THE HIGHWAYS AGENCY TA 30/82

THE SCOTTISH OFFICE DEVELOPMENT DEPARTMENT

THE WELSH OFFICE
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THE DEPARTMENT OF THE ENVIRONMENT FOR
NORTHERN IRELAND

Choice Between Options for Trunk Road Schemes

Summary: Advice is given on choice of route, carriageway type and junction layout for trunk roads. The Advice Note confirms that the Department is not prepared to stipulate a level of service to be provided based solely on operational criteria whenever mayor increments of expenditure are involved. Choices between options should be made on the basis of the examination of feasible alternatives and decisions made taking account of all circumstances peculiar to each case. Incremetal investments should be expected to give value for money in terms of combined economic and environmental impacts.

VOLUME 5	ASSESSMENT AND PREPARATION OF ROAD SCHEMES
SECTION 1	ASSESSMENT OF ROAD SCHEMES

TA 30/82

CHOICE BETWEEN OPTIONS FOR TRUNK ROAD SCHEMES

Contents

1. INTRODUCTION

1.1 Until recently, decisions on carriageway and junction provision were largely considered to be matters for 'design standards' which relate choice to traffic forecasts. But now a range of forecasts has been introduced and appraisal techniques have evolved to such an extent that the previous 'standards' should be used only as the starting point for assessment. Decisions should therefore be based on the relative economic and environmental advantages of the available options. The Department is not prepared to stipulate a minimum level of service to be provided in all cases; each decision must reflect value for money in economic and environmental terms in the particular circumstances for each case. In this, general decisions about alignment and those on the capacity to be provided are clearly distinguished from standards established for safety reasons, including those affecting such detailed aspects of alignment as gradient, curvature and forward visibility - though these, too, should not be regarded as inviolable.

2. SCOPE

2.1 This Notes gives advice on the way in which the three most important decisions on a trunk road scheme should be approached. These decisions are:-

(i) confirmation that the scheme is justified, and choice of route;

(ii) choice of carriageway type;

(iii) basic junction type.

The Note emphasises the need for a flexible approach, as recommended by the Leitch Committee and summarised in paras 71-73 of "Policy for Roads: 1980".

2.2 A good deal of advice has been issued recently concerning methods of appraising trunk road schemes (traffic, environment and economics). But the existing publications stop short of comprehensive advice on decision-making. It is the purpose of this Note to bring together the various threads and to provide guidance on the way in which major decisions should be approached.

3. THE APPROACH TO DECISION MAKING

3.1 Decisions involving major increments of expenditure should be tackled by assessment. Figure 1 illustrates the process for a preferred route decision. Generally the steps are to:-

i) define the problem

ii) carry out a traffic appraisal

iii) identify appropriate options

iv) carry out economic and environmental appraisals

v) prepare an assessment framework

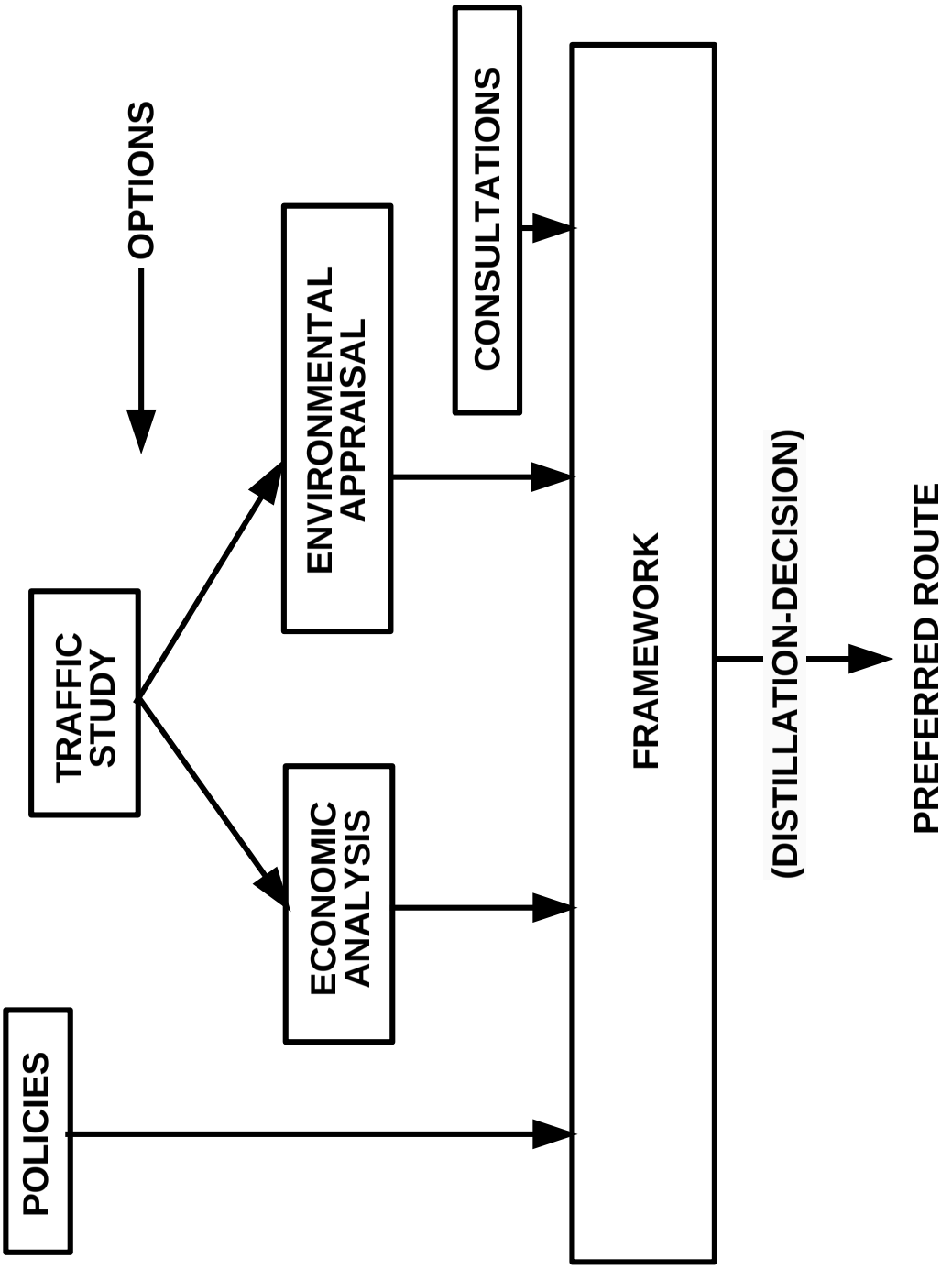
vi) select a preferred option

These steps will usually involve iteration - for example, iv) will have a bearing on iii).

3.2 The traffic appraisal will provide future year estimates of daily traffic flows for both high and low growth forecasts, the resulting range of flows being regarded by the Department as the widest range within which it is normally sensible to plan. For the purposes of economic appraisal and subsequent decision-making, no point within the range is considered to be more likely than any other. Peak period estimates can be provided but these are subject to much greater uncertainty than daily flows and are generally suitable only for checking decisions against operational performance criteria.

3.3 The existing design standards and the range of traffic estimates will indicate the likely options for consideration. These should always include Do Minimum. Options which can be judged to be out of the question can be rejected without detailed appraisal but care should be taken not reject possibilities because they do not conform to preconceived ideas, or the Planning Brief (this may be amended in consultation with RPHP whenever there is good reason) or simply because of high capital costs or residual traffic congestion. The solution giving best value for money might involve high costs - or some peak period congestion. Major decisions should only be taken after a careful assessment of all possibilities starting with the provision indicated by the low growth forecast and considering incrementally the costs and benefits to be obtained by moving to a higher (or lower) level of provision.

3.4 A major element in decision-making is the economic appraisal, usually employing COBA. This appraisal should be used not only for final decisions but also during the development of options. However, it should be appreciated that COBA has certain limitations, and that for some choices (eg junction designs) the differences may be too fine to be distinguishable in terms of COBA user benefits. When applying COBA, design engineers should be aware of the relationships inside the program which lead to the economic results, eg the speed/flow relationships. These relationships are fully explained in the COBA 9 Manual and the advice of traffic engineers should always be sought in cases of difficulty. Designers should also bear in mind that the limits of error applying to cost estimates also impose a restraint upon the degree of refinement that can be applied to incremental cost analysis.


OPTIONS
TRAFFIC STUDY
ENVIRONMENTAL APPRAISAL
ECONOMIC ANALYSIS
CONSULTATIONS
POLICIES
FRAMEWORK
(DISTILLATION-DECISION)
PREFERRED ROUTE

3.5 The economic disbenefit of delays to traffic outside usual conditions may weigh heavily on some decisions. Delays during construction and future maintenance operations, or possibly those due to breakdowns and accidents while the road system is operating normally, may be crucial to the choice of carriageway or junction provision. Maintenance delays may be evaluated using QUADRO, a new version of which should be available by mid-1982. Advice may also be issued shortly on the evaluation of delays due to breakdowns and accidents: this subject can be particularly important on carriageways of restricted width carrying higher flows.

3.6 The results of all elements of the appraisal should be presented in the Appraisal Framework. It is not necessary to produce a formal framework for all decisions (eg carriageway provision) but the framework approach should always be used; in some cases the impact (eg on residential property) may vary substantially with type of road as well as route.

3.7 Advice on the preparation of frameworks is given in Departmental Standard TD/8/80 and Advice Note TA/7/80, with emphasis on the impact of road schemes on people. It is sometimes suggested that factors such as operational aspects or levels of service should be included in the Framework, but both of these can be further broken down into elements of costs, benefits and impact on people and should therefore already be counted.

4. SELECTION OF THE PREFERRED OPTION

4.1 To give definitive advice on how entries in the Framework should be used in taking decisions would be presumptuous. Circumstances vary from scheme to scheme; there is no common unit of measurement; and judgement will differ between individuals in finely balanced cases. Ultimately the decision-taker is the Secretary of State. But there are two qualities which should be manifest in every recommendation passed up to Ministers:-

(i) They should be based on the incremental differences between competing options (including Do Minimum). Not all the alternatives need be examined in the same detail, however, those which are clearly non-starters may be rejected using only outline information.

(ii) The papers should explain clearly why the preferred choice is considered to be superior to all alternatives. Attention should be drawn to the crucial judgements.

4.2 The preferred choice is unlikely to be superior in every respect and so judgement is required. The final selection process is therefore one of judging between a number of disparate factors. This will be a matter for the individual concerned. All the analyst can do is summarize the impacts and identify the crucial issues.

4.3 When choosing between route options, impacts on the policies of central Government and other bodies will be present in the Framework and considered alongside the views expressed during the consultation period by the public and by elected authorities. Government policies for roads, as expressed in White Papers, will be an essential ingredient in a decision but it is likely to be more relevant to the degree of priority to be allocated to the scheme rather than to the choice between options.

4.4 It is not possible when preparing a Framework to exclude all elements of double-counting. This double-counting is unavoidable because some factors can be of such importance - in particular cases - that decision-takers need to take account of them explicitly as well as implicitly (for example, accidents are evaluated in the economic appraisal, and capital costs incorporate compensation payments for disturbance or severance). In practice, however, the extent of double-counting can usually be identified quite readily and due allowance made according to the particular circumstances.

4.5 Where there is a large number of options, one method of cutting the problem down to a more manageable size is to compare the options, two at a time, eliminating the least favoured in turn. The advantage of this method is that the problem is sub-divided into a discrete number of smaller problems. This approach is particularly helpful in presenting a recommendation and it enables the reasons behind past decisions to be traced without ambiguity. It is particularly suitable where options fall into recognisable groups with a key feature in common. For example, it may help to identify both the best route north of a town and the best route south of a town before comparing those best routes one with another. Similarly, alternative routes with substantial sections in common might be looked at first. Care should be taken when using the method to avoid the hypothetical paradox which might arise in a voting situation (A preferred to B, B to C, yet C to A). In practice, this problem can be avoided by comparing the preferred option against all other strong contenders.

4.6 Care must be taken not to give undue weight to small differences in economic returns. Both low and high growth economic returns should be studied and where an option performs markedly better than its competitors on both low and high then, other things being equal, it will be preferred. Where one option performs better on low growth and another on high, it will be necessary to consider each in the context of the least favourable outturn in traffic growth. The decision between the options should take into account both their relative merits under a favourable outturn and the 'cost of being wrong'. And, of course, often "other things" will not be equal, so decisions can never be taken on the basis of economic appraisal alone.

4.7 Tactically, there is advantage to be gained from adopting a solution which would leave open for the future as many options as possible. If part of the investment can be deferred without serious congestion or environmental damage, then a better economic performance might result and the possibility of over-provision will be virtually eliminated. Some upgradings will never be required while those which do become necessary will compete for funds in a

future programme when their return is more certain. (It is worth remembering that even the range given by the low and high growth forecasts represents only the widest range within which it is sensible to plan.) But there may well be drawbacks; improving an existing facility at a later stage can be very expensive in terms of capital costs and delays to traffic during the subsequent construction periods, and the scheme preparation costs of staging options cannot be ignored. All this must be included in the consideration of the "cost of being wrong".

4.8 Special care is needed to allow for the limitations of evaluations methods which might favour a particular option. For example, the lowest level of provision in choice of carriageway type may invoke the cut-off on the COBA speed/flow curve. But the costs of evaluation must be kept within sensible bounds. As with capital expenditure, scarce evaluation resources should not be allocated to work which can effect marginal improvements only. Detailed advice on the scope of traffic appraisals is given in the Traffic Appraisal Manual.

5. FACTORS AFFECTING PARTICULAR DECISIONS

5.1 This section deals with specific factors which can affect the three kinds of decisions identified in para 2.1. It will be appreciated that these decisions are inter-related and must be approached iteratively.

(a) Preferred Route

5.2 Thee various economic and environmental impacts of the front running options and the Do Minimum scenario will be presented in an Appraisal Framework together with policy implications. Public Consultation provides information about the reactions of people and organisations to the alternatives. All of this information will need to be distilled so that a senior officer can make a recommendation on the preferred route to Ministers. The method of comparing options in pairs (para 4.5 above) is recommended for presentation of the material in the Scheme Assessment Report. An example is given in Appendix 2.

5.3 One of the key choices is whether or not to proceed with the scheme (ie the choice between Do Minimum and the preferred Do Something option) when the NPV for the Do Something is negative over much of the expected range. In such cases a decision to proceed would imply a minimum value for the sum of the environmental gains and losses.

5.4 When considering whether options with negative NPVs or options which do not produce the highest NPV are justified in overall terms, it is often useful to highlight the trade-off between environmental and economic factors. This can be done by summarising and comparing the main environmental and economic differences between the options involved. It may sometimes be possible to identify a key proxy environmental variable such as the net number of properties with noise relief greater than 3db(A), and express the trade-off in adopting the less economic option in terms of NPV foregone per property with noise relief. This implicit valuation approach is described in the COBA 9 Manual. The method is somewhat simplistic and must be used with caution but can give a rough indication of the price which is being paid to achieve non-economic objectives.

5.5 Neighbouring schemes, which may compete with or be complementary to each other, create special problems of a detailed nature. Guidance on such cases including the "scheme-in-route" problem, is given in Appendix 1.

5.6 One final point. The solution which is economically optimal, among these schemes which the Department would be prepared to build, must be identified in the Scheme Assessment Report even though it may subsequently be rejected in the same document, for environmental or other reasons. It is needed for administrative purposes relating to the delegation of certain powers by Treasury. Obviously, the costs of design and appraisal of a rejected option must be kept to a reasonable minimum. Further details are given in the Highways Manual section on public consultation (TRU 614).

(b) Carriageway Provision

5.7 The choice of preferred route cannot always be separated from an initial selection of carriageway provision for each of the various line options. But, on any particular option, it is usually possible to determine the optimum carriageway provision in isolation. Obviously, fewer factors will be involved but the approach adopted should be similar to that used in the selection of a preferred route.

5.8 The relevant factors are usually capital costs, traffic forecasts, composition of traffic, peaking characteristics, the costs of delays during specific occurrences, and environmental effects (although these are usually less significant than in route choice). Generally, the most important single factor is the capital cost or, more precisely, the incremental difference in costs between alternative options. It is inevitable when seeking value for money that the selected level of provision to meet a particular level of traffic flow will vary according to the cost of provision. In other words, a level of provision which might be acceptable in relatively 'soft' terrain may not be justified in difficult country or on a long viaduct. The concept of a minimum acceptable level of service is no longer tenable.

5.9 The approach should be to use the range of forecasts for (say) the fifteenth year after opening to identify the approximate carriageway requirements and then to test alternatives consistent with this range to determine the optimal design over the life of the scheme. For these purposes the life can be taken as 30 years. This range will normally span several width options. For example, if the middle of the range for the forecast traffic flows provisionally indicates that WS2 will be appropriate, then S2 and D2 should also be tested. Designers will also need to take account of options within the basic categories (climbing lanes, the new approach to highway link design).

5.10 The crucial issues, apart from capital costs, will be the incremental benefits as shown by COBA 9, and considerations of delays during future maintenance operations and possibly the impact of accidents and breakdowns under normal service. These considerations should be sufficient in most cases to justify a relatively high level of service, in which case driver discomfort will not need to be taken into account also. But in cases where incremental costs (environmental as well as economic) are extremely high (eg for the widening of an existing dual carriageway) so that only low standards of provision are otherwise justified, driver discomfort may be a relevant issue. Such cases should be referred to APM and TE (the values for non-work time used in COBA 9 incorporate non-time elements such as driver discomfort - research is currently under way to help resolve the problem further).

5.11 Appendix 3 contains an example to illustrate the way in which the above factors can be used in arriving at a decision on carriageway provision.

(c) Choice of Junction Type

5.12 The choice of junction type is particularly difficult because estimates of traffic delays are very sensitive to future year forecasts. Below about 85% of capacity the delays for an average vehicle at a junction approach differ little (generally under 30 seconds) but thereafter, as traffic loadings increase, average delay increases rapidly with flow (the average delay increasing to perhaps 2-3 minutes or more where traffic flows at a junction are hovering around capacity in a peak period). Under the latter conditions, if forecast traffic loadings, or the capacity of the junction approach, are slightly different from those estimated then the resulting delays (and economic costs to traffic) will vary significantly. The traffic figures used for the decision will be expressed in the form of a range, not a single estimate, which will typically be 35% different between low and high growth in 20 years time. At least part of this range may embrace the sensitive part of the curve.

5.13 In junction choice, as with other decisions, it is necessary to be clear about the problem to be solved. The problem is to select a junction type from a number of alternatives not to estimate future traffic volumes or economic returns. Many junction choices will, in practice, be constrained within obvious economic, environmental or topographical boundaries and can be assessed with the most cursory of traffic information (eg grade separation will never be justified for junctions carrying low flows; while major motorways cannot sensibly intersect at a major/minor junction).

5.14 It is common practice in some offices to base junction choice on high growth traffic forecasts alone. In many cases, considerations of the kind outlined in the last paragraph will lead to a choice of junction type which is commensurate with high growth, but this is not always the case. For example, on the "cost of being wrong" criterion (see paragraph 4.6), it might be sensible to defer a major improvement to a junction on an existing road if the extra costs of grade-separation at the later date, in terms of higher contract rates, and the extra delays to traffic during construction, are not likely to be excessive. In other cases environmental factors will be important, especially in relation to grade-separated junctions in built up areas. Some consideration should always be given, therefore, to all options which would be appropriate for at least part of the range.

5.15 The economic appraisal can be used to justify the case for grade separation as against at-grade solutions, but no choice of junction type should rely on economic appraisal without careful sensitivity testing and optimisation of lower standard options using operational analysis. Fortunately many decisions on junction type are either robust over a range of flows (eg in most rural locations, the roundabout which meets minimum deflection requirements provides near maximum capacity); or the costs of being wrong may be low (eg conversion of major/minor junction to small island roundabout) and unlikely to call for further expenditure until later years if at all.

5.16 Appendix 4 illustrates through an example how the above principles can be applied.

6. CONCLUSION

6.1 Where choices are difficult, this represents no more than the unavoidable uncertainty and conflicts of the real world. In financial markets, for example, estimates about the future returns from different unit trusts are bedevilled by uncertainty, but nevertheless choices must be made. Economic returns from different road options are similarly difficult to estimate and the environmental dimension further increases the complexity. But choices do have to be made with imperfect information: at the end of the day the sole criterion for a scheme being worth the investment recommended is that it should be reasonably certain to give value for money, in terms of combined economic and environmental impacts.

7. ENQUIRIES

IMPACT OF NEIGHBOURING SCHEMES

1. A special problem arises when two or more schemes are either competing with each other, or complementary. Each scheme (or section) should be evaluated with and without its neighbours and the necessary decisions can be illuminated using conventional risk analysis based on a judgement of the probability that the later schemes will materialise. Consider the economic case for scheme A in the following circumstances. The results from COBA indicate that the scheme would only be economically viable if scheme B (about which there is some doubt) is also constructed.

	NPV for scheme A	
	Low growth	high growth
on its own	-£1.9m	-£0.6m
If B is built	£2.6m	£4.7m

2. If the probability of scheme B being constructed is judged to be 0.7, then the "effective" NPVs for scheme A would be:-

Low growth	-1.9 x .3 + 2.6 x .7 = +£1.2
High growth	-0.6 x .3 + 4.7 x .7 = +£3.1

3. On the basis of the assumption about the probability of B, the economic case for building A is robust. In practice, the problem would probably be more complex than shown above because the date of construction of scheme B would be in doubt. The effect of using different assumptions for date and probability of construction for scheme B could be tested or judged. It is likely that the crucial pieces of information for management purposes will be the "probability of B" at which the case for A becomes marginal - and the year of construction for B at which the case for A becomes marginal.

4. Judgements of probability will need to be made, initially at least, at a Regional level. They may relate to trunk roads or local authority proposals. Difficulties might arise over publication by the Department of estimates of probability relating to local authority proposals.

5. The more complex issues relating to a "scheme-in-route" are discussed in the COBA 9 Manual (section 3.4). Basically, three evaluations are needed for each option:-

i. in isolation (assuming that none of the complementary schemes are ever built);

ii. by adding the complementary schemes sequentially to the Do Minimum network - each at the appropriate opening year;

iii. as an integral part of the whole route evaluation, again making reasonable assumptions about the opening dates for each scheme.

None of these evaluations provide the complete picture alone. Each provides a particular insight and they should be considered together when decisions are being taken on the economic viability of the section in question. A similar approach should be applied to environmental impacts if the differences prove to be significant. On the other hand, when selecting the preferred route or deciding carriageway provision, etc, the second mode of evaluation will usually suffice. The options may need to be the subject of sensitivity testing relating to the dates of opening, when they have been reduced to a short list.

EXAMPLE OF CHOICE OF PREFERRED ROUTE

Introduction

1. This appendix describes a particular method of selecting a preferred route from a given set of options. The method is particularly useful for presenting a decision or recommendation but it can also be used during the actual decision-making process. The method is illustrated by the description of the way in which a decision was made in a particular (mythical) case. The description starts with an appraisal framework setting out the many factors involved and it concludes with a presentation of the arguments which lead to the choice of a particular option. The example provided is appropriate to a Scheme Assessment Report but a similar approach could be used for other purposes, including the preparation of evidence for a public inquiry.

2. Details of the decision described in the following example are not important; the purpose of this appendix is to illustrate the general approach and the manner of presentation. The following points should be noted:-

i) the results of the technical evaluations for the various alternative solutions are presented in the form of an Appraisal Framework;

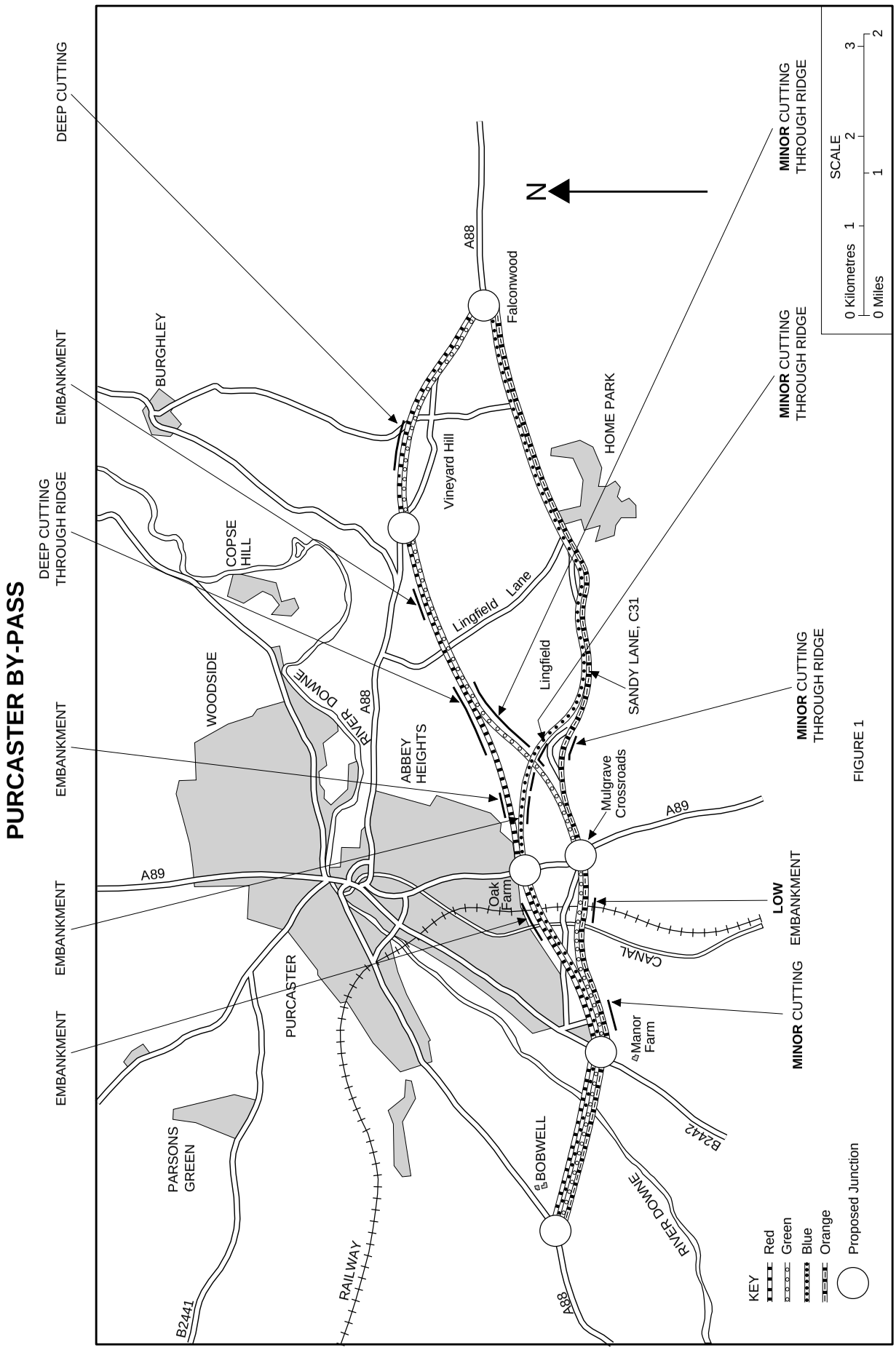
ii) the debate which proceeds from the framework is structured in a particular way to allow the alternatives to be discussed in pairs. Each sub-section of the debate concludes with a recommendation that one of the pair should be discarded;

iii) for each pair of options, entries in the framework have been "distilled" until all that remains is the key differences between the impacts of each option. It is sometimes necessary to introduce points which would not appear in a published framework, notably the routes favoured by the public and local authorities;

iv) the route which emerges as the preferred route is compared with the "do-minimum" option to establish whether it is worth building.

Example: Purcaster Bypass

3. Figure 1 shows the four alternatives for a bypass of Purcaster which is a small town with a population of about ten thousand, serving as a centre for shopping and employment in a predominantly rural area. The town is also a considerable tourist attraction. An ancient bridge in the centre of the town provides the only access across the river Downe. The problems for local and tourist traffic are made worse by the presence of through traffic on the trunk road, A88.


PURCASTER BY-PASS
DEEP CUTTING
EMBANKMENT
DEEP CUTTING THROUGH RIDGE
EMBANKMENT
EMBANKMENT
EMBANKMENT
MINOR CUTTING THROUGH RIDGE
MINOR CUTTING THROUGH RIDGE
MINOR CUTTING THROUGH RIDGE
LOW EMBANKMENT
MINOR CUTTING
N
SCALE
0 Kilometres 1 2 3
0 Miles 1 2
BURGHLEY
A88
Falconwood
Vineyard Hill
HOME PARK
COPSE HILL
Lingfield Lane
Lingfield
SANDY LANE, C31
WOODSIDE
RIVER DOWNE
A88
ABBEY HEIGHTS
Mulgrave Crossroads
A89
A89
Oak Farm
CANAL
PURCASTER
Manor Farm
B2442
PARSONS GREEN
BOBWELL
RIVER DOWNE
RAILWAY
B2441
A88
KEY
Red
Green
Blue
Orange
Proposed Junction
FIGURE 1

GROUP 1: TRAVELLERS

sub-group	effect	units	RED		GREEN		BLUE		ORANGE		DO-MINIMUM	Comments
			High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth		i. Each column shows the improvements of the particular route over the "do-minimum" option. Hence the "Do Minimum" entries are zero.
Car Users	Time savings and vehicle operating costs (VOC) savings	£m (PVB	4.5	3.7	4.1	3.5	4.2	3.6	4.0	3.4	0	ii. Present value of benefits (PVB) for 30 year periods from the expected dated of opening and discounted to 1979 at 7% pa.
Users of Light Goods vehicles	Time savings and VOC savings	£m (PVB)	0.7	0.5	0.7	0.5	0.7	0.5	0.7	0.5	0	
Users of other Goods Vehicles	Time savings and VOC savings	£m (PVB)	1.2	1.0	1.1	0.9	1.2	1.0	1.2	1.0	0	
All vehicle travellers	Value of accidents savings	£m (PVB)	1.4	1.2	1.3	1.1	1.3	1.1	1.2	1.0	0	iii. It is assumed that national average figures for vehicle occupancy and for accident rates and costs will apply.
	Reduction in casualties:											The figures indicate the probable reduction in casualties over the whole 30 years assessment period if the national average rates and distribution between groups applies to each alternative. They take no account of the safety inmplications of the detailed design of the new routes.
	Fatal	number	9	7	8	6	8	6	7	6	0	
	Serious	number	145	182	245	210	180	106	205	83	0	
	Light	number	1061	926	818	620	950	910	828	707	0	
	Driver stress	-	Low		Low		Low		Low		High for most of the route	
	Traffic delays during construction	£m (PVB)	-0.02	-0.02	-0.02	-0.02	-0.04	-0.04	-0.06	-0.05	0	Figures are calculated using the same assumption on traffic composition as for travel benefits. No detailed survey has been undertaken.

GROUP 1:	TRAVELLERS Continued							
sub-group	**effect**	**units**	**RED**	**GREEN**	**BLUE**	**ORANGE**	**DO-MINIMUM**	**Comments**
Pedestrians	Amenity & Safety	-	Reduction of 25% in E/W through traffic in town centre will improve amenity and safety	As Red	As Red but pedestrians in Sandy Lane will suffer disruption & considerable noise increase	As Blue	Pedestrians in town centre will continue to be exposed to noise and pollution from heavy traffic	
	Severance	-	No effect	No effect	Pedestrians from Home Park area will have to cross a new footbridge	As Blue	No change from exisitng position	

GROUP 2: OCCUPIERS

sub-group	effect	units	RED	GREEN	BLUE	ORANGE	DO-MINIMUM	comments
Residential	Properties demolished	No	2	2	Nil	Nil	Nil	These properties are in bad condition and unoccupied. The cost of property acquisition and demolition is included in Group 6.
	Noise	Number of houses experiencing an increase of 10-15dB(A) 5-10dB(A) 3-5dB(A) Number of properties experiencing a decrease of 10-15dB(A) 5-10dB(A) 3-5dB(A)	 130 245 306 5 60 150	 30 33 57 5 60 150	 140 261 342 10 40 110	 50 53 80 10 50 90	 0 ca 100 ca 500 0 0 0	Compensation payments are included in Group 6. In the do-minimum situation, increasing congestion will drive traffic to divert to residential street.
	Visual obstruction	Number of properties within 300m of centre line subject to: Severe Significant Slight	 10 30 145	 0 30 35	 5 10 161	 0 50 53	 0 0 0	The embankments causing the obstruction will all be grassed.
	Visual intrusion	-	Deep cuttings at Vineyard Hill and SE of Abbey Heights would be widely visible	As Red but also intrudes on the landscape between Mulgrave cross-roads and Lingfield Lane	Intrudes on the landscape between Mulgrave cross-roads and Lingfield Lane	A deep cutting south of Sandy Lane is visible from Home Park	-	The report of the Landscape Advisory Committee gives more details

GROUP 2:	OCCUPIERS	continued						
sub-group	**effect**	**units**	**RED**	**GREEN**	**BLUE**	**ORANGE**	**DO-MINIMUM**	**comments**
	Disruption during construction	Number of properties within 100m of boundaries of site or haul roads	25	10	70	60	-	Disruption to 10 properties along Sandy Lane would last for 9 months if the Blue or Orange routes were chosen
Shops and businesses	Noise increase	Number of properties subject to increase of more than 5dB(A)	4	4	1	1	10	In the do-minimum situation, traffic will increasingly divert to minor roads
	Noise decrease	Number of properties subject to decrease of more than 5dB(A)	40	44	44	44	0	All new routes produce a marked improvement for shops in the old part of town
	Disruption during construction, severance and visual intrusion	-	Slight	Slight	Slight	Slight	Nil	
Industrial commercial								No industrial or commercial buildings are directly affected
Farming	Farm structure	Number of farms affected by land take or severance	16	14	9	8	Nil	2 farms with land on both sides of Sandy Lane will have severance problems if the Blue or Green route are chosen
	Land take	Hectares of land: Grade i Grade ii Grade iii	0 18 85	0 18 72	0 10 46	0 10 35	Nil Nil Nil	Based on MAFF land classification grades Compensation included in Group 6
Recreational areas - Manor Cricket Club (area 3½ hectares)	Land take	Hectares	1	0	1	0	0	Suitable adjacent additional land may be available

GROUP 3:	USERS OF FACILITIES							
sub-group	**effect**	**units**	**RED**	**GREEN**	**BLUE**	**ORANGE**	**DO-MINIMUM**	**comments**
Visitors to the old town area (ca 2000 per week in the tourist season)	Improved amenity due to reduced E/W traffic flow		East-West traffic flow reduced by 50%	As Red	As Red	As Red	Congestion and pollution due to traffic will accelerate the present reduction in number of visitors	The Old Town area has been designated as an Outstanding Conservation Area. It includes a Grade I and Grade II listed building
Walkers on Abbey Heights (ca 100 per week)			Some traffic noise will be perceptible over the whole area	Some traffic noise will be perceptible over half the area	No effect	No effect	No effect	The noise increase will be less than 3dB(A)
Users of Manor Cricket Club (membership 65)			One of the two pitches will be severely restricted	No effect	No effect	No effect	Suitable adjacent land could be purchased to replace land needed for the Red or Blue routes	

POLICY	AUTHORITY	RED	GREEN	BLUE	ORANGE	DO-MINIMUM	Comments
GROUP 4:	POLICIES FOR CONSERVING	AND ENHANCING THE AREA					
To protect the Old Town Outstanding Conservation Area	Purcaster DC	The removal of through East-West traffic will reduce the damage caused by traffic to the OCA	The removal of through East-West traffic will reduce the damaage caused by traffic to the OCA	The removal of through East-West traffic will reduce the damaage caused by traffic to the OCA	The removal of through East-West traffic will reduce the damaage caused by traffic to the OCA	Increasing vibration and pollution will accelerate the existing deterioration of the buildings	
To maintain the amenity value of Abbey Heights	Downshire CC Purcaster DC	Amenity value reduced considerably by noise and visual intrusion	Some reduction in amenity value but less than for the Red route	Amenity value maintained	Amenity value maintained	Amenity value maintained	Report of Landscape Advisory Committee is relevant. The countryside to the East of Purcaster especially Abbey Heights is exceptionally attractive
To protect listed buildings outside the Old Town area	DOE Downshire CC Purcaster DC	One of the Purcaster listed buildings will be relieved of vibration from traffic	As Red	As Red but the buildings in Home Park will be exposed to some visual intrusion	As Blue	The Purcaster buildings will be subject to increasing damage. The Home Park buildings will remain protected	There are 2 other grade 2 listed buildings in Purcaster and 2 in Home Park
GROUP 5:	TRANSPORT DEVELOPMENT	AND ECONOMIC POLICIES					
To provide by-passes for smaller towns	DTp Purcaster DC (for Purcaster by-pass only)	Purcaster will be by-passed for East-West traffic	Purcaster will be by-passed for East-West traffic	Purcaster will be by-passed for East-West traffic	Purcaster will be by-passed for East-West traffic	Policy will not be implemented	
To develop land to the South of the town	Downshire CC Purcaster DC	Land available for development would be separated from existing developed areas	Development could proceed with the new road forming a useful boundary between town and country	Land available for development would be separated from existing developed areas	Development could proceed with the new road forming a useful boundary between town and country	Development could proceed	There are proposals for residential and industrial development in the Mulgrave area south of Purcaster
To avoid exposing residential property to traffic noise in the Oak Farm area	Purcaster DC	Circa 500 houses will be exposed to noise increase of 3dB(A) or more	Ca 20 houses will be exposed to noise increase of 3dB(A) or more	Ca 20 houses will be exposed to noise increase of 3dB(A) or more	No additional noise to properties in this area		

GROUP 6:	FINANCE IMPLICATIONS							
sub-group	**effect**	**units**	**RED**	**GREEN**	**BLUE**	**ORANGE**	**DO-MINIMUM**	**comments**
Department of Transport	Construction costs	£m (PVC)	6.6	6.8	6.2	6.8	0.4	Costs are discounted from years of expected expenditure to 1979 at 1979 prices
	Land and compensation costs	£m (PVC)	0.1	0.1	0.1	0.1	0.1	Excess maintenance cost due to additional length of road
	Maintenance costs	£m (PVC)	0.3	0.3	0.3	0.3	-	
	Total cost	£m (PVC)	7.0	7.2	6.6	7.2	0.5	
			High growth / Low growth	High growth / Low growth	High growth / Low growth	High growth / Low growth		Includes changes in travelling time, accidents and vehicle operating costs, taken from Grade I
	Total quantified monetary benefit	£m (PVB)	7.6 / 6.4	7.2 / 6.0	7.4 / 6.2	7.0 / 5.9	-	
	Net present value compared to do-minimum	£m (PVB)	1.1 / -0.1	0.5 / -0.7	1.3 / 0.1	0.3 / -0.8	-	

ssessment of Options

4. The four alternatives are essentially two routes with variations south of Purcaster. The effects of each alternative on the different groups of people affected are detailed in the attached appraisal framework, with a summary of the economic evaluations carried out using the COBA program.

5. The main options for the bypass consist of:-

a. A common route from the A88 at Bobwell, west of the town, to the B2442 at Manor Farm. This section involves a crossing of the river Downe;

b. two alternative lines between the B2442 and the A89, south of Purcaster. The Red and Blue routes follow one line close to the built-up area and the Green and Orange routes follow a line which swings out to the Mulgrave crossroads;

c. either the improvement of Sandy Lane (C31) from Lingfield to Falconwood or a new route from the A89 to Falconwood. The Blue and Orange routes follow Sandy Lane while Red and Green take the new alignment.

The possibility of a route close-in to the town on the east side was rejected prior to public consultation because of its adverse impact on Abbey Heights, an area of outstanding beauty.

6. The process of selecting the preferred route is presented as a series of eliminations. The routes are compared, two at a time, one being eliminated after each comparison, and the process is repeated until the preferred route emerges. Before each comparison is made, the significant advantages of each option are listed.

These lists comprise the outstanding differences which can be identified from the appraisal framework. The relevant views of the public and local authorities are also included where appropriate.

7. The sequential elimination method is vulnerable to criticism when used in a voting situation (it is possible for A to emerge as being preferable to B, B as preferable to C and yet C as preferable to A). Difficulties of this type could possible arise in the context of a trunk road assessment when there is little to choose between three or more front-running options. In such cases, care should be taken to check-out the option which finally emerges against all of its close competitors (see paragraph 3.5).

8. Generally, the presentation will show comparisons between the preferred route A and every alternative, B, C, D etc, including do-minimum. But because the options in this particular case consists of combinations of elements from two basic routes, it is more appropriate to compare Blue with Orange, Red with Green, then Orange with Green and finally Orange with do-minimum.

Comparisons between Options
Orange compared with Blue:

9. The differences between these options occur at the western end of the scheme. This is where Orange follows the existing Sandy Lane as closely as possible but Blue swings north to join the junction close to the town at Oak Farm. The advantage of Orange are:-

i. it was the first choice of most people;

ii. it utilises the greatest area of existing roads, saving 11 hectares of agricultural land over Blue (preferred by MAFF);

iii. exposes 90 fewer properties to noise increases of 10-15 dB(A) and 208 fewer properties to increase of 5-10 dB(A);

iv. it avoids a private cricket ground;

v. it does not restrict the developments of the southern part of the town and is therefore more acceptable to the local authority;

10. The advantages of Blue are:

i. it intrudes less into countryside (marginally preferred by the LAC);

ii. it is slightly more attractive to traffic visiting the town;

iii. it is cheaper (£0.6m) to build and its net present value is £0.4m greater than that of Orange for low traffic growth forecasts, and £0.5m greater for the high growth.

11. The balance of advantage appears to lie predominantly in favour of Orange. As Blue approaches much closer to the town than Orange, it affects many more residential properties. The public showed their disfavour of this route by placing it at the bottom of their order of preference and also by suggesting that noise and pollution were the most important factors relevant to the selection of the route. The local planning authorities were not in favour of this route because it would hinder the development of the Mulgrave area and prevent a road link from the industrial area. However, the LAC marginally favoured it because it intruded less into the countryside to the south of the town. This factor must be balanced against the fact that it would take 11 hectares more agricultural land than Orange. The position of the junction with A89 makes Blue slightly more attractive to drivers wishing to visit the town because it provides better access. However, this is at the expense of those people living close to the route who would suffer increased noise and also those drivers who do not wish to call at the town and would have to travel a slightly longer distance.

12. For these reasons Blue can be rejected.

Red compared with Green:

13. Red and Green also differ only at the western end of the route and in many respects the choice between them is dictated by the same factors that differentiate Orange from Blue.

14. The public showed a strong preference for Green over Red.

15. The arguments set out in paragraph 11 apply equally to these two alternatives and for the same reasons, Red can be rejected.

Orange compared with Green:

16. The final choice then lies between Orange and Green. Both take the outer line immediately south of the town and then follow different lines, Orange follows Sandy Lane and Green cuts across to the A88 corridor, but does not follow the existing road.

17. The advantages of Orange are:-

i. it saves 45 hectares of farmland, of which 8 hectares are Grade 2 land;

ii. it causes less effect on farm structure;

iii. it is less intrusive in the area between Mulgrave crossroads and Lingfield Lane - the major topographical feature of the study area;

iv. it avoids the diversion and deep cutting at Vineyard Hill;

v. it is preferred by most people;

vi. it is preferred by those interested in the countryside;

vii. it is preferred by LAC;

viii. it is preferred by MAFF.

18. The advantages of Green are:-

i. there are 20 fewer properties exposed to noise increases of 10-15 dB(A);

ii. it causes less disruption during construction;

iii. there would be fewer frontage accesses and connections with side roads;

iv. it is preferred by most local authorities.

v. it has a marginally better economic return.

19. Orange utilises the line of an attractive lane which passes close to a major village, Homepark. The existing character of the lane would be completely altered by the construction of the 10m wide road along its line. Mature hedges and trees would be lost but, on the other hand, there would be very litter severance of land. During construction, there would be disruption to existing traffic but this is fairly light outside peak hours. There would be intermittent disruption over 9 months to occupants of 10 homes. Existing accesses onto the road would have to be maintained and there are side roads at which junctions would have to be provided.

20. Green takes an entirely new line across open farm land and would create no problems with accesses and side road junctions. There would, however, be severe agricultural severance. This route does not involve existing side roads to the same extent as Orange and so there would be fewer problems due to disruption of traffic during construction.

21. Green would have a more obvious impact on the landscape than Orange. Deep cuttings at both Vineyard Hill and between Mulgrave crossroads and Lingfield Lane have aroused adverse comment from the LAC, the Countryside Commission and amenity groups. The LAC preferred Orange.

22. The main concern of the local authorities was that the new road should be kept well away from the built up area so as not to affect existing or proposed development. Both options achieve this objective. However, Purcaster District Council and Homepark Parish Council prefer Green because it has no impact on Homepark. The County Council found little to choose between the Options.

23. The public preferred Orange to Green.

24. The view of MAFF was very definite; they would oppose Green unless the diversion at Vineyard Hill could be avoided, because of Grade 2 land that would be affected. The avoidance of the diversion would have to be at the expense of the demolition of several houses and a garage and there would also be problems with junction arrangements and accesses. For these reasons, the diversion at Vineyard Hill is undesirable and if Green is preferred further consultation with MAFF is vital. There are other agricultural reasons for preferring Orange; it will require about 50 hectares less land and the effects on farm structure would be slight.

25. The support for Green appears to stem from the fact that it keeps clear of Homepark. It has little else in its favour. Orange on the other hand has greater public support and there are economic and environmental advantages in its favour. On balance the Orange route is preferred.

Orange compared with Do-Minimum

26. From the comparisons outlined in the previous sections, Orange emerges as the preferable route. But, before it can be recommended for construction it must be compared with the Do-Minimum option.

27. The main advantages of the Do-Minimum Option are:-

i. it would avoid increased noise and visual intrusion to 183 residential properties;

ii. it would avoid the acquisition of 45 hectares of agricultural land;

iii. there would be no damage to the landscape;

iv. the character of Sandy Lane would not be damaged, and there would be no disruption during construction;

v. it would save the expenditure of £6.5m (PVC).

28. The advantages of Orange are:-

i. it would relieve Purcaster and its approaches of congestion and environmental disturbance;

ii. it would save about 30 casualties per year;

iii. it would relieve the already overloaded A88 and improve conditions for through traffic;

iv. it has a net present value of £0.3m on the high growth assumption although the low growth assumption produces a negative NPV;

v. there has been a demand by the residents of the town and the Local Authorities for a Bypass for Purcaster for over 25 years.

29. The A88 from Purcaster is already overloaded and acute congestion is caused by slow moving vehicles as few opportunities are available for overtaking. During the summer weekends traffic often comes to a standstill in the town. The bypass will bring considerable relief problems in the town.

30. Although the new route would increase the noise and visual intrusion along its length there would be reductions along the existing roads and in the centre of Purcaster for some 600 properties.

31. Much of the damage to the landscape caused by Orange would be short term. Many trees and hedgerows along Sandy Lane can be preserved and new planting would be designed to restore the lost vegetation.

32. The balance of advantage is clearly for proceeding with Orange rather than the Do-Minimum.

Conclusions

33. All the routes considered give a return on the investment near to the Test Discount Rate. All are of similar length and will satisfactorily achieve the objectives of relieving the A88 and removing through traffic from Purcaster.

34. Green is preferred by most local authorities and the people of Homepark, but it appears that the main reason for this choice is the closeness of Orange to the village. Green is strongly opposed by the MAFF as twice as much agricultural land would be taken.

35. The choice between Green and Orange is finely balanced but Orange is better economically, environmentally, in landtake and landscape terms and is preferred by most people.

EXAMPLE OF CHOICE OF CARRIAGEWAY PROVISION

1. PROBLEM

An assessment is in its final stages and decisions remain solely on road type. Options have so far been reduced to 5 feasible contenders:

(i)	single 2 lane (S2L)		
(ii)	wide 2 lane road (W2L)		
(iii)	dual 2 lane all purpose (D2AP)		
(iv)	staging option A	low growth:	S2L for full 30 year assessment period
		high growth:	S2L for first 10 years then W2L thereafter
(v)	staging option B	low growth:	W2L for full 30 year assessment period
		high growth:	W2L for first 12 years then d2AP thereafter.

A number of traffic model and COBA runs have taken place; and estimates of extra delay costs during maintenance,and due to accidents and breakdowns have been made. An environmental appraisal has been carried out and cost estimates have been prepared. All issues relevant to this particular choice between options have been distilled onto the framework shown in figure A1. The framework contains every item regarded in this particular case as significant enough to have a bearing on the final choice.

2. METHOD OF SOLUTION

The process to prepare a framework has been carried out as described in section 3 of this Advice Note (and illustrated in Figure 1). The process of selection described in section 4, in particular the pairwise comparison method described in section 4.5, is adopted.

FIGURE A3.1: EXAMPLE FRAMEWORK FOR CHOICE OF CARRIAGEWAY PROVISION
(all money costs are 1979 present values and prices in £m)

	(1) S2L		(2) W2L		(3) D2AP		(4) Staging Option A		(5) Staging Option B	
	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth
TRAVELLERS										
User Cost Savings (£m)	5.5	9.0	6.8	11.2	8.0	13.2	5.2 7.9	5.5 10.4	6.8	12.5
Accident Savings (£m)	0.5	0.6	0.6	0.7	0.7	0.8	0.5	0.6	0.6	0.7
Additional User Costs during Maintenance & Reconstruction (£m)	0.3	0.7	0.1	0.4	0	0.1	0.1 0.1	0.3	0.1 -	0.1
Additional User Costs during Accidents & Breakdowns (£m)	0.1	0.3	0	0.2	0	0	0.1 0.1	0.1 0.3	- -	-
Conditions experienced by Drivers	sparse overtaking opportunities during all peak periods all years		sparse overtaking opportunities in peak periods in later years if high growth materialises		high standard at all times		sparse overtaking opportunities in all high growth peak periods		above average standard at all times	
Number of accidents saved on network over 30 years	40	60	61	76	78	97	48	61	61	85
OCCUPIERS										
Residential number of properties within 300m subject to increased visual impact	about 15		about 17		about 22		about 15	about 17	about 17	about 22
Number of properties requiring demolition	5		6		8		5	6	6	8
Agricultural land acquisition necessary (ha)	10		11.5		17		10	11.5	11.5	17
TRANSPORT DEVELOPMENT POLICY										
County Council wish to concentrate available maintenance resources on principal roads	very marginal between options with D2AP option reducing vehicle kilometreage by further 25,000 veh-kms (0.5% HGVs) on 5 kms of secondary network over S2L option									

FIGURE A3.1: EXAMPLE FRAMEWORK FOR CHOICE OF CARRIAGEWAY PROVISION
(all money costs are 1979 present values and prices in £m)
continued

	(1) S2L		(2) W2L		(3) D2AP		(4) Staging Option A		(5) Staging Option B	
<u>FINANCE IMPLICATIONS</u>										
PVC: Total cost (including full maintenance, scheme preparation and supervision costs)	5.0	5.0	5.6	5.6	7.2	7.2	5.0	7.0	5.6	7.2
PVB: Total Quantified Monetary Benefits	5.6	8.6	7.2	11.3	8.7	13.9	5.6	10.3	7.2	13.1
NPV: Net Present Value	0.6	3.6	1.6	5.7	1.5	6.7	0.6	3.3	1.6	5.8

Compare Option 1 with Option 2
Option 2 is better in every respect than Option 1 except for Occupiers. The incremental NPV of Option 2 over 1 is £1.0m to £2.1m better. To select option 1 would grant an extremely high implied environmental value to the additional 3 properties and 1.5 ha affected.

Carry option 2 forward.

Compare Option 2 with Option 3
Option 3 is better in every respect than Option 2 except in relation to Occupiers and economic return should low growth materialise (although not much significance should be attached to small differences in economic return). The incremental NPV is - £0.1m to + £2.6m. However, looking across the range as a whole, and regarding any point within the range as equally likely to occur (paragraph 2.2), Option 3 provides very much higher incremental benefits with negligible risk. To adopt Option 2 would imply high environmental values to occupiers especially since Option 3 is also better in respect of accidents and driver conditions. Option 3 is judged preferable.

Carry Option 3 forward.

Compare Option 3 with Option 4
Option 3 is better in every respect than Option 4 except for occupiers. The incremental benefit of Option 3 over Option 4 is £0.9m to £3.4m. Again, by rejecting the very large implied value of environmental benefits to occupiers, select Option 3.

Carry Option 3 forward.

Compare Option 3 with Option 5
The incremental benefits of Option 5 over Option 3 are - £0.1m to + £0.9m. Option 5 is preferable in respect of:

(i) economic return if low growth materializes (marginally)

(ii) occupiers

Option 3 is preferable in respect of:

(i) economic return if middle to high growth materializes

(ii) driver conditions

(iii) accidents (beyond the economic evaluation)

(iv) very marginal extra reductions of traffic on secondary network with very small maintenance reduction for the Local Authority.

Looking across the range it is clear that although the incremental differences of economic return are not overwhelming, a robust case can be advanced for investment in Option 3.

3. CONCLUSION
Option 3 is therefore recommended (there is no other strong contender with which Option 3 has not been compared - see paragraph 3.5).

4. ISSUES ARISING FROM THE EXAMPLE

i) The choice of option is always peculiar to the special circumstances surrounding each case. No issue of significance to the choice should be left out of the framework although the framework should not become cluttered with peripheral information.

ii) The capital cost of a scheme is critical in assessing the choice of option. If the incremental cost of the D2AP scheme had been £1m greater then the incremental benefit of Option 3 over Option 2 would have been -£1.1m to £0.1m. Option 3 would therefore be unlikely to be recommended as this would give a very high implied value to driver comfort and the environmental aspects of accident savings (see paragraph 4.4) notwithstanding the disadvantages to Occupiers. Option 5 would also have become much more attractive.

iii) The full range of economic returns must be used in making choices.

iv) It should be stressed that the particular judgements made in this example do not have general applicability.

v) The design team, in this particular case, did not offer a staging Option from S2 to D2. Their early analysis must have shown that the faster running speed and greater capacity of the WS2 convincingly outweighed the incremental costs. A comparison of Option 1 with Option 2 shows that they were almost certainly right (though this comparison is over the full 30 year period). The design team should nevertheless have shown this staging Option to Senior Officers.

EXAMPLE OF CHOICE OF JUNCTION TYPE

1. PROBLEM

Significant delays are being experienced during peak periods, and to a lesser extent the inter-peak, at an existing roundabout on a trunk road at the fringes of an urban area.

Alternative options have been designed and a choice remains between:

i) do nothing

ii) a 70m inscribed circle diameter (ICD) roundabout

iii) a major signalised intersection

iv) a grade separation scheme

v) staged construction
- low growth : 70m roundabout only
- high growth : 70m roundabout followed by grade separation in year 10.

A framework has been prepared (see Figure A4.1) containing all the issues likely to have a bearing on this particular choice between options. COBA runs have been carried out and advice on the sensitivity of results to input assumptions is available from the traffic study team.

2. METHOD OF SOLUTION

The choice of junction represents a decision taken under much greater uncertainty than carriageway provision (see paragraphs 5.12 - 5.15). The economic returns given by COBA should be used with an understanding of the relationships within the program, particularly their sensitivity to small changes in estimated capacities or traffic volumes.

In the example the 5-minute maximum delay allowed by COBA has been encountered in options 1 and 2 on both low and high growth (see asterisks). The signalised junction and grade separation schemes have adequate reserve capacity to cope with high growth.

FIGURE A4.1 EXAMPLE FRAMEWORK FOR JUNCTION CHOICE
(all money costs are 1979 present values and prices in £m)

	(1) Do Nothing 63m ICD Roundabout	(2) 70m ICD Roundabout	(3) Major signalised intersection	(4) Grade separation	(5) Staged construction low growth: 70m roundabout only high growth: 70m roundabout followed by separation in year 10	Remarks
TRAVELLERS		Low growth / High growth	Low growth / High growth	Low growth / High growth	Low growth / High growth	* denotes COBA 5-minute cut off encountered
User cost savings (£m)	-*	1.0* / 2.1*	4.8 / 8.4	6.4 / 10.5	1.0* / 5.5	
Accident savings (£m)	-	-	0 / 0	.2 / .3	0 / .2	
Additional User Costs during reconstructions (£m)	-	.1 / .2	.1 / .2	.2 / .3	.2 / .2	
Conditions experienced by Drivers	Significant queueing all peak periods low and high growth all years: severe in later years. Lay-out delay at all times	Queueing all peak periods, severe at high growth in later years. Lay-out delay at all times.	Layout delay at all times but little queueing	Free flow for major movements at all times. Layout delay for minor movements at all times	Significant queueing in peak periods in early years if high growth were to take place. Later years only if low growth takes place	
Number of P1 Accidents saved over 30 years	-	.0 / 10 Uncertain	7 / 10 (Uncertain accidents usually slightly more severe than roundabouts)	26 / 36	0 / 28	See Section 2.5.5 of COBA manual
OCCUPIERS						
Residential: No. of properties subject to noise increase	-	about 2	about 5	about 15	As per option 2 on low growth and high growth to year 10. As per option 4 on high growth from year 10.	
No. of properties within 300m exposed to increased visual impact	-	-	about 6 (gantry signing)	about 42		
USERS OF FACILITIES		½ ha public house gardens reduced to ¼ ha	½ ha public house gardens reduced to 0.2 ha	Demolition of public house with associated gardens and childrens playground	As for "Occupiers" in respect of users of facilities	public house gardens contain 7 protected trees
CONSERVATION ENHANCEMENT POLICIES	Local Authority wish to increase attractiveness of trunk road to reduce small amount of "rat-running" on residential roads. All but option 1 serve this objective but options 3 and 4 serve it best.					

FIGURE A4.1 EXAMPLE FRAMEWORK FOR JUNCTION CHOICE
(all money costs are 1979 present values and prices in £m)
continued

	(1) Do Nothing 63m ICD Roundabout	(2) 70m ICD Roundabout		(3) Major signalised intersection		(4) Grade separation		(5) Staged construction low growth: 70m roundabout only high growth: 70m roundabout followed by separation in year 10		Remarks
FINANCE IMPLICATIONS		Low growth	High growth	Low growth	High growth	Low growth	High growth	Low growth	High growth	
PVC: Total cost (including full supervision, scheme preparation and additional maintenance costs) (£m)	-	.1	.1	.3	.3	2.4	2.4	.2	1.3	
PVB: Total quantified monetary benefits (£m)	-	.9	1.9	4.7	8.2	6.4	10.5	.8	5.5	
NPV: Net Present Value (£m)	-	.8	1.8	4.4	7.9	4.0	8.1	.6	4.2	

The problem is not to estimate economic returns with precision but to choose a junction (as stated in paragraph 5.13) and demonstrate that it represents an investment that is likely to give value for money (paragraph 6.1).

The pairwise comparison method is again adopted.

Compare Option 1 with Option 2
Both junctions are operating over-capacity at peak times during the assessment period. The incremental value of £ .8m to £1.8m therefore carries considerable uncertainty. Nonetheless Option 2 is clearly superior to Option 1 and the implied environmental value to occupiers is judged substantially less than the order of these incremental values.

Carry Option 2 forward.

Compare Option 2 with Option 3
Option 2 is operating over capacity frequently during the assessment period but Option 3 is not. The order of incremental benefits of Option 3 estimated at £3.8m to £6.3m far exceed the incremental costs of £0.2m. The incremental environmental disbenefits are small. It is not possible to estimate the effect on overall accidents that this design will produce but the detailed design is known to be very satisfactory.

Carry Option 3 forward

Compare Option 3 with Option 4
Neither Option 3 nor Option 4 are operating over or around capacity for a significant time during the assessment period. The incremental NPVs of Option 4 over Option 3 of - £0.4m to + £0.2m are therefore uncluttered by being highly sensitive to small variations in traffic flows or capacity. The incremental NPVs are nonetheless small and differ between high and low growth: over the range as a whole there is hardly any difference between the two schemes on economic grounds.

The advantages of the signalised intersection are:

i) very much less intrusive to neighbouring properties with respect to both noise and particularly visual intrusion

ii) leaves Public House and its associated gardens and childrens' playground in use.

The advantage of the grade separation are:

i) free flowing conditions for major road traffic

ii) will save an estimated 19-26 PI accidents over the assessment period.

There is strong local resistance to Option 4 so it is rejected.

Carry Option 3 forward.

Compare Option 3 with Option 5
Option 5 is rejected as it has a substantially lower economic return and, if high growth materializes, does not avoid environmental damage from year 10 onwards.

3. CONCLUSION

The recommendation is to proceed with Option 3.

All Options evaluated show good economic returns.

4. ISSUES ARISING FROM THE EXAMPLE

i) Because the cost of the signal scheme was very little different than the 70m roundabout schemes, and performs so much better the design team should have offered a staged signalised junction to grade separation scheme for consideration.

ii) The capital cost of this grade separation scheme was relatively low for the site. A much more expensive scheme would have increased the relative attractiveness of Option 5.

iii) Because budget constraint is managed nationally for trunk road schemes in the National Programme, the lower capital cost of Option 3 over Option 4 was not an issue in the local evaluation: the objective of local teams (in the first instance) is to maximise NPV (see COBA manual section 3.1). Local Authority schemes and schemes in the Regional Programme, however, have different budget constraint methods.