Priority Assessment Techniques for British Local Authority Highway Schemes

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Since the mid-1970s, many British local authorities have developed analytical tools to establish a set of priorities among competing highway scheme proposals. These priority assessment techniques (PATs) vary greatly in terms of structure, complexity, data requirements, diversity of schemes to which they are applied, and role within the planning process. Nevertheless they all seek to reduce multivariate information on different projects to a common base, thereby permitting comparison and the setting of priorities in order to optimize the use of scarce capital resources. In this paper, PATs currently used by the local authorities are compared and evaluated, and ways of improving and streamlining their application are suggested. A diverse sample of six PATs is tested on a common set of six highway schemes that have different impacts and costs. The widely different project rankings thus obtained suggest the need for a more homogeneous approach to PAT development and use, and the paper concludes with an outline of a methodology for achieving this.

Local authorities in Great Britain have responsibility for all roads except the 15 030-km motorway and trunk road network, and their highway investment expenditure reached £721 million in 1985–1986. There have, however, been two significant changes in local authority structure in the last 13 years. In 1974 local government underwent a major reorganization, which concentrated highway responsibilities in the hands of a smaller group of English and Welsh counties and Scottish regions. In addition to the existing Greater London Council, six metropolitan county councils were designated in England, covering Greater Manchester, Merseyside, South Yorkshire, Tyne and Wear, West Midlands, and West Yorkshire. Then in 1986 these seven councils were abolished and most of their highway responsibilities devolved to 69 metropolitan boroughs and districts. These changes have certainly had a notable effect on local authority highway investment decision making and capital allocation policy.

The 1974 reorganization brought with it a number of conflicting pressures on these new authorities and the professionals who advised them. Many authorities inherited large highway programs at a time when financial pressures, reaction against highway construction, and concern over blight meant that many highway schemes would not be implemented. Procedures were therefore required for selecting preferred projects from large pools of disparate schemes in wide geographic areas.

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Three further requirements for any such assessment could be discerned:

1. The need to reflect the wider range of objectives then emerging for transport policy, particularly environmental, planning, and equity issues;
2. The ability to be executed rapidly without undue reliance on complex transport planning models and cost-benefit techniques, which were then increasingly being questioned; and
3. The need for development in consultation with politicians, reflecting the changing relationship between politicians and professionals in the decision-making process.

Several local authorities responded, largely independently, by developing a range of priority assessment techniques (PATs). The purposes for which they were designed included problem assessment, comparison of alternative solutions to problems, coarse sieves to eliminate less urgent or attractive schemes, and establishing detailed priorities among schemes. Although the methods themselves differed, their documentation suggested a degree of uniformity in the criteria on which they were developed (*1–4*):

- Inclusion of the full range of transport policy objectives;
- Assessment of the severity of problems as well as the efficacy of solutions in most cases;
- Adaptability to different kinds of data source;
- Reliance on readily available data;
- Simplicity of execution;
- Adaptability to different value judgments and priorities among objectives;
- Identification of any implicit value judgments; and
- Provision of output as a decision-making guide, not an apparently "right" answer.

These criteria are broadly comparable with those for the Leitch framework, which was being developed for the central government's Department of Transport at the same time (*5–7*) and which also had its roots in multiple criteria assessment methods (*8, 9*). Recent work for the Department of Transport's Urban Roads Appraisal Report (*10*) uses a similar form of analysis but only to examine alternative solutions to a single problem.

In 1986 the Greater London Council and six English metropolitan county councils, many of which had been pioneers in this field, were abolished, but there has been renewed interest among their successor authorities in the shire counties and Scottish regions. Although the Welsh Office has developed a common procedure for use by Welsh counties (*11, 12*), there is still considerable diversity of methods within Britain.

In the United States, many departments of transportation have developed their own schemes for assessing both highway expenditure and public transport support (*13–15*). As is the case in the United Kingdom, and despite some attempts at coordination, a heterogeneous set of systems has emerged. Perhaps because the physical scale and institutional settings are different, the emphasis in U.S. work appears to have been placed on easily implementable sifting systems, intended to eliminate from detailed analysis at an early stage large numbers of schemes with low probabilities of being implemented. Nonetheless, there is a substantial enough core of common interest and shared methodological approach to make cross-fertilization among the approaches employed on each side of the Atlantic potentially valuable.

After earlier exploratory work (*16*) the Institute for Transport Studies has been engaged for the last 18 months on a project sponsored by the Economic and Social Research Council to investigate the range of priority assessment techniques in use; compare their structures, assumptions, and applications; and investigate ways of streamlining their use. In this paper the characteristics of PATs are outlined, a detailed comparative analysis of a sample of methods is discussed, and brief comments are offered on the implications of this exercise for further refinement of such techniques.

PRIORITY ASSESSMENT TECHNIQUES

General Considerations

The PATs developed by local authorities are, with few exceptions, of the points-scoring variety. They are a form of multiattribute decision-making tool designed to facilitate direct comparison of diverse projects. A series of variables relating to traffic, safety, environment, and other relevant issues is defined. These may be measured objectively or subjectively. The evaluating officer gives each problem or solution a score against each variable. These are then summed to produce an aggregate numerical score for each problem or solution. In other words, multidimensional data are reduced to unidimensional form. In addition, each variable or group of variables can be given a weight to reflect policy considerations.

Initial enquiries to 61 English and Welsh counties and Scottish regions drew an encouraging response from 38 (63 percent). Twelve respondents did not use a formal PAT or were only in the early stages of developing one. Two declined to cooperate. Analysis therefore proceeded on the PATs reported by 24 local authorities plus the Welsh Office (*7, 17*). Not all were still in regular use; conversely, a few authorities had developed more than one PAT. Some authorities use the Leitch framework (*5*), the Department of Transport's COBA computer cost-benefit analysis package for major interurban schemes (*18*), or the department's Roads 502 assessment method for small schemes (*19*) instead of, or in addition to, their own PATs. However, these have not always proved appropriate (*7*). Interest in the work of the Institute for Transport Studies was marked; numerous requests for details of the project output were received.

Because of the great diversity of techniques, categorization was attempted using eight possible criteria relating to the internal structure of the techniques and their use within the planning process. Several potentially appealing criteria, such as (a) the cost band of the scheme to which they are applied; (b) whether they are used for inter- or intrabudget ranking; and (c) whether they evaluate problem severity, degree of relief expected, or both, were not used as classificatory tools at this stage because of either insufficient or excessive variation for useful categorization.

Types of Variables

More than 70 percent of the PATs reported have at least some explicitly subjective variables as well as objective ones. "Subjective" means that an officer is required to use judgment in scoring (e.g., decide among categories describing the seriousness of blight).

Number of Variables

With respect to the number of variables in each PAT, several clear categories were distinguishable (Table 1). In practice, this serves as a proxy for the range of information covered because there is a broad correlation between the number of variables and a PAT's comprehensiveness. The methods of the local authorities listed as examples on the right of Table 1 were selected as a representative sample for more detailed comparative analysis of their structure. The availability of documentation and the willingness of officers in the respective local authorities to provide additional assistance as necessary were obviously also prerequisites.

TABLE 1 NUMBER OF VARIABLES IN PATs

Variable Range	No. of PATs	Examples
1–5	4	Gloucestershire
6–10	10	South Yorkshire, West Sussex
11–15	7	West Midlands
16–20	0	
More than 20	4	Devon, Strathclyde

Points System

All of the PATs list a series of relevant variables, often grouped under headings or sections covering traffic, accidents, environment, planning, development, and so forth, against which measured or imputed data are entered. Three-quarters of the techniques use a points-scoring mechanism to compare problems or schemes. Points can be allocated to each variable either by using set conversion rates or thresholds (e.g., one point per 250 vehicles) or by assigning points to particular categories (e.g., no problem = 0, very severe problem = 5). The latter is mostly used for subjective variables. Point ranges can be either open (unbounded) or closed (fixed) range scores (e.g., 0–4 or 1–5). Again, the latter are commonly used with categorical data or subjective variables.

Weighting System

The purpose of a weighting system is to provide a coherent technical or policy-related basis for discriminating among variables. Sixty percent of the PATs attach weights to at least some variables or sections. In some cases, the weights are attached by officers using their technical judgment of relative importance; in others the weights are derived directly or indirectly from council policy statements in documents such as Transport Policies and Programmes (TPPs) and Structure Plans. Both entire sections and individual variables can in theory be weighted, but this may compound the effect if not designed carefully. For simplicity, the weights are most commonly integers, but fractions occur too. In one case (the Welsh Office's SCRAM technique), weights sum to 1 within and between sections in a tree structure (*12, 20*). This approach has great methodological appeal.

QUANTITATIVE COMPARISON OF SIX PATs

Techniques

Even the six PATs selected for detailed comparison differ significantly in the way they measure and calibrate basic traffic and accident data. Other differences in coverage, structure, and use within the planning process are evident:

1. Gloucestershire (5 factors). Other attributes: points scoring, all variables weighted, objective variables only, evaluates problem severity only, applied to all scheme sizes.
2. South Yorkshire (7 factors). Other attributes: points scoring, some variables weighted, objective and subjective variables, evaluates problem severity and solution efficacy, applied to schemes < £250,000.
3. West Sussex (8 factors). Other attributes: points scoring, all variables weighted, objective and subjective variables, evaluates problem severity only, applied to all scheme sizes.
4. West Midlands (12 factors). Other attributes: points scoring, all variables weighted, objective variables only, evaluates problem severity and solution efficacy, applied to all scheme sizes.
5. Strathclyde (39 factors). Other attributes: points scoring, all variables weighted, objective and subjective variables, evaluates solution efficacy only, applied to all scheme sizes. This PAT does not employ fixed or open score ranges in the manner common to other techniques. It awards only scores of +1, 0, and –1 for significant positive, insignificant or zero, and significant negative impacts of schemes, 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 sections heads and variables under which individual schemes have scored because two or more schemes with the same total points may well have quite different characteristics and scores on different variables.
6. Devon (43 factors). Other attributes: points scoring, all variables weighted, objective and subjective variables, evaluates problem severity and solution efficacy, applied to schemes > £250,000.

Details of the six techniques are given in Simon (*21*). Some indication of the degree of variation within the set of techniques and of the input requirements of the techniques themselves can be gathered from Tables 2 and 3, which list, respectively, the variables used in the smallest (Gloucestershire) and largest (Devon) of the PATs studied in detail.

TABLE 2 VARIABLES USED IN THE GLOUCESTERSHIRE PAT

Variable	Name	Description
I	Accidents	Number of accidents
II	Traffic performance	Route efficiency
III	Environment	Environmental impact
IV	User restraints	User restraint impact
V	Strategic and planning implications	Implications for strategic access and other planning objectives

PATs in the Planning Process

As is evident from the preceding comments, PATs are used in different ways in the respective local authorities' planning processes. In general, simple techniques (which may be unweighted) are used only for preliminary problem identification; more complex (and usually weighted) PATs have the potential for use in successive stages of the planning process, ultimately producing final or nearly final scheme rankings.

It is important to appreciate the applications of the six 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 or potential schemes, or both; and detailed evaluation and ranking). Initial sifting characteristically attempts to discard proposals that, 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, along with comparison of the optimal solutions to each problem.

Problem-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 projects and detailed evaluation. Logically, therefore, PATs intended for use in all planning stages should incorporate both problem and solution components to yield a measure of how well proposed schemes alleviate the problems. Table 4 gives a summary of each authority's use of its PAT. Some overlap between planning stages may occur in practice.

In some cases schemes may be eligible for grants from the Department of Transport through the TPP system or from the European Community's European Regional Development Fund (ERDF). Availability of these funds may affect the mix of schemes finally implemented.

Comparative Exercise

Notwithstanding these differences and the problems they pose for direct comparison, it was resolved that direct quantitative testing of a sample of schemes should be attempted with the

TABLE 3 VARIABLES USED IN DEVON PAT

Variable	Name	Description
I	Traffic	Estimate 1991 August flow Estimate 1991 April flow Existing August congestion Existing April congestion Network impairment by local traffic Network improvement from scheme Proportion of heavy goods vehicles Route relevance to functional route network
II	Accidents	Personal injury accidents (existing road) Pedestrian accidents Fatal accidents Scheme's estimated personal injury accident reduction Scheme's estimated pedestrian accident reduction Scheme's estimated fatal accident reduction Accident-reducing efficacy of cheap safety scheme
III	Highway characteristics	Existing carriageway's structural condition Degree of deficiency from current design standards Standard of bridges, culverts, and so forth Standard of footways, verges Adequacy of existing pedestrian facilities Deficiency of network continuity due to present situation Extent to which scheme will upgrade to acceptable design standards Degree of network functional improvement with regard to continuity
IV	Environment and conflicts	Scheme's relief of Residential area traffic intrusion Pedestrian/vehicle conflict in shopping and industrial areas Sensitive land use disturbance Detrimental environmental effects Noise levels Parking Community severance
V	Commercial and public transport undertakings	Severity of current public transport delays Scheme's reduction of public transport delays Will scheme allow bus priority system Will scheme contribute to heavy lorry route
VI	Development and economy	Will scheme improve access to existing development Is scheme necessary for future development Will scheme facilitate goods vehicle service to shops Will scheme access future housing development Will scheme improve town center access Will scheme facilitate extracounty communications Scheme's housing take Agricultural impact (including farming land lost) Cost Considerations Scheme cost

TABLE 4 PAT USES

	Problem Identification	Problem Sifting	Solution Sifting	Detailed Evaluation	TPP Submission	ERDF Submission
Devon	X	X	X	X	X	
Gloucestershire	X	X				
South Yorkshire	X	X	X	X		
Strathclyde			X			X
West Midlands	X	X	X	X		
West Sussex	X	X				

object of ascertaining the degree to which these PATs produce similar or different rankings of schemes.

To this end, information on a sample of six diverse schemes was obtained from Strathclyde Regional Council. Significant additional data collection and manipulation proved necessary, however, to ensure compatibility with each PAT. Even if essentially the same variables appear, the PATs frequently use different formats or variable definitions. The schemes include a minor rural junction improvement costing £95,000 (Scheme 4); two urban schemes to improve alignments and relieve pedestrian-vehicle conflict caused by heavy through traffic for £1.1 million and £560,000, respectively (Schemes 2 and 3); two rural bridge realignments and reconstructions costing £456,000 and £780,000 (Schemes 1 and 5); and a £5.8 million town center bypass (Scheme 6).

Results

Table 5 gives the scores and rank order of the six schemes according to each PAT. Bearing in mind the points about comparability made earlier, several general conclusions can be drawn.

Scheme Size and Total Points Scores

From the top part of Table 5 it is evident that, irrespective of PAT structure, variable definition, and use for problem or solution evaluation, large schemes tend to score high points. Thus the bypass (Scheme 6) heads all of the rankings whereas the junction improvement (Scheme 4) performed poorly, ranking sixth, fifth, and fourth (twice each) in all cases. There is greater variation among PATs in the ranking of intermediate schemes.

Cost-Related Scores

When cost considerations are taken into account, however, the extreme rankings are reversed in three cases, and some changes also occur in the intermediate ranks (bottom of Table 5). Devon, Gloucestershire, and Strathclyde actually derive cost-

TABLE 5 COMPARISON OF PAT PROJECT RANKINGS

	Scheme					
	1	2	3	4	5	6
Weighted Totals						
Cost (£ millions)	0.456	1.10	0.560	0.095	0.780	5.80
Devon						
Weighted total	307.6	324.3	504.3	321.1	317.4	1,132.9
Rank	6	3	2	4	5	1
Gloucestershire						
Weighted total	202.7	272.2	463.7	202.8	166.8	1,881.5
Rank	5	3	2	4	6	1
South Yorkshire						
Weighted total	9.6	30.4	37.8	7.2	8.6	696.8
Rank	4	3	2	6	5	1
Strathclyde						
Weighted total	5.0	6.0	9.0	1.0	12.0	28.0
Rank	5	4	3	6	2	1
West Midlands						
Weighted total	13.0	41.0	45.0	22.0	65.0	127.0
Rank	6	4	3	5	2	1
West Sussex						
Weighted total	12.0	23.0	45.1	13.0	20.7	134.7
Rank	6	3	2	5	4	1
Weighted Totals/Cost						
Cost (£ millions)	0.456	1.10	0.560	0.095	0.780	5.80
Devon						
Weighted total/cost	248.6	229.2	394.4	348.9	235.9	650.0
Rank	4	6	2	3	5	1
Gloucestershire						
Weighted total/cost	300.2	259.5	619.7	658.0	188.9	781.3
Rank	4	5	3	2	6	1
South Yorkshire						
Weighted total/cost	21.1	27.6	67.5	75.8	11.0	120.1
Rank	5	4	3	2	6	1
Strathclyde						
Weighted total/cost	11.0	6.0	21.0	21.0	15.0	5.0
Rank	4	5	1	1	3	6
West Midlands						
Weighted total/cost	28.5	37.3	80.4	231.6	83.3	21.9
Rank	5	4	3	1	2	6
West Sussex						
Weighted total/cost	26.3	20.9	80.5	136.8	26.5	23.2
Rank	4	6	2	1	3	5

weighted rankings as a standard part of the PAT procedure although they use different cost measures. The other authorities take cost into account during their decision-making process, using pure scheme cost as does Strathclyde, but not within the PAT structure as such. When their scores are divided by cost, an effect similar to that noted previously for the other PATs is observed, even though in the South Yorkshire case the urban bypass (Scheme 6) actually retains top rank. Once again, it is the ranking of intermediate schemes that varies significantly among PATs.

A sensitivity analysis was conducted that showed that, for any single PAT, scheme rankings vary according to the measure of cost used. Most of the PATs tested use pure scheme cost, but one uses the square root of cost and another a discounted log cost formula. Applying, for example, the Gloucestershire PAT to the sample of six schemes yields the results given in Table 6. In the table, cost-weighted scores and ranks are calculated on the basis of

1. Weighted scheme cost/score,
2. Weighted scheme score/log cost, and
3. Weighted scheme score x [log 141/log cost].

Cost measures 1 and 2 are not sensitive to the units in which cost is expressed because both the rankings and the ratios between the actual scores remain constant. With cost measure 3, however, the use of million pounds creates negative scores in four cases. For normal purposes, pure scheme cost is logically most appropriate in that it yields a benefit-to-cost ratio analogous to NPV/C in cost-benefit analysis (*21*).

Analysis by PAT Application

If the PATs are disaggregated according to the purpose for which they are used, the following points are observed:

- Problem severity: The Gloucestershire and West Sussex PATs appear to accord reasonably well overall, agreeing on ranks 1, 2, and 3, despite some differences between them in the relative scores of schemes. In the cost-weighted rankings there are greater differences, although they agree on Rank 4.
- Solution efficacy: Because 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. Devon and South Yorkshire also concur on Ranks 2, 3, and 5, and differ only on the other two.

Once again, however, the relative points scored by the respective schemes differ significantly among the techniques. In cost-related terms, Devon and South Yorkshire agree that Scheme 6 (the bypass) remains first, but they differ on all five other ranks; South Yorkshire and West Midlands agree on Ranks 3, 4, and 5.

Overall, then, it appears that there is some correspondence in rankings among PATs designed to evaluate problems, solutions, or both. However, differences in internal structure, variable definition, and weighting account for significant variation. The degree of correspondence among PATs in each of these categories is approximately the same for cost-weighted scores as for scores excluding cost.

Scheme Size and Distortion of Results

Some distortion of results was expected because 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 for the bypass, which, at £5.8 million, is many times costlier than the ceiling of £250,000 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 > £250,000. Although the Strathclyde PAT is not directly comparable, because it measures solution efficacy only, its rankings were compatible with the problem and solution PATs at the extremes; it differed only on the intermediate rankings. Given the potential comparability problems referred to earlier, it is difficult to be more precise here.

PAT Appropriateness and Ease of Use

The exercise also clarified several other issues related to the inappropriateness of certain variables and even PATs as a whole, depending on the nature of individual schemes and the importance of using appropriate variables, points, and weights (*21*). These include

- Gaps or double counting with use of inappropriate variables,
- Appropriate variable definition,

TABLE 6 SCHEMES RANKED BY THE GLOUCESTERSHIRE PAT USING THREE DIFFERENT COST MEASURES

		Scheme					
Cost Measure	Unit	1	2	3	4	5	6
1	£m	444.5	247.5	828.0	2,134.7	213.8	324.4
		3	5	2	1	6	4
2	£k	9.49	8.21	19.59	20.81	5.97	24.71
		4	5	3	2	6	1
2	£m	300.2	259.5	619.7	658.0	188.8	781.3
		4	5	3	2	6	1
3	£k	163.8	192.4	362.6	220.4	124.0	1,074.5
		5	4	2	3	6	1

NOTE: k = thousands, m = millions.

TABLE 7 PERCENTAGE OF POINTS BY HEADING FOR THREE PATS

	Scheme					
	1	2	3	4	5	6
Traffic						
Devon	54	48	36	55	60	25
Gloucestershire	6	16	6	5	11	18
West Sussex	36	37	17	11	90	14
Safety						
Devon	34	40	43	30	29	61
Gloucestershire	35	49	53	35	18	41
West Sussex	64	50	64	56	10	70
Environment						
Devon	0	2	11	0	0	6
Gloucestershire	0	1	28	0	0	24
West Sussex	0	12	19	33	0	16
Planning						
Devon	12	10	10	15	10	8
Gloucestershire	59	33	13	59	72	16
West Sussex	0	0	0	0	0	0

NOTE: None of these PATs included a financial implications section.

- Compound or other difficult-to-interpret variables,
- Combining open and closed point ranges,
- Use of ordinal instead of interval or ratio scale points,
- Compounding of individual variable and section weights, and
- Use of different cost measures.

The 43-factor Devon PAT illustrates well that a comprehensive technique need not be complex or clumsy in practice. It was one of the simplest tested because of the clear layout; definition of variables and categories, even when subjective assessment is called for; and the absence of complex formulas. Much the same is true of the Strathclyde PAT, although it was not used in such a detailed manner because the scheme appraisal sheets were obtained in completed form.

Allocation of Points Among PAT Sections and Objectives

The percentages of points allocated to each scheme under the respective PAT sections, which correspond broadly to highway scheme objectives (i.e., traffic, safety, environment, planning including development, and financial implications), were compared. The PATs were then ranked according to the percentage of points in each section to examine differences in scheme performance by section or objective in the various PATs and to establish whether any systematic bias in favor of or against particular sections emerged in the use of any technique.

There are indeed substantial differences among techniques as indicated by the data in Table 7. For example, Devon awards 54 percent of the points for Scheme 2 to the Traffic heading, as opposed to only 6 percent in the Gloucestershire PAT. Scheme 4 scores 0 percent under Environment with the Devon and Gloucestershire PATs, but 33 percent with that of West Sussex. The Planning scores for Scheme 5 range from 0 percent (West Sussex) to fully 72 percent (Gloucestershire). Overall, it is noteworthy that schemes score poorly on Traffic (< 19 percent) with the Gloucestershire PAT, but highly (> 50 percent) with the West Midlands PAT (not included in the table) whereas West Sussex awards > 50 percent of its points on Safety in five of the six schemes.

CONCLUSIONS AND NATURE OF FURTHER WORK

On the basis of information on PATs provided by 25 authorities, six techniques were selected for detailed and quantitative comparison. It has been shown that the six yield significant differences, not only in both pure and cost-weighted project rankings for the diverse sample of schemes but also in the proportional allocation of points among the major sections or objectives of traffic, safety, environment, planning including development, and financial implications. In many respects, this outcome reflects differences in PAT design and use and local authority policies. The implication, however, is that there is a distinct lack of uniformity and standardization among the methods and procedures used by local authorities for priority assessment of highway projects. Some of the techniques certainly leave something to be desired in terms of their technical properties. Furthermore, a number of authorities have no formal PAT; instead they rely on officers' judgment and the political process.

Although it is inevitable that local authorities have different requirements, it does appear that some standardization of overall approach would be advantageous. This does not imply that all authorities should use identical PATs, variables, and weights. Political judgment in this sphere is rightly a local matter. However, this analysis and discussions with representatives of cooperating authorities have led to the conclusion that there is a good case at least for ensuring that the techniques used possess desirable and broadly compatible logical properties.

The final phase of the project is intended to build on the work already completed by proposing improvements to the theory and practical use of PATs. It is intended to develop a general form of PAT that could be used by any local authority, permit a wide degree of flexibility in use, avoid the logical inconsistencies identified in some existing PATs, and incorporate formalized procedures for allocating weights among variables (22). The intention is that this general PAT should be computer based and, in due course, provide computer graphics output to aid decision making.

At the time of writing, initial decisions are being made about the basic design issues for this general PAT. The issues on which initial design decisions have been made follow.

1. The method should be applicable to both problem and solution assessment.

2. The method should be able to assess the full range of highway construction projects but not, at this stage, traffic management or highway maintenance projects, which are viewed as applications for further development.

3. The method should be able to accommodate virtually the full range of scheme costs; only very minor schemes (£25,000) would be excluded. This is a particularly demanding requirement, and the implications for variables are noted in Item 7.

4. The method should include the full range of variables that are of interest to local authorities and relevant to the decision; this raises interesting issues regarding variables such as traffic flow, which is often employed but in practice is only relevant for its contribution to congestion, environmental intrusion, safety, and similar effects that are measured separately.

5. More generally, the method should avoid double counting effects or treatment of both first-run effects such as poor alignment and second-run effects such as accidents, except where there is a clear case for including both to reflect separate problems.

6. Different variables may be needed for certain aspects of problem and solution assessment; rates may be more important for comparison of problems if differences in scale could otherwise bias problem identification; conversely before-and-after differences in absolute values may be more useful for solution assessment.

7. Variables should be arranged in a hierarchical structure, providing a comprehensive set of variables appropriate to large schemes while permitting assessment of more minor schemes against a smaller set of simpler variables, which still attract the same distribution of weights among headings.

8. Points should be scored on an open-ended scale for objective variables but on a closed scale for subjective variables; consistency will, however, be particularly important for the latter, and the facility will be needed to identify schemes for which the upper end of the subjective scale underassesses the size of the effect or problem.

9. The lower end of the open-ended scales may be assessed more coarsely and judgmentally to avoid the need for detailed evaluation of small schemes.

10. Weights should be determined independently by the individual local authority in the light of its policy objectives and used consistently across all schemes; the method should permit both zero weighting for policy issues that the authority considers unimportant and sensitivity testing to make possible assessment of robustness of schemes against changing policies.

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