																		
housing			0.0			0.0			0.0			0.0			0.0			-7.5
industry & commerce			0.0			0.0			0.0			0.0			0.0			350
Development Score			0.0			0.0			0.0			0.0			0.0			342.5
Total			9.55			30.37			37.83			7.2			8.56			696.77
Rank			4			3			2			6			5			1

Key: s - score
w - weight
ws - weighted score
u - unweighted

	Welltrees Bridge			Canniesburn Rd - Annan Dr			Canniesburn - Kinfauns - Annan Dr			Balmore Rd - Balmuildy Rd			Balmore Rd Bridge			Kirkintilloch Town Centre		
	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws
a) Through Movement																		
Bus journey length	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0
Bus journey time	0	3	0	1	3	3	0	3	0	0	3	0	1	3	3	1	3	3
Car journey length	0	1	0	0	1	0	-1	1	-1	0	1	0	0	1	0	0	1	0
Car journey time	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
Goods journey length	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Goods journey time	0	2	0	0	2	0	0	2	0	0	2	0	1	2	2	1	2	2
Larger/Heavier Lorries	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Through Movement	1-0		1-0	2-0		4-0	1-1		1-1	0-0		0-0	3-0		6-0	3-0		6-0
Score	= 1		= 1	= 2		= 4	= 0		= 0	= 0		= 0	= 3		= 6	= 3		= 6
b) Local Movement																		
Allows new bus service	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0
Allows larger buses	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
Roads for ind. devt.	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Roads for housing devt.	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
Roads for other devt.	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	1	2	2
Larger/Heavier Lorries	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Better ped. provision	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	1	2	2
Better car park prov.	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
Local Movement	0-0		0-0	0-0		0-0	0-0		0-0	0-0		0-0	0-0		0-0	2-0		4-0
Score	= 0		= 0	= 0		= 0	= 0		= 0	= 0		= 0	= 0		= 0	= 2		= 4
c) Environment/Safety																		
Improved service level	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Safety on improved route	1	2	2	1	2	2	0	2	0	0	2	0	1	2	2	0	2	0
Fewer affected by noise	0	2	0	0	2	0	1	2	2	0	2	0	0	2	0	1	2	2
Severance of farm units	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
Ped. accidents reduced	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	1	2	2
Less extraneous traffic	0	2	0	0	2	0	1	2	2	0	2	0	0	2	0	1	2	2
Less community severance	0	2	0	0	2	0	1	2	2	0	2	0	0	2	0	1	2	2
Safety in adj. streets	0	2	0	0	2	0	1	2	2	0	2	0	0	2	0	1	2	2
Environment/Safety	2-0		3-0	2-0		3-0	5-0		9-0	1-0		1-0	2-0		3-0	6-0		11-0
Source	= 2		= 3	= 2		= 3	= 5		= 9	= 1		= 1	= 2		= 3	= 6		= 11
d) Socio-economic and Land-Use Policies																		
Area of priority treatment	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Social initiative area	0	2	0	0	2	0	1	2	2	0	2	0	0	2	0	0	2	0
Early action area	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0
Urban renewal area	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Economic initiative area	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0
Avoids productive land	0	1	0	-1	1	-1	-1	1	-1	-1	1	-1	1	1	1	0	1	0
Preferred housing site	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Preferred ind. site	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0
Parking deficiency	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0
Strategic road scheme	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	1	3	3
Environmental relief	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	1	3	3
Socio-Economic & Land Use Policy Score	0-0		0-0	0-1		0-1	1-1		2-1	0-1		0-1	1-0		1-0	2-0		6-0
	= 0		= 0	=-1		=-1	= 0		= 1	=-1		=-1	= 1		= 1	= 2		= 6
e) Financial Implications																		
Pot. of prev. invst.	0	1	0	0	1	0	0	1	0	0	1	0	1	1	1	0	1	0
Complements invst.	0	1	0	0	1	0	0	1	0	1	1	1	0	1	0	1	1	1
Acceptable rate of return	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
No rise in rev. budget	1	1	1	0	1	0	-1	1	-1	0	1	0	1	1	1	0	1	0
Road at end of econ. life	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
Financial Score	1-0		1-0	0-0		0-0	0-1		0-1	1-0		1-0	2-0		2-0	1-0		1-0
	= 1		= 1	= 0		= 0	=-1		=-1	= 1		= 1	= 2		= 2	= 1		= 1
Totals	4-0		5-0	4-1		7-1	7-3		12-3	2-1		2-1	8-0		12-0	14-0		28-0
	= 4		= 5	= 3		= 6	= 4		= 9	= 1		= 1	= 8		= 12	= 14		= 28
Weighted Score/£m			11			6			21			21			15			5
Rank: U			3=			5			3=			6			2			1
W			5			4			3			6			2			1
W/£m			4			5			1=			1=			3			6

Key: s - score
w - weight or weighted
ws - weighted score
u - unweighted

V WEST MIDLANDS PAT

	Welltrees Bridge			Canniesburn Rd - Annan Dr			Canniesburn - Kinfauns - Annan Dr			Balmore Rd - Balmuildy Rd			Balmore Rd Bridge			Kirkintilloch Town Centre		
	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws	s	w	ws
a) Road hierarchy	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0	0	3	0
b) Constriction of development	0	11	0	0	11	0	0	11	0	0	11	0	0	11	0	1	11	11
c) Delays to vehicular traffic	0	10	0	0.5	10	5	0	10	0	0.5	10	5	3	10	30	0	10	0
d) Ped. and cycle problem	0	6	0	1	6	6	1	6	6	0	6	0	0	6	0	4	6	24
e) Accident problem	1	6	6	1	6	6	1	6	6	1	6	6	1	6	6	3	6	18
f) Public transport trouble spot	0	10	0	1	10	10	1	10	10	0	10	0	0	10	0	2	10	20
g) HGV problem	1	7	7	1	7	7	2	7	14	1	7	7	3	7	21	3	7	21
h) Specific highway problm	0	2	0	1	2	2	2	2	4	1	2	2	2	2	4	2	2	4
i) Envir. effect - noise	0	3	0	1	3	3	1	3	3	0	3	0	0	3	0	3	3	9
j) Envir. effect - visual/social intrusion	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	3	4	12
k) Parking problem	0	2	0	1	2	2	0	2	0	0	2	0	0	2	0	1	2	2
l) Maintenance difficulty	0	2	0	0	2	0	1	2	2	1	2	2	2	2	4	3	2	6
Totals	2		13	7.5		41	9		45	4.5		22	11		65	25		127
Weighted Rank		6			4			3			5			2			1	

Key: s - score
w - weight
ws - weighted score
u - unweighted

VI WEST SUSSEX PAT

	Welltrees Bridge			Canniesburn Rd - Annan Dr			Canniesburn - Kinfauns - Annan Dr			Balmore Rd - Balmuildy Rd			Balmore Rd Bridge			Kirkintilloch Town Centre		
	S	W	WS	S	W	WS	S	W	WS	S	W	WS	S	W	WS	S	W	WS
a) Mobility																		
Overload (links)	0.29	14.8	4.29	0.58	14.8	8.58	0.53	14.8	7.84		14.8		1.26	14.8	18.65	1.29	14.8	19.09
Delay (junctions)	-	-	-	-	-	-	-	-	-	57969	2.5×10^{-5}	1.45	-	-	-	-	-	-
Mobility Score			4.29			8.58			7.84			1.45			18.65			19.09
b) Safety																		
Accident rate	2.86	2.71	7.75	4.26	2.71	11.54	10.59	2.71	28.70	2.69	2.71	7.29	0.77	2.71	2.09	34.74	2.71	94.15
Safety Score	2.86	2.71	7.75	4.26	2.71	11.54	10.59	2.71	28.70	2.69	2.71	7.29	0.77	2.71	2.09	34.74	2.71	94.15
c) Environmental Problems																		
Noise	-			0			0			2			-			2		
Urban fabric detriment	-			-			-			-			-			3		
Severance	-			0			3			0			-			3		
Ped/veh conflict (town centres)	-			-			-			-			-			4		
Residential nuisance	-			2			3			1			-			3		
Environment Score	-			2	1.43	2.86	6	1.43	8.58	3	1.43	4.29	-			15	1.43	21.45
Total		12.04			22.98			45.12			13.03			20.74			134.69	
Rank		6			3			2			5			4			1	

Table 2

Introduction of Cost Considerations into the PATs

	Scheme					
	1	2	3	4	5	6
cost (£m)	.456	1.10	.560	.095	.780	5.80
Devon						
weighted total	307.6	324.3	504.3	321.1	317.4	1132.9
rank	6	3	2	4	5	1
weighted tot/cost	248.6	229.2	394.4	348.9	235.9	650.0
rank	4	6	2	3	5	1
Gloucestershire						
weighted total	202.7	272.2	463.7	202.8	166.8	1881.5
rank	5	3	2	4	6	1
weighted tot/cost	300.2	259.5	619.7	658.0	188.9	781.3
rank	4	5	3	2	6	1
S. Yorkshire						
weighted total	9.6	30.4	37.8	7.2	8.6	696.8
rank	4	3	2	6	5	1
weighted tot/cost	21.1	27.6	67.5	75.8	11.0	120.1
rank	5	4	3	2	6	1
Strathclyde						
weighted total	5.0	6.0	9.0	1.0	12.0	28.0
rank	5	4	3	6	2	1
weighted tot/cost	11.0	6.0	21.0	21.0	15.0	5.0
rank	4	5	1=	1=	3	6
W. Midlands						
weighted total	13.0	41.0	45.0	22.0	65.0	127.0
rank	6	4	3	5	2	1
weighted tot/cost	28.5	37.3	80.4	231.6	83.3	21.9
rank	5	4	3	1	2	6
W. Sussex						
weighted total	12.0	23.0	45.1	13.0	20.7	134.7
rank	6	3	2	5	4	1
weighted tot/cost	26.3	20.9	80.5	136.8	26.5	23.2
rank	4	6	2	1	3	5

3.3 Analysis by PAT Objective: Now we disaggregate the PATs according to what they evaluate.

problem severity: Gloucestershire and West Sussex. These PATs seem to accord reasonably well overall, agreeing on ranks 1, 2, and 3 for Kirkintilloch and the two Canniesburn schemes respectively. Nevertheless, there are some major differences between them in the relative scores of schemes. In the cost weighted rankings, however, there are greater differences, although they agree on rank 4.

Solution efficacy: As Strathclyde is the only PAT in this category, direct comparison is not possible.

Problem severity and solution efficacy: Devon, South Yorkshire and West Midlands are the three PATs of this type. They all agree on rank 1, while Devon and South Yorkshire also concur on ranks 2, 3 and 5, differing only on the other two. Once again, however, the relative points scored by the respective schemes differ significantly between the techniques. In cost related terms, Devon and South Yorkshire agree that Kirkintilloch remains first, but differ on all 5 other ranks; while South Yorkshire and West Midlands agree on ranks 3, 4 and 5.

Overall, then, it appears that there is some correspondence in rankings between PATs designed to evaluate problems, solutions or both. But differences in internal structure, variable definition and weighting do account for signficant variation. The degree of correspondence between PATs in each category is approximately the same for cost weighted scores as for scores excluding cost. Given that scheme costs are constant between PATs, this is not surprising.

3.4 Scheme Size and Distortion of Results: Some distortion of results was expected in that several of the schemes included in this sample are out of the design cost range of one or more of the PATs. This is true particularly with Kirkintilloch, which, at £5.8m, is many times costlier than the ceiling of £250k for the South Yorkshire PAT. Some of the variables included in the South Yorkshire PAT are clearly geared mainly to the smaller end of the cost spectrum e.g. with respect to footway deficiency and provision. Conversely, some variables to account for strategic issues appropriate to large bypass-type schemes are not included. It is thus interesting that the rankings obtained with this technique did not differ all that much from those of the Devon PAT, with which it is most directly comparable, but which is designed for schemes > £250k. Although the Strathclyde PAT is not directly comparable, since it measures solution efficacy only, its rankings were compatible with the problem and solution PATs at the extremes, differing only on the intermediate rankings. Given the potential comparability problems referred to earlier, it is difficult to be more precise here.

3.5 Inapplicability or Inappropriateness: A feature of the analysis is that, irrespective of scheme type or cost,

significant parts - or even sections - of every PAT were inapplicable to each scheme (see Table 1). In some cases this is a reflection of the original design and principal use of individual PATs. The South Yorkshire and West Midlands PATs, for example, were designed for urban schemes, and thus lack questions relating to agricultural land take or severance. And according to officials, the Gloucestershire method has never been used to evaluate a complex urban bypass such as Kirkintilloch. Taken in conjuction with point 3.4 above, this may render particular PATs as a whole technically inappropriate to certain schemes. A related but distinct aspect of the problem is that in respect of the bigger, more comprehensive techniques, most notably Strathclyde and Devon, it is inevitable that no one scheme will score on all variables. Only Kirkintilloch scored under each of the five headings (sections) of the Strathclyde PAT, and even so, on only 14 of the 39 variables. This is a high score, reflecting the size and diverse impacts of the scheme. Officials do not expect average schemes to score on more than roughly 5-7 variables, and these are usually concentrated under one, two or perhaps three headings (vide Welltrees Bridge, Canniesburn Rd. to Annan Drive, and Balmore Rd. - Balmuildy Rd. junction, in the present sample). This is merely a consequence of the fact that many small and intermediate schemes are designed to overcome particular problems in the safety, traffic or environmental spheres. The smaller a scheme, the more limited its impact will normally be. For this reason, officials examine not only the weighted score and cost weighted scores, but also the unweighted score and number of variables on which schemes have scored.

Even with smaller PATs, such as South Yorkshire, few schemes score on all variables and headings. This is seen as an inevitable conseiquence of applying a uniform framework to diverse project types, and is not regarded as problematic.

3.6 Need for Appropriate Variables, Points and Weights: Arising from this, though, is an important issue. Unlike the Strathclyde method, the other point scoring PATs produce rankings which imply that the higher the score, the more urgent the problem and/or the more effective the solution. The score may or may not be directly related to cost, but in a situation where the bulk of a scheme's points are derived from only a few headings, it is vital that the different variable and section points and weights are both realistic and satisfactory. This is because the assumption underlying these methods is that traffic, safety, environmental, developmental and financial variables can be equated in a particular value system.

From the experience of this comparative exercise, it appears that some problems do exist in this sphere. Four are cited here to highlight different points of methodlogy and interpretation. This should not be taken as representing a complete list.

(i) the data requirements for the environment section of the Gloucestershire PAT are interesting and very relevant; however,

the method of calculation appears to lose major differences between schemes in both the scores and weights, and also reduces environment to insignificance compared with the other sections. Were this the desired outcome, a less complex procedure would seemingly have sufficed.

(ii) The Gloucestershire traffic performance heading, which compares actual performance with that pertaining under ideal conditions, requires rather complex calculations. The version as documented uses speed/flow relationships from TRRL LF 170. This is designed for rural schemes and is unsuitable for urban situations. Partly to overcome this problem, COBA flow data are now used instead, but they too are geared essentially to rural schemes. Experience with this sample of schemes suggests that the method is insufficiently sensitive to distinguish the value of different scheme types. For example, the Balmore Rd. - Balmuildy Rd. junction, designed primarily to promote safety and reduce feed-in waiting times, comes out at zero since no speed change or increased flow occur on the main link through the junction. Conversely, the Kirkintilloch bypass scores very highly indeed because of the great change in speeds, even if one were to assume a margin of error in their accuracy.

(iii) Another example of the need for care in determination of variables and their respective point and weight allocations is provided by the South Yorkshire PAT. Inspection of the traffic and environment sections shows that relatively small changes from the 'before' to 'after' situations can give rise to large differences in scores, depending on the weights attached. Clearly, this may distort the outcome where a diverse sample such as this is being evaluated. Perhaps the effect is more acute here because of the size of most schemes included, but the general point remains valid.

(iv) The converse may also be true. The West Midlands PAT, for example, scores vehicular delay using delay bands of different width, e.g.

0 - 0.9	thousand	veh.	hrs/	mill.	vehs	=	0.0
1 - 1.9	"	"	"	"	"	=	1.0
. .							.
. .							.
5 - 6.9	"	"	"	"	"	=	2.5
7 - 8.9	"	"	"	"	"	=	3.0
9 - 11.9	"	"	"	"	"	=	3.5
>12	"	"	"	"	"	=	4.0

Thus Kirkintilloch, which experiences a 75% reduction in delays from the 'before' to 'after' situation, scores 4 in both cases, because of the high absolute values. The net score is thus 0. This is a clear anomaly.

(v) The Devon PAT provides a good example of separate variable and section weights used in combination. In such a situation, particular care is obviously necessary to avoid

distortions caused by compounding or diminution of differences between section scores. For example, individual variable weights in the environment and conflict, and development and economy sections produce very high weighted scores, which are then counteracted by the overall section weights. Conversely, the accident and highway characteristics scores are magnified by the section weights, so that their final scores are greater than the previous two. While this final balance may, in fact, accurately reflect council policies and priorities, the procedure raises the question of why such high points and weights are initially allocated to the environment and development variables.

3.7 PAT Size not Necessarily Problematic: Overall, though, the Devon PAT illustrates well that a comprehensive technique, in terms of the number of variables incorporated, need not be complex or clumsy to use in practice. In fact, to outsiders, it was one of the simplest tested here, because of the clear layout, definition of variables and categories even where subjective assessment is called for, and absence of complex formulae. Much the same is true of the Strathclyde PAT, although it was not used in such a detailed manner, since the scheme appraisal sheets were obtained in completed form.

3.8 Allocation of Points between PAT Sections: Comparison of the PATs was also undertaken in terms of the percentage of points allocated to each scheme under the respective PAT sections. The PATs were then ranked according to their percentage of points in each section (Table 3). The objects of this exercise were:

- to examine differences in scheme performance by section in the various PATs.

- to establish whether any systematic bias in favour of or against particular sections emerged in the use of any technique.

In three cases, PAT sections had to be divided between the objective headings adopted in Table 3; this was done on a proportional basis where possible (Strathclyde's Environnment and Safety section) or split on a 50:50 basis if this appeared a close and reasonable approximation (Gloucestershire's User Restraints section; and Devon's Highway Characteristics section, both divided between traffic and safety).

One further procedural point with respect to the Strathclyde PAT, warrants mention at this stage: where negative as well as positive scores are involved, they have been used here without regard to sign. This was felt necessary to give a true indication of the number of sections and variables under which individual schemes scored, especially because this PAT awards only indicative points (-1, 0, +1) rather than true points, as explained earlier. Again, this creates problems of direct comparability with the other PATs. Use of net section scores (i.e. taking sign into account), would be impractical since some individual section totals would then exceed the net total PAT score. The Strathclyde officers have confirmed that this

Table 3

Percentage Distribution of Points Scored by the Six Schemes by Broad Objective in Each PAT*

Scheme

	Welltrees Bridge		Canniesburn Rd - Annan Dr		Canniesburn - Kinfauns - Annan Dr		Balmore Rd - Balmuildy Rd		Balmore Rd Bridge		Kirkintilloch Town Centre	
PAT	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
Devon												
Traffic	54	3	48	4	36	5	55	2	60	1	25	6
Safety	34	4	40	3	43	2	30	5	29	6	61	1
Environment	0	4=	2	3	11	1	0	4=	0	4=	6	2
Planning	12	2	10	3=	10	3=	15	1	10	3=	8	6
Financial Implic.	0		0		0		0		0		0	
Gloucestershire												
Traffic	6	4=	16	2	6	4=	5	6	11	3	18	1
Safety	35	4=	49	2	53	1	35	4=	18	6	41	3
Environment	0	4=	1	3	28	1	0	4=	0	4=	4	2
Planning	59	2=	33	4	13	6	59	2=	72	1	16	5
Financial Implic.	0		0		0		0		0		0	
S. Yorkshire												
Traffic	25	5	78	2	34	4	0	6	100	1	39	3
Safety	75	2	14	4	35	3	100	1	0	6	8	5
Environment	0	4=	7	2	31	1	0	4=	0	4=	3	3
Planning/Development	0	2=	0	2=	0	2=	0	2=	0	2=	49	1
Financial Implic.	0		0		0		0		0		0	
Strathclyde (u)**												
Traffic	25	3	20	4=	20	4=	0	6	38	1	36	2
Safety	20	2=	24	1	20	2=	13	5	10	6	17	4
Environment	30	2=	36	1	30	2=	20	5	15	6	26	4
Planning	0	5=	0	5=	20	2	33	1	13	4	14	3
Financial Implic.	25	2=	20	4	10	5	33	1	25	2=	7	6
Strathclyde (w)**												
Traffic	20	4	50	1=	13	5	0	6	50	1=	36	3
Safety	24	1=	15	4	24	1=	13	5	10	6	16	3
Environment	36	1=	23	3=	36	1=	20	5	15	6	23	3=
Planning	0	6	12	4	20	3	33	1	8	5	21	2
Financial Implic.	20	2	0	6	7	4	33	1	17	3	4	5
W. Midlands												
Traffic	54	5	71	4	73	2=	73	2=	91	1	51	6
Safety	46	1	22	4	20	5	27	2	9	6	24	3
Environment	0	4=	7	2=	7	2=	0	4=	0	4=	17	1
Planning	0	2=	0	2=	0	2=	0	2=	0	2=	9	1
Financial Implic.	0		0		0		0		0		0	
W. Sussex												
Traffic	36	3	37	2	17	4	11	6	90	1	14	5
Safety	64	2=	50	5	64	2=	56	4	10	6	70	1
Environment	0	5=	12	4	19	2	33	1	0	5=	16	3
Planning	0		0		0		0		0		0	
Financial Implic	0		0		0		0		0		0	

Footnotes

* This comparison uses the weighted scores, but not divided by cost. Strathclyde appears in both unweighted and weighted forms, since both are used in decision-making.

** These % calc. on basis of the sum of pos + neg scores.

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interpretation corresponds to their own practices.

The analysis in Table 3 shows that there are indeed major differences in percentage points allocation for a single scheme between techniques. Under traffic, for example, the percentages and ranks for Welltrees Bridge range from 6% (4th =) in the Gloucestershire PAT to 54% (3rd and 5th) in the Devon and West Midlands cases. All the techniques actually rank Welltrees Bridge 3rd, 4th or 5th. Conversely, 4 PATs rank the Balmore Rd. - Balmuildy Rd. junction 6th under traffic, while the remaining 2 rank it 2nd. Somewhat perversely, Kirkintilloch's traffic ranking ranges from 1st (18%) with the Gloucestershire PAT to 6th (51%) with the West Midlands PAT. The same scheme's environment ranking varies from 1st (17%) with the West Midlands Pat to 4th (26%) with the unweighted Strathclyde PAT. Overall, it is noteworthy that schemes score poorly on traffic (<19%) with the Gloucestershire PAT, but highly (>50%) with the West Midlands PAT, while West Sussex awards >50% of its points on safety in 5 of the 6 schemes.

These few examples suffice to show that both the relative rankings and especially also the percentage allocations of points between sections differ greatly between techniques. This holds true even when the PATs are analysed in the subsets evaluating problems only and problems-and-solutions respectively.

3.9 The Appropriateness of Different Cost Indices: The issue of cost-related scoring warrants further comment. All authorities take account of scheme costs at some stage in their planning and priority assessment process. Current pressures on capital budgets make this inevitable. The manner in which this occurs, however, differs widely. Whether directly included in the PATs or not, cost is one of the criteria used in matching the available budget to priorities established via the PATs. Where PATs are not used, cost may even be the prime consideration.

As stated above, the Devon, Gloucestershire and Strathclyde PATs actually incorporate scheme costs within their structures, as a value for money indicator. However, each uses a different measure of cost, thus raising the question of which formulation is most appropriate. The simplest and logically most appropriate is to divide the scheme score by cost to give 'points per £k or £m, as do Strathclyde (although their points scores are not cardinal measures - see pp.2-3 above). South Yorkshire, West Midlands and West Sussex also use this index in their assessments.

Devon multiply the weighted scheme scores by the ratio [log 141/log cost], where log is the log to base 10, and 141 is the current cost index.

Gloucestershire use the square root of cost, to avoid the problem of smallest schemes scoring highest (This is the mirror image of large schemes scoring highest when costs are ignored).

Officers of these two authorities argue that their formulations

achieve a better balance between large and small schemes by using a less 'extreme' measure of cost.

In order to throw some light on the practical implications of using different cost measures, a sensitivity analysis was undertaken with the Gloucestershire PAT on the 6 sample schemes. The results are given in Table 4. Cost-weighted scores and ranks were calculated using the three measures cited above, namely

(i) weighted scheme score/cost
(ii) weighted scheme score/square root of cost
(iii) weighted scheme score x [log141/log cost]

It should be noted that (i) and (ii) are not sensitive to the units in which cost is expressed (£k or £m), in the sense that both the rankings and the ratios between the actual scores of any pair of schemes remain constant. With (iii), however, use of £m creates negative scores in 4 cases and does therefore affect both ranks and score ratios.

Table 4

Schemes Ranked y the Gloucestershire PAT

Using 3 Different Cost Measures

		Scheme					
		1	2	3	4	5	6
(i)	£m	444.5	247.5	828.0	2134.7	213.8	324.4
		3	5	2	1	6	4
(ii)	£k	9.49	8.21	19.59	20.81	5.97	24.71
		4	5	3	2	6	1
(ii)	£m	300.2	259.5	619.7	658.0	188.8	781.3
		4	5	3	2	6	1
(iii)	£k	163.8	192.4	362.6	220.4	124.0	1074.5
		5	4	2	3	6	1

Each index yielded a different ranking, although Scheme 5 (Balmore Rd. bridge) performed least well in all three. Clearly, therefore, the choice of cost measure is important, and in the

absence of methodologically sound explanations of how (ii) and (iii) have been derived, it must be concluded that pure cost is the most appropriate measure. It is directly analogous to the NPV/C calculation (i.e. the benefit : cost ratio) in cost benefit analysis. NPV is, of course, equivalent to the total weighted score here.

If, however, this procedure results in the selection of too many small schemes for implementation in terms of staff and equipment resources, and no ready expansion of these resources is possible, some adjustment procedure is necessary. But it is generally unsound to solve one problem by manipulating calculations in a manner which introduces another (methodological) problem. One possible solution would be to compare the project rankings both with and without cost weightings, accepting first those schemes which score highly in both lists, then schemes highest on one or other list, within the budget constraint and other political factors as required e.g. the need to obtain a balanced geographical spread. It is well-nigh impossible to avoid bias altogether, without using integer mathematical programming techniques (e.g. Weingartner 1963), which are clearly inappropriate to the type of easy to use application dealt with here.

4. CONCLUSIONS

The foregoing analysis has shown that the priority assessment techniques considered provide widely differing project rankings and emphasis on the respective objectives for the cross sectional sample of six diverse schemes.

This outcome is not surprising, and indeed was anticipated, since PATs are designed by individual authorities in accordance with their own requirements, data capabilities, policies and so forth. Comparative analysis was also hindered by the fact that the PATs differ in structure, complexity, variable definition, nature of points scoring and weighting procedures, use within the planning process, and relevant scheme cost ranges.

When problem, solution, and problem-and-solution oriented PATs were considered separately, the variation was markedly reduced, although comparison was then possible only between three problem ranking PATs on one hand and two problem-and-solution ranking PATs on the other.

Despite all the above caveats, the overall implication of the exercise is that a distinct lack of uniformity or standardisation exists between local authorities in their methods and procedures for assessment of priorities in the road improvement sphere. Closer congruence is undoubtedly desirable, particularly in this age of increasingly severe financial stringency and the commensurate need to demonstrate the optimal utilisation of such funds as are made available. How this might best be tackled forms the subject of Phase 3 of this project.

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