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PRIORITY MANAGEMENT FOR URBAN ARTERIALS

TRANSFERABILITY OF TECHNIQUES

HYPOTHETICAL ARTERIALS

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CONTENTS

ABSTRACT

A series of hypothetical corridors have been simulated, representing a range of junction spacings, capacity distribution, availability of parallel routes, bus flows and routing patterns. These have been used to test a range of traffic management measures designed to increase capacity, improve public transport operations and calm traffic. All measures have been assessed in terms of their impact on travel costs and conclusions have been drawn in terms of the appropriateness of different measures in differing contexts.

1 INTRODUCTION

The efficient and equitable control of traffic is an increasingly complex problem as traffic volumes continue to rise. All user groups (car drivers, bus passengers, cyclists, pedestrians, residents) are in competition for the use of the limited available road space. Individual measures to control or enhance one aspect of this use can be disadvantageous to one or other of the remaining groups. The adoption of a package of measures may ensure a fairer distribution of these road priorities. Given the large number of potentially useful measures available, the combined use of individual measures needs to be carefully assessed.

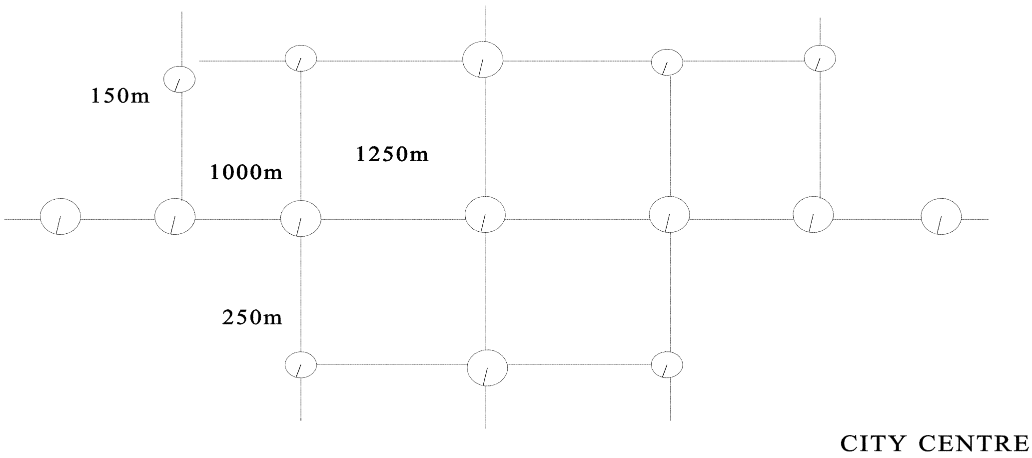
This paper describes the background and methodology employed in research funded by EPSRC to assess the effect of individual traffic control measures, both in isolation and in combination upon urban arterials. The aim of the project was to test the transferability of the techniques developed in an earlier project to a range of different types of urban corridor. Measures have been classed into three broad categories: Congestion Management, Public Transport Priority and Traffic Calming. The scope of these measures is wide, some operating at a junction level whilst others have an impact over a whole corridor.

The project which provided the initial stimulus to the study was a three year EU funded project on the priority management of urban arterials. This project, entitled PRIMAVERA, used off-line evaluation tools to select a set of integrated traffic management measures to apply to two test sites, one in Leeds, UK and another in Torino, Italy (see Fox et al, 1995). Whilst these two sites possessed many of the typical characteristics of urban arterial roads and provided an insight into the interaction of a limited range of measures, there was concern that the results might well be specific to those arterials. It was thought that further studies on other urban arterials could provide additional insight. This gave rise to the submission to the then SERC for a grant to apply those techniques developed within PRIMAVERA to other UK urban arterial corridors. The scope of this study was to be somewhat different from that of PRIMAVERA. One important difference was the relaxation of the EU's emphasis on Transport Telematics, providing the study with a greater degree of flexibility in the range of measures to consider, in particular civil engineering measures. Another consideration was that this study did not possess the resources to implement on-street field trials of the optimum combination of measures. This did not, however, remove the requirement that each measure should be capable of on-street application.

While the majority of the project has focused on the assessment of measures applied to three selected urban arterials, the results are inevitably specific to the arterials selected. In an attempt to generalise the results, a set of hypothetical corridors has been simulated to enable measures to be assessed in terms of their appropriateness in a range of conditions. This part of the project provided a context within which measures could be selected for the real world arterials. It also provided a test-bed for the implementation of the program code for each measure.

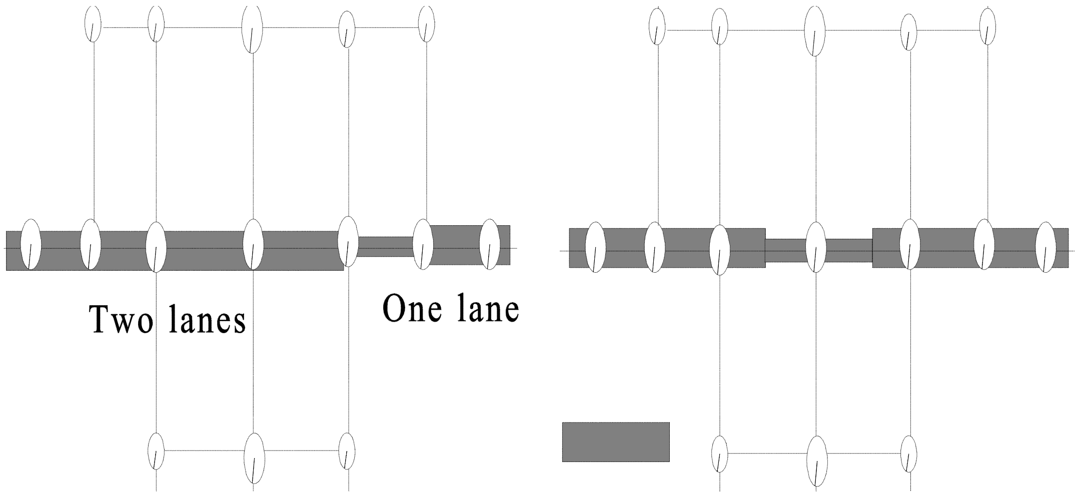
2 DESIGN OF THE HYPOTHETICALS

The basic form of the hypothetical arterial is a main, East-West radial roadway, bisected by an orbital ring road and with an associated set of lower capacity routes parallel to each. Figure 1 shows this basic structure.

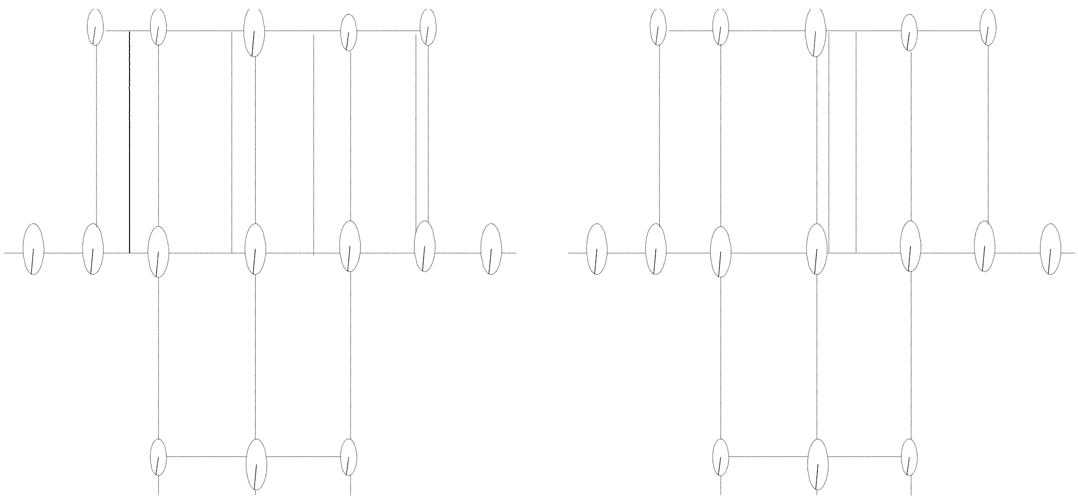


Each hypothetical was constructed from combinations of all of the following attributes, each of which has two mutually exclusive levels:

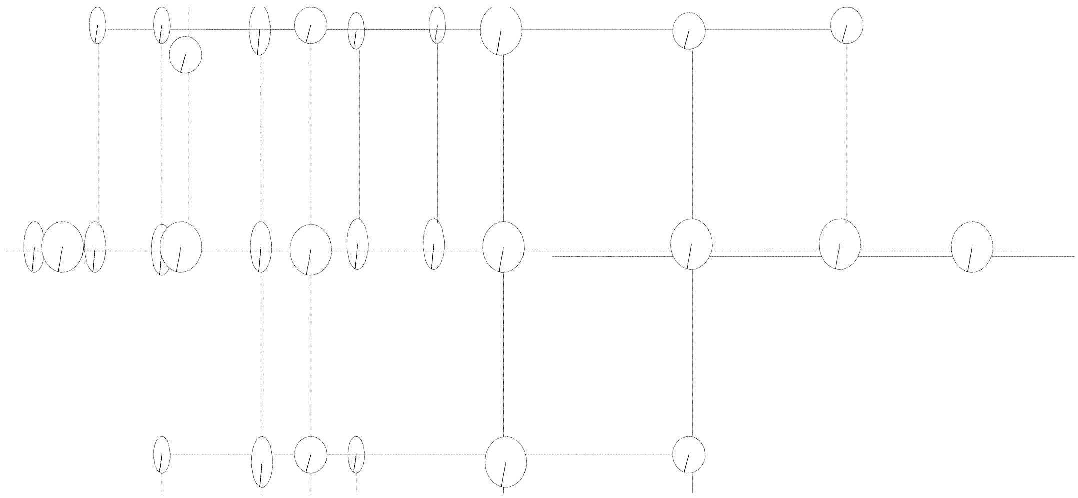
Reduced capacity. Rarely will an arterial road maintain the same capacity along its entire length. The road may narrow from three or two lanes down to two or one per direction, causing a bottleneck and, potentially, upstream congestion. Even in those cases where the capacity is maintained the demand may increase on a section of roadway, putting greater strain on the available, constant, capacity. Since reductions in capacity and increase in demand can be seen as two sides of the same coin, by addressing the issue of capacity reduction, the issue of increased demand is also addressed. The hypotheticals possess a reduction in capacity from two lanes per direction down to one at two separate places. One is towards the City Centre and the other is surrounding the section near the ring road.



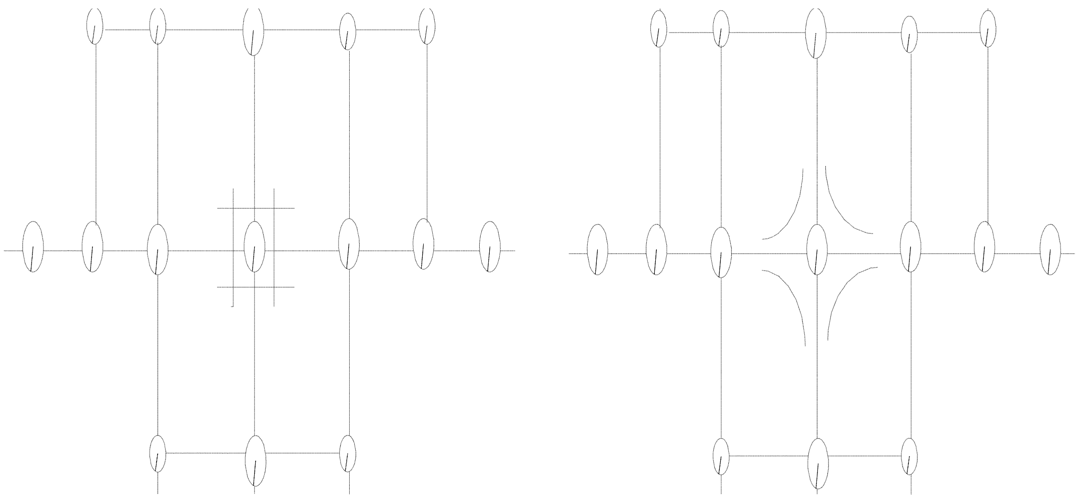
Junction spacing. The spacing of junctions can have an important influence on the behaviour of an arterial road. One advantage of short links is that coordination between linked traffic signals is more efficient. Compact platoons can be formed and progressed along the road on a green wave. On the other hand, such links have a limited queue storage capacity. If long queues are allowed to build up on such links, due for instance to long red periods at signals, the risk of traffic blocking an upstream intersection becomes greater. For the hypothetical arterial there are two places for a section of shorter links (100m as against 250m and 500m elsewhere). The first is towards the City Centre end of the arterial. Here there is only one alternative route. In the second case the shorter links are in the middle of the arterial, with two alternative routes available (although one of these routes can be removed, see below).



Alternative routing. The operation of an arterial is not just influenced by its own characteristics but also by those of its surrounding network of roads. Where alternative routes exist, these may accommodate traffic that would otherwise use the arterial. In the first level of this characteristic there is an extensive network of alternative routes both to the north and south of the arterial. In the other level, the southern route has been removed. This will place increased demand on the arterial and at the critical arterial/Ring Road junction. A possible benefit will be simpler, enhanced signalling at those intersections which have been reduced from cross roads to t-junctions.

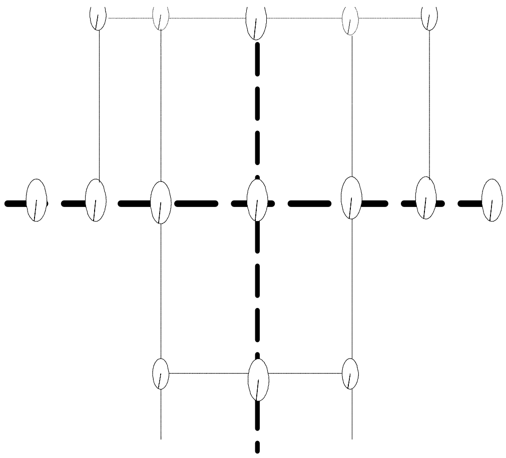


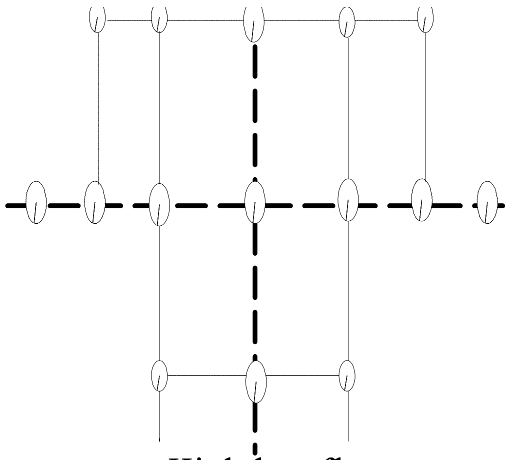
Routing patterns. The efficiency of an arterial may not be simply a function of its capacity measured in terms of traffic volumes but may also be influenced by the turning patterns in the network. Large turning volumes become a problem when there is a corresponding strong crossing flow. If there are insufficient gaps in the crossing flow to allow this turning movement to take place, it may necessitate the inclusion of a filter signal stage for the turning traffic. The first case has strong flows across the critical arterial/Ring Road junction and weak turning flows. The second case has strong turning volumes both from the arterial into the Ring Road and from the Ring Road into the arterial. These two cases are represented by two differing origin-destination matrices. In both cases



the link volumes are comparable, only the pattern of the traffic has changed.

Bus flows. Buses have different behavioural characteristics from other forms of traffic. They tend to have flatter acceleration and deceleration profiles and stop to pick-up and drop-off passengers. The proportion which they form of the general traffic stream may be important both in the operation of the traffic stream and in the performance of measures which will be adopted to control the traffic. For the hypotheticals the first case is high bus flows (20 buses per hour) on both the arterial and the Ring Road whilst the second is a reduced flow on the Ring Road (10 buses per hour) but still 20 per hour on the arterial.





Combination of characteristics. Given these attributes, it is clear to see that there are $2^5=32$ different styles of hypothetical arterial. Figures 7 to 22 show 16 of these combinations and the assigned turning flows along each link in the network. The bus attributes are not considered in these figures since they have no effect on the traffic assignment. The numbers given above and below a significant link in these figures represent the total hourly flow in vehicles (not including buses) on that link.
The key used for the figure captions is:

CR - Reduced capacity towards the City centre of the arterial;
MR - Reduced capacity in the Middle of the arterial;
CJ - reduced Junction spacing towards the City centre end of the arterial;
MJ - reduced Junction spacing in the Middle of the arterial;
F - Full network;
R - Reduced network;
X - Strong flows across the Ring Road;
T - Strong turning flows at the Ring Road;
H - High bus flows;
L - Low bus flows.

3 MEASURES

The same set of individual and combined measures were applied to every arterial combination. In total 15 simulations (including the base case of a TRANSYT derived signal plan) were applied to each of the 32 arterials, making available 480 sets of results.

The base case and each of the six individual measures is described in turn.

Base. The eight basic network topologies and two flow patterns were used to build TRANSYT data files in order to derive a suitable base signal plan. A problem exists in that to obtain flows a signal plan is required but in order to obtain a reasonable signal plan flow information is required. To some extent the assignment procedure will attempt to match the flows to the given signal plan. The link flows used in the TRANSYT plan were those taken from an assignment with a reasonable signal plan in operation. (TRA)

Bus Laybys. In the base case there are no bus laybys anywhere in the network. This measure implements bus laybys in strategic locations. These locations tend to be where there is a bus stop immediately up or down stream of a critical junction or on a road section where the road narrows from two to one lanes. The first case helps to maintain saturation at the junctions in the network whilst the second reduces the effect of the capacity reduction. (LAY)

Bus lane. An existing general traffic lane is converted into a reserved bus lane with a set-back of between 80m to 120m. Where this bus lane passes side streets, it is discontinued for a limited length to allow turning vehicles to access these side streets. The total extent of the reserved lane is approximately 1km and is situated upstream of the reduction in capacity. (LANE)

Selective vehicle detection. Four junctions are equipped to provide priority to inbound buses. These junctions are all on the arterial where it intersects with the Ring Road and the Ring Road's parallel routes, and the junction on the arterial which is nearest the City Centre. (SVD)

Starting and stopping waves. Starting and stopping wave coordination was attempted on all those links in the network which were signal controlled at both junctions. The maximum allowed movement in the offset from one cycle to the next was 5 seconds. (SSW)

Autogating. The autogating measure was used on the four signal controlled links immediately upstream of the reduction in capacity from two to one lane. For the first upstream link the required percentage of storage space to maintain is set high and the minimum green time low. As the chained application of this measure moves upstream, the required percentage of free space reduces and the minimum green increases. (MX)

Calming. This measure physically calms the northern sidestreets in the network. The application is at those streets which link the arterial and the northern parallel route immediately before or after the reduction in capacity is implemented. This tends to re-distribute the rat-running traffic back onto the arterial or onto other sidestreets further up or down stream of the capacity constraint. The traffic is calmed by a reduction in the usual flow, usually to one third or a half, and a maximum speed of 5 to 7 m/s (18km/hr to 25km/hr). (CALMED)

A limited number of combined measures were also tested on each of the 32 configurations. The combinations were chosen to reflect a mixture of measures from each of the three categories of measures. Implementation of bus lanes was tested in combination with selective vehicle detection; starting and stopping wave coordination and autogating. A reserved bus lane was also tested in combination with starting and stopping wave coordination and autogating. Finally calmed sidestreets were tested with the two queue management measures, starting and stopping wave coordination and autogating.

4 COST BENEFIT RESULTS

A user cost analysis was the primary measure used to assess the effect of each measure on each combination. This allows impacts which are measured in differing units to be converted into monetary values which can then be aggregated. A full explanation of this approach is given in Clark et al (1995a). A full set of multi-criteria results were also derived but these results are not presented here.

The complete set of cost benefit results for all 14 simulations on 32 arterials is given in the appendix. This appendix also displays this information in 32 bar graphs.

4.1 BASE COSTS

A number of points emerge from the structure of the hypothetical corridor.

Corridors with high bus flows have a consistently higher operating cost. This is a reflection of both the disruption that buses may cause to traffic flows and also the fact that more bus passengers will be included in the travel time costs for the higher bus flow situations.

The removal of the alternative route to the south of the arterial always increases the operating cost of the corridor, not a surprising result. The ranking of the structures (from least to greatest cost) is:

low bus flows and full network;
high bus flows and full network;
low bus flows and reduced network;
high bus flows and reduced network;

4.2 EFFECTS OF MEASURES

A codification of the Cost Benefit results is given in tables 1 and 2. A ✓ denotes a decrease in the operating cost of the measure in comparison to the TRANSYT base case. The greater the number of ✓'s the greater the percentage reduction. Conversely, an x denotes an increase in costs, with the more x's the greater the percentage increase. The impact of each measure described in section 3 will be taken in turn.

Laybys. Laybys perform well on their own, except with MRCJR (the capacity reduction in the middle, more junctions to the city end and a limited secondary network). It is not immediately clear why this should be.

Bus lanes. Bus lanes work well with the capacity reduction in the middle, but not with it to the city end. This may well be because the lane is less likely to disrupt the major junction.

Selective vehicle detection. Selective vehicle detection works well when there are more junctions to the city end, particularly with a limited secondary network. It does not perform well when there are more junctions in the middle. These results are less clear, however, with the second traffic pattern. It is not immediately clear why this should be, unless the detector nearest to the city centre performs better in these circumstances.

Starting and stopping waves. The use of starting and stopping waves to set signal timings performs badly. The only exception to this is CRCJR (reduced capacity and more junctions to the city end, and a limited secondary network). This seems reasonable; this signal control approach works best (and is most needed) where junctions are closely spaced and capacity limited.

Autogating. Autogating performs similarly to starting and stopping waves, and for broadly the same reasons.

Calming. Not surprisingly, calming of side streets has adverse effects on efficiency, since capacity is reduced. The only situation in which results are not adverse is MRCJ (capacity reduction in the middle and more junctions to the middle) where it may be that the opportunities for using side streets are greater, even when certain streets are calmed.

Combinations of measures. Inspection of tables 1 and 2 indicates that the results for some combinations are much closer to those of one component measure than the other. Signal control using stopping and starting waves and, to a lesser extent, autogating, is likely to dominate the effects of the measure with which it is combined. This is particularly true for laybys, calming and bus lanes. Since these measures generally performed badly, it is clearly important to avoid them in combination with other measures.

The effect of laybys dominates that of selective vehicle detection, and hence helps to increase its effectiveness. It also dominates the effect of autogating in the specific situation in which the capacity reduction is to the city end. Since this is the situation in which autogating performs best, this is a beneficial effect.

With the exceptions mentioned above, neither selective vehicle detection nor calming interacts significantly with other measures.

FIRST PATTERN (X)	CRCJF		CRCJR		CRMJF		CRMJR		MRCJF		MRCJR		MRMJF		MRMJR	
	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
LAYBYS	✓✓✓	✓✓	✓✓✓	XX	✓✓✓	✓✓	✓	✓	✓✓✓	✓	X	✓✓✓	✓✓✓	✓✓	✓✓	✓
LANE	XXX	XX	X	XXX	XX	XX	XXX	XXX	✓	X	✓✓	✓✓	✓✓	X	✓✓	X
SVD	X	✓	✓✓✓	XX	✓	✓	XX	XX	✓	✓	✓✓	✓✓✓	X	✓	X	✓✓
SSW	XXX	XXX	✓✓✓	✓✓	XXX	XXX	XXX	XXX	XX	XXX	X	X	XX	XXX	✓✓	X
MX	XX	XX	✓✓✓	XX		X	X	X	XX	XX	✓	XXX	X	XX	XXX	XXX
CALMED	XXX	X	✓	XXX	XX	X	XX	XX	✓	✓	✓✓✓	✓✓✓	X	X	X	X
LAY+LANE	✓✓✓	X	✓✓	XXX	✓	X	XX	XXX	✓✓✓	X	✓✓	✓	✓✓	✓	✓✓	X
LAY+SVD	✓✓✓	✓✓✓	✓✓	XX	✓✓	✓✓	✓✓✓	✓	✓✓✓	X	✓	✓✓	✓✓✓	X	✓✓	✓✓
LAY+SSW	XXX	XXX	✓✓✓	✓✓	XXX	XXX	XXX	XXX	X	XX	✓✓	X	XX	XXX	✓	X
LAY+MX	✓	✓✓	✓✓	X	✓✓✓	✓✓	✓✓	✓	X	XX	XX	XX	X	X	XXX	XXX
LANE+SSW	XXX	XXX	✓✓	X	XXX	XXX	XXX	XXX	XX	XXX	✓✓	✓	XXX	XXX	XX	XX
LANE+MX	XXX	XX	XXX	XX	XX	XX	XX	XX	XX	XX	✓	XX	X	XX	XXX	XXX
CALMED+SSW	XXX	XXX	✓✓✓	✓✓	XXX	XXX	XXX	XXX	XX	XX	XX	X	XXX	XXX	X	X
CALMED+MX	XXX	X	✓	XXX	XX	X	XX	XX	XX	XX	✓	XX	XX	XX	XXX	XXX

Table 1: Changes in Cost Benefit figures for first routing pattern

Key (for Tables 1 and 2)

✓	0 to 2% decrease	x	0 to 2% increase
✓✓	2 to 4% decrease	xx	2 to 4% increase
✓✓✓	4%+ decrease	xxx	4%+ increase

SECOND PATTERN (T)	CRCJF		CRCJR		CRMJF		CRMJR		MRCJF		MRCJR		MRMJF		MRMJR	
	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
LAYBYS	✓✓✓	✓	✓✓✓	XX	✓✓	✓	✓✓✓	X	✓✓	✓	✓✓✓	XX	✓✓✓	X	✓	X
LANE	✓	X	✓	X	XXX	X	✓✓	XX	X	X	X	XXX	✓	XX	✓✓	X
SVD	✓✓	✓	✓	X	X	X	✓✓	X	✓	✓	XXX	✓✓	✓✓	X	X	X
SSW	XXX	XXX	✓✓✓	✓✓✓	XXX	XXX	XXX	XXX	XX	XX	XX	X	XXX	XXX	✓	X
MX	XX	X	XX	✓✓	X	✓	✓✓	X	XX	XX	XXX	XXX	XX	XX	XXX	XXX
CALMED	XXX	XX	XXX	XX	XX	X	X	XXX	XX	X	XXX	X	X	XX	✓	XX
LAY+LANE	✓✓	X	X	XX	✓	X	✓	XX	✓	X	✓	X	✓	XX	✓✓	X
LAY+SVD	✓✓✓	✓✓	✓✓✓	✓✓	✓✓	✓	✓	XX	✓✓	✓	✓	X	✓	X	✓✓	✓
LAY+SSW	XX	XXX	✓✓✓	✓✓✓	XXX	XXX	XXX	XX	XX	XX	X	XX	XX	XX	✓	X
LAY+MX	✓✓	X	✓✓✓	✓✓	✓✓	✓✓	✓✓✓	X	X	XX	XXX	XXX	X	X	XXX	XXX
LANE+SSW	XXX	XXX	✓	✓✓	XXX	XXX	XXX	XXX	XXX	XXX	XX	XX	XXX	XXX	X	XX
LANE+MX	XX	XXX	✓✓	XXX	XX	X	✓✓✓	XX	XX	XXX	X	XXX	X	XX	XXX	XXX
CALMED+SSW	XXX	XXX	✓✓	✓✓	XXX	XXX	X	XXX	XXX	XX	XX	XX	XXX	XXX	XX	X
CALMED+MX	XXX	XXX	XX	XX	XX	X	✓✓	XX	XX	XX	XXX	XXX	XX	XX	XXX	XXX

Table 2: Changes in Cost Benefit figures for second routing pattern

5 CONCLUSIONS

This review of the impacts of a range of measures on a series of hypothetical corridors has been limited to an analysis of the efficiency effects. The study of the three real corridors indicates that the aggregate environmental effects can be expected to be similar in direction (although calming should improve the environment on the side streets) while the safety effects will be opposite, largely because speeds are increased when efficiency is improved.

Of the measures tested, laybys, bus lanes and selective vehicle detection generally performed well, while the two forms of queue management and traffic calming generally performed badly in efficiency terms. With the exception of the queue management measures, these results were as expected.

The performance of the measures was, however, to some extent dependent on the characteristics of the corridor. When the section with low capacity was in the middle of the corridor, as opposed to near the city centre, bus lanes were likely to perform better. When, in addition, there was closer junction spacing nearer to the city centre, calming could be beneficial but, for less obvious reasons, layby provision was less effective.

When the section with low capacity was near to the city centre, and there was closer junction spacing in the same area, and fewer side streets, queue management measures worked well. These were, however, the only circumstances in which they did.

Closer junction spacing towards the city centre and fewer side streets also made selective vehicle detection more effective, regardless of where the capacity reduction was.

Generally, therefore, there is a case for selecting different types of measure in differing circumstances. However, the only measures which are particularly sensitive are the queue management ones, which appear to be appropriate only in very specific conditions in which close junction spacing and low capacity are combined near to the city centre.

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APPENDIX: Cost Benefit Results

CRCJF		X H	X L	T H	T L
	TRA	16034	13713	16315	13848
	LAYBYS	15512	13392	15824	13654
	LANE	16259	13988	16306	13992
	SVD	16054	13693	16052	13750
	SSW	16908	14282	17041	14609
	MX	16209	13912	16662	14154
	CALMED	16642	13757	16954	14467
	LAY+LANE	15398	13879	16099	14180
	LAY+SVD	15356	13368	15341	13454
	LAY+SSW	16480	14302	16690	14466
	LAY+MX	15594	13558	16015	13917
	LANE+SSW	17145	14747	17320	14876
	LANE+MX	16640	14192	16684	14627
	CALMED+SSW	17105	14485	17903	14949
	CALMED+MX	16787	13861	17070	14619
CRCJR		X H	X L	T H	T L
	TRA	20064	16983	20060	17675
	LAYBYS	19296	17329	19467	17901
	LANE	20102	18068	19964	17817
	SVD	19705	17394	19882	17742
	SSW	19633	16572	19259	16492
	MX	19646	17362	20349	17342
	CALMED	20007	17957	20952	17988
	LAY+LANE	19833	17558	20118	18114
	LAY+SVD	19725	17390	19496	17330
	LAY+SSW	19030	16538	19431	16867
	LAY+MX	19740	17142	19177	17420
	LANE+SSW	19468	17019	19938	17241
	LANE+MX	20590	17450	19723	18273
	CALMED+SSW	19302	16511	19764	17374
	CALMED+MX	19925	17918	20426	18005
CRMJF		X H	X L	T H	T L
	TRA	15659	13338	15562	13341

	LAYBYS	14931	12953	15253	13165
	LANE	16007	13712	16175	13511
	SVD	15409	13219	15799	13567
	SSW	16984	14139	17020	14644
	MX	15659	13339	15569	13341
	CALMED	15981	13446	16057	13357
	LAY+LANE	15495	13436	15412	13412
	LAY+SVD	15006	13060	15237	13301
	LAY+SSW	16544	14290	16830	14313
	LAY+MX	14931	12954	15242	13163
	LANE+SSW	17233	14693	17206	14807
	LANE+MX	16004	13767	16122	13537
	CALMED+SSW	17241	14867	17093	14830
	CALMED+MX	15948	13445	16083	13357
CRMJR		X H	X L	T H	T L
	TRA	19280	16658	20026	16715
	LAYBYS	19039	16584	18923	16865
	LANE	20366	17657	19407	17272
	SVD	19675	16991	19489	16994
	SSW	21237	18162	22575	18344
	MX	19348	16747	19667	16676
	CALMED	19956	17041	20197	17745
	LAY+LANE	19926	17506	20059	17480
	LAY+SVD	18691	16449	19958	17250
	LAY+SSW	21352	17924	22063	17395
	LAY+MX	18894	16360	19102	16878
	LANE+SSW	21975	18545	21367	18076
	LANE+MX	19877	17045	19358	17189
	CALMED+SSW	22234	18816	20263	18057
	CALMED+MX	20088	17003	19406	17154
MRCJF		X H	X L	T H	T L
	TRA	15376	13092	15416	13024
	LAYBYS	14865	13057	14929	13005
	LANE	15267	13198	15765	13060
	SVD	15306	13027	15395	13004

	SSW	15777	13744	16075	13725
	MX	15854	13501	16017	13635
	CALMED	15262	12976	15810	13041
	LAY+LANE	15031	13129	15122	13136
	LAY+SVD	14939	13108	14941	12984
	LAY+SSW	15683	13629	15876	13802
	LAY+MX	15619	13575	15532	13530
	LANE+SSW	16041	13901	16312	13982
	LANE+MX	15937	13750	15933	14351
	CALMED+SSW	16062	13752	16065	13747
	CALMED+MX	15878	13534	15880	13580
MRCJR		X H	X L	T H	T L
	TRA	20640	17850	20382	17637
	LAYBYS	20749	17107	19714	17980
	LANE	20298	17591	20518	18232
	SVD	20405	17271	21296	17425
	SSW	20993	17907	20949	17712
	MX	20671	18903	21238	18688
	CALMED	20016	17283	21486	17923
	LAY+LANE	20376	17647	20349	17760
	LAY+SVD	20532	17402	20349	17702
	LAY+SSW	20351	17868	20458	17918
	LAY+MX	21196	18592	21113	18598
	LANE+SSW	20437	17839	20814	18236
	LANE+MX	20656	18474	20640	18840
	CALMED+SSW	21064	17981	20851	17949
	CALMED+MX	20565	18493	21283	18874
MRMJF		X H	X L	T H	T L
	TRA	15096	12907	15314	12828
	LAYBYS	14653	12749	14700	12908
	LANE	14873	13110	15312	13277
	SVD	15163	12842	14998	12858
	SSW	15695	13478	15910	13469
	MX	15356	13198	15633	13242
	CALMED	15368	13121	15378	13220
	LAY+LANE	14820	12858	15060	13082

	LAY+SVD	14710	12870	15035	12971
	LAY+SSW	15388	13431	15551	13483
	LAY+MX	15215	13003	15312	13169
	LANE+SSW	15845	13548	16059	13739
	LANE+MX	15188	13202	15434	13359
	CALMED+SSW	15754	13584	16068	13736
	CALMED+MX	15414	13144	15552	13290
MRMJR		X H	X L	T H	T L
	TRA	17753	15105	17630	14955
	LAYBYS	17504	15070	17557	15028
	LANE	17618	15193	17315	15001
	SVD	17794	14864	17842	15047
	SSW	17529	15262	17617	15180
	MX	20001	17859	20451	17401
	CALMED	18017	15276	17504	15620
	LAY+LANE	17459	15192	17360	15214
	LAY+SVD	17503	14825	17103	14860
	LAY+SSW	17638	15198	17460	15276
	LAY+MX	19428	17422	19996	17372
	LANE+SSW	18383	15637	17801	15727
	LANE+MX	20367	17438	19477	16864
	CALMED+SSW	17785	15275	18022	15273
	CALMED+MX	20762	17524	20965	18148