Final Report for Publication

DANTE

Designs to **A**void the **N**eed to **T**ravel in **E**urope

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DANTE

Designs to Avoid the Need to Travel in Europe

Executive Summary

THE DANTE MISSION STATEMENT:

"To identify strategies that would reduce the amount of travel to a necessary minimum, particularly during peak traffic periods, and to determine those journeys which have the greatest potential for reduction"

DANTE was a collaborative European research and development project, designed to assess the strategies available to reduce the need and level of demand for road travel in European cities and on inter-urban road corridors. The aim of the DANTE project was to identify the types of measure which are available to promote travel reduction, and to evaluate the effects and potential of these measures. The work has been undertaken as part of the European Commission's Transport Directorate research programme on Road Transport by an experienced international consortium.

Technical approach and output

DANTE has used a range of case studies from seven European countries to evaluate the implementation and impacts of travel reduction strategies and demonstrate examples of existing good practice. The principal case study cities were: Aalborg (DK); Bristol (UK); Bucharest (RO); Enschede (NL); Mytilini (GR); Rome (IT); and Zürich (CH). The major output of the project is a European Guide to Good Practice in Reducing Travel, entitled "Encouraging Travel Alternatives". The Guide, aimed at transport professionals and decision-makers, demonstrates good practice in achieving travel reduction across a range of strategies. The project has also developed a framework for evaluating the impacts of individual measures, to assess their potential to reduce travel.

The project has involved the following technical components:

- A review of travel trends in Europe over the last 10 years, concentrating on those trips which are important contributors to overall patterns of mobility, and providing the context within which the opportunities for avoiding the need to travel could be assessed;
- Development of a comprehensive classification of the range of policy options available to reduce the need to travel, based on recent trends. Identification of a set of six strategies to reduce travel in Europe by encouraging travellers to switch mode of transport, the time of travel or the destination of travel; or by substituting some journeys by using telecommunications, linking a number of trips, or by trip modification. Identification and classification of a wide range of measures to use as the 'building blocks' of these strategies.
- Development of a framework for the assessment of the benefits and impacts of travel reduction measures;

- Creation of a network of DANTE Associate Cities, to both receive information on the DANTE project and provide input to the Good Practice Guide;
- Review of the measures to avoid the need to travel which have been implemented in each DANTE case study;
- Assessment of the impact of these measures on travel reduction, in terms of the scale and nature of changes in journey timing, activity location, type of journey purpose, travel mode and combining trips;
- Assessment of the potential for each measure in terms of necessary conditions for implementation, potential barriers to implementation, transferability of results and comparability across cities. Assessments were carried out by means of interviews with local decision makers in each case study, together with a qualitative assessment of the potential for transferability and comparability of results across Europe;
- Production of a quality, publishable exploitation report - the Good Practice Guide - demonstrating good practice for the implementation of strategies to avoid the need to travel.

The DANTE Good Practice Guide: *Encouraging Travel Alternatives: A Guide to Good Practice in Reducing Travel* provides a directory of some thirty types of travel reduction measure, illustrating their use and effects by means of case studies. It also discusses the underlying mechanisms of switching and substitution and the ways in which these might be combined towards the objectives of travel reduction. The Guide also provides comparisons across the case studies and hence the potential for transferability of results. Finally, the Guide discusses the different kinds of barriers to implementation and barriers to realising travel reduction outcomes and draws conclusions on the best means of achieving travel reduction. With its use of case studies, illustrations and cross-referencing, the Guide aims to present the complexities of travel reduction in an accessible format.

Project results have been widely disseminated during the course of the DANTE project. The Good Practice Guide was officially launched at the DANTE 'Strategies for Travel Reduction' event, held in Bucharest in June 1998, and is currently being printed for national dissemination. Project results are also due to appear in a special issue of the journal *Built Environment*, in various individual papers and in book form.

Conclusions arising from DANTE

Broadly, it can be concluded that travel reduction is most likely to occur where a series of policies are in operation which reinforce each other towards the objectives of travel reduction. Thus, examples have been shown in which strategy packages combine restraint on car use with promotion of alternatives (i.e. which include both 'carrot' and 'stick' measures).

The project has also identified three significant caveats. Firstly, it has been seen that 'travel reduction' is often difficult to quantify, and must be deduced indirectly. This means that the assessment of - and potentially the justification for - travel reduction strategies is not necessarily straightforward. Secondly, it has been seen that sometimes travel might be 'pinned down' in one instance, but might be 'released' elsewhere, or that any freed-up vehicles or roadspace may be used by others. This points to the need for a co-ordinated and consistent approach to achieve the best possible results. Thirdly, in some cases any travel reduction 'gains' are overwhelmed by travel growth in a relatively short period of time.

Nevertheless, successes of a small magnitude have the potential to be replicated elsewhere to achieve greater travel reduction benefits on a wider scale.

Overall, it has been found that careful development and implementation of policies can create successful conditions in which travel reduction may be achieved. Awareness of potential barriers and pitfalls - cases where contradictory outcomes result - can help achieve success. The role of public information is also particularly important, in order to encourage a change in attitude to travel, and hence a shift in behaviour.

It is possible to learn from the case studies and the wider travel reduction context, and suggest a few principles or pointers which may be used to summarise the messages of travel reduction emerging from the Good Practice Guide:

'Things to Do'

- Use a package of several complementary travel reduction measures;
- In particular, combine restraint of the car with promotion of the alternatives;
- Start with low expectations - for example start with small, practical measures which have a high probability of demonstrable success;
- However, do not neglect land use planning measures, which may allow travel reduction to be 'built in' to communities without the need for ongoing pro-active travel reduction policies;
- Anticipate any potential barriers to implementation in order to avoid negative results;
- Get the public involved, and build on any local initiatives which are in line with travel reduction policies;
- Use public awareness messages to encourage people to want to change travel behaviour, as well as informing them of the available alternatives;
- Authorities (as employers and individuals) are in a good position to lead by example;
- Take the initiative by giving people the opportunities to work in different ways, providing facilities, bicycles etc;
- Where possible, demonstrate direct benefits to those changing behaviour.

'Things to Avoid'

- Avoid implementation of policies elsewhere which tend to increase travel, for example:
    - Promoting the efficiency of the traffic system without considering travel-encouraging consequences.
    - Creation of out-of-town centres which encourage longer, car-based trips.
    - Regulations which require minimum parking provision or forbid mixed use development.
- Avoid any changes which encourage or require short term increases in mobility by car (which may become habit-forming);
- Avoid appearing to be too hostile to the car user, as this may in turn receive a hostile public reaction. Rather, emphasise positive aspects - car users are also sometimes pedestrians;
- When promoting alternatives to the car, avoid promoting poor quality alternatives;
- Avoid introducing public transport too late into newly developed residential areas, as people are likely to have chosen to use the car. By then, it will be very difficult to change that habit;

- Wherever possible, avoid uncertainty when introducing restrictive measures such as area access control, as these may get a negative reaction from shopkeepers and businesses.

DANTE has demonstrated that travel reduction has been achieved over a wide variety of circumstances and by a variety of means: it has been achieved though policies for restraining car use, promoting alternatives to car use, land use planning and technological solutions, and has been demonstrated in all countries studied and at all scales of application. A range of agents and individuals can make valuable contribution to travel reduction, from local authorities and national governments to employers and transport operators.

1. INTRODUCTION AND OBJECTIVES

1.1 Introduction

DANTE was a collaborative European research and development project, designed to assess the strategies available to reduce the need and level of demand for road travel in European cities and on inter-urban road corridors. The aim of the DANTE project was to identify the types of measure which are available to promote travel reduction, and to evaluate the effects and potential of these measures. The work has been undertaken as part of the European Commission's Transport Directorate research programme on Road Transport by an experienced international consortium.

THE DANTE MISSION STATEMENT WAS:

"To identify strategies that would reduce the amount of travel to a necessary minimum, particularly during peak traffic periods, and to determine those journeys which have the greatest potential for reduction"

The DANTE project has addressed the issue of reducing road travel requirements. Eighty five percent of all journeys made in the European Union occur on the road network. In addition to a rapid expansion of freight movement on roads, the last 30 years have seen a fivefold increase in European car ownership levels - with increases of an additional 30% expected in the next 20 years. As a result, traffic forecasts for European cities will increase by up to 80% over current levels by 2015. The environmental, energy, economic and social costs of this increase are huge, and must be avoided. In European policy terms, the medium term consequences of these trends are clear - road systems will simply not be able to cope with the traffic levels forecast for them. New roads will only create additional demand for the road space available and, as a result, policy makers now believe that future European transport policies must be supply rather than demand led.

The aspiration towards reducing travel is increasingly found on the policy agenda across Europe. Yet, in order to be able to realise travel reduction, it is necessary to be aware of the types of policies available and what their effects might be - in other words there is a need for the demonstration of good practice in reducing travel. The DANTE project has addressed this need by demonstrating good practice in achieving travel reduction across a range of strategies, including transport policy, land use planning and the use of technology.

DANTE has used a range of case studies from seven European countries to evaluate the implementation and impacts of travel reduction strategies and demonstrate examples of existing good practice. The major output of the project is a European Guide to Good Practice in Reducing Travel, entitled "Encouraging Travel Alternatives". The Guide, aimed at transport professionals and decision-makers, demonstrates good practice in achieving travel reduction across a range of strategies. The project has also developed a framework for evaluating the impacts of individual measures, to assess their potential to reduce travel.

1.2 The Project objectives

The research objectives of the DANTE project were as follows:

1. To determine the nature and scale of the growth in transport in Europe over the last 10 years including levels of car dependence and recent changes in trip purposes, distances and frequencies, in order to provide the context within which the opportunities for avoiding the need to travel can be assessed.

2. To develop a comprehensive classification of the range of policy options available in the road sector to reduce the need to travel, incorporating both substitution and switching strategies.

3. To make a preliminary assessment of the potential implementation problems of each policy option.

4. To develop a framework for the assessment of the benefits and impacts of each policy option.

5. To create a network of Associate Cities which will be approached for feedback and input in the Good Practice Guide. To maintain contact with the Associate Cities.

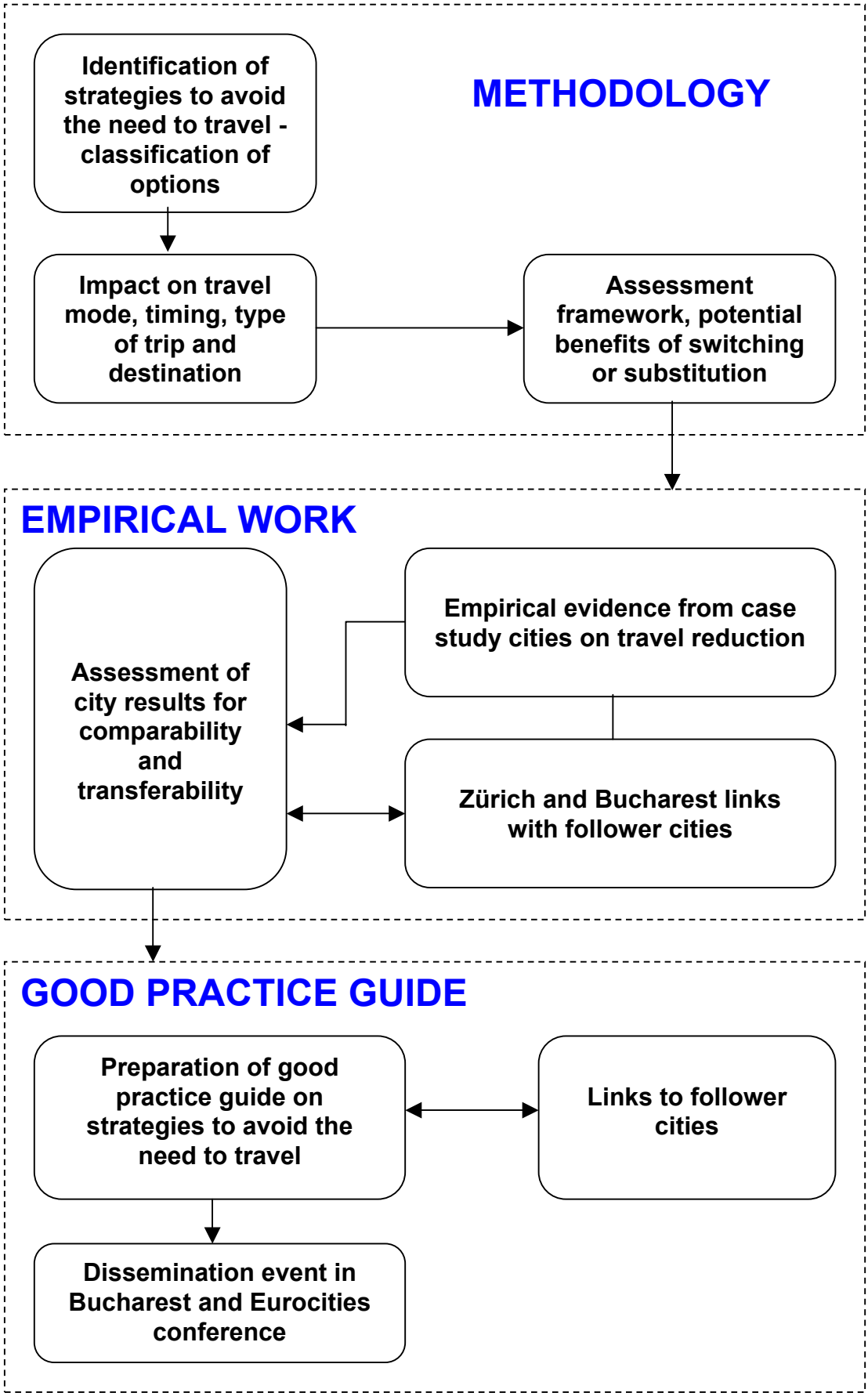
6. To review the strategies to avoid the need to travel which have been implemented in each case study, both cities and interurban corridors. To assess the impact of these strategies in terms of the scale and nature of changes in journey timing, activity, location, type of activity, mode and trip linkages.

7. To conduct interviews with local decision makers in each case study to look at the potential for each strategy and the barriers to implementation. Also to assess qualitatively, the potential for transferability and comparability of results across Europe, inside and outside the EU.

8. To produce a quality, publishable exploitation report - The Good Practice Guide - which will provide details of good practice for the implementation of strategies to avoid the need to travel.

The project workplan is summarised in Figure 1.

Figure 1. The DANTE Approach



2. SCIENTIFIC AND TECHNICAL DESCRIPTION OF THE PROJECT

2.1 Introduction and summary of scientific and technical achievements

DANTE successfully achieved each of its project objectives through the scientific and technical activities within three research workpackages (wp) and a management workpackage. This section describes each workpackage in turn, outlining the technical work conducted and the main results achieved.

Workpackage 1
The DANTE consortium reviewed changes in the pattern of travel over the last decade, concentrating on those trips which are important contributors to overall patterns of mobility, and determined a set of six strategies to reduce travel in Europe. These strategies aim to reduce travel by encouraging travellers to switch mode of transport, the time of travel or the destination of travel; or by substituting some journeys by using telecommunications, linking a number of trips, or by trip modification. A wide range of measures available to use as the 'building blocks' of these strategies were identified and classified. WP1 also developed an evaluation framework to judge the effectiveness of measures in achieving travel reduction.

Workpackage 2
The main empirical part of DANTE took place in a series of city case studies - Aalborg (DK), Brescia (IT), Bristol (UK), Bucharest (RO), Enschede (NL), Mytilini (GR), Rome (IT) and Zürich (CH) - and one interurban corridor (Bristol-Bath, UK). The assessment framework developed in WP1 was used to assess the nature and scale of trip reduction achieved by a number of measures implemented in the case studies. Later work in WP2 emphasised more practical implementation issues, assessing measures in terms of necessary conditions for implementation, potential barriers, transferability of results and comparability across cities.

Workpackage 3
Information collected from the case studies was used to develop the final product - 'Encouraging Travel Alternatives: A Guide to Good Practice in Reducing Travel', submitted in December 1998. The Guide provides a tool for cities, local authorities and governments, demonstrating good practice in achieving travel reduction across a range of strategies. With its use of case studies, illustrations and cross-referencing, it aims to present the complexities of travel reduction in an accessible format. The Guide has been produced in both electronic and paper formats.

2.2 Identifying Strategies to Avoid the Need to Travel

A review of travel trends in Europe over the last 10 years is presented, both for Europe as a whole and for individual countries participating in DANTE. It is important to appreciate the rapid increase in overall mobility levels in EU member states over the last 10 to 15 years. Overall passenger km have increased by roughly one third during this period. A majority of the rise in mobility is among car users and on the road network. A growth in the number of households owning more than one car and leading car dependent lifestyles has been an important feature of recent trends.

Differences do exist in trends between Northern and Mediterranean Europe, and between the EU and Eastern Europe. In Northern Europe, levels of car use are high, although within the last 10 years the rates of growth in car ownership have been declining, partly due to recession effects and partly indicating possible saturation. In Mediterranean Europe, mobility and car use are increasing at broadly similar rates, although the rate of car ownership growth in the Mediterranean is still increasing. Romania, representing the position of Central and Eastern European countries, markedly contrasts to EU member states. The transition to a market economy has seen mobility levels fall by one third. Most households rely on public transport, although there has been a rapid increase in car ownership and use, albeit from a much lower level than exists in the EU. Cars are relatively cheaper to buy than to maintain and operate.

It is concluded that, in order to achieve a sustainable transport system in Europe, it is necessary to devise strategies to avoid the need to travel.

Bearing in mind the implications of recent European travel trends, six general types of strategy have been suggested to reduce travel in Europe. These strategies aim to reduce travel by encouraging travellers to switch mode of transport, the time of travel or the destination of travel; or by substituting some journeys by using telecommunications, linking a number of trips, or by trip modification.

In order to develop effective travel avoidance strategies, it is essential to identify and assess the individual measures which can be used as the 'building blocks' of those strategies. The DANTE consortium identifies, classifies and presents measures available to use as these 'building blocks' - measures with the potential to reduce travel by achieving one of the identified switching or substitution effects. In all, 64 measures are identified, the majority of which address modal switching. Destination switching and trip linking are each addressed by approximately one sixth of measures, while measures available to achieve time switching, substitution using technology, or trip modification, are relatively uncommon. Measures available to reduce travel are shown in the matrix on the following pages.

A review of identified travel avoidance measures implemented in the DANTE countries is presented. This includes the identification of bodies responsible for implementation of measures in each country, levels of current implementation of each measure, and a discussion of the potential impact of these travel avoidance measures in the light of the earlier review of recent travel trends in Europe.

Of the 64 available measures identified in Europe for reducing the need to travel, local and national/central governments are responsible for implementation of the majority (39% and 25% respectively), while transport companies and other private companies are responsible for

the implementation of far fewer measures (10% and 13% respectively). While this may suggest that aid and advice for the development of travel reduction strategies should be aimed at local authorities, since they have the greatest potential to reduce travel due to their extensive responsibilities, it also points to the need for further involvement by other actors responsible for travel reduction. This is backed up by the fact that measures for which local authorities and central governments are responsible already have fairly high levels of implementation in the DANTE countries, while measures implemented by transport companies and other private companies have slightly lower levels of implementation.

Measures to encourage travellers to switch from private cars to alternative modes are considered to be valuable for future travel avoidance strategies. Despite the fact that measures of this type already have relatively high levels of implementation in the DANTE countries, the wide range of modal switching measures available, combined with the ever increasing trend for car use and dependence in Europe, suggests that they still have potential for future travel reduction.

Further emphasis on measures which address travel reduction using methods other than modal switching is also required - these include measures designed to switch the time or destination of travel, substitute trips using technology, link trips, or modify trips. The fewer numbers of measures available in these categories, and lower levels of current implementation in the DANTE countries, suggests future potential both in terms of the development of further measures, and in terms of increased implementation of existing measures.

In order for decision-makers to develop effective travel reduction strategies, practical guidance is required regarding the actual impacts of identified measures on travel reduction, in order to establish which are the most appropriate to use as the 'building blocks' for strategy development. The six types of strategies identified in DANTE are used to develop criteria to judge the effectiveness of measures in achieving travel reduction. An assessment framework is developed, shown in Figure 2, which assesses measures in terms of: movement from car to bus, rail, cycle or walking (mode switching); reduction in travel at peak times (time switching); reduction in distances travelled (destination switching); and reduction in overall numbers of journeys (trip substitution/ avoidance). The DANTE framework also examines the effects of travel avoidance measures on broader issues, such as transport network, social, economic/financial, environmental and safety impacts. Practical implementation issues and processes, including potential barriers to implementation are also considered.

Using the DANTE assessment framework, a range of travel avoidance measures implemented in the DANTE case study cities will be assessed in terms of the above issues (WP2). The DANTE Good Practice Guide will provide urban and inter-urban transport decision-makers in Europe with the results of these assessments, summarising the opportunities to implement travel avoidance measures and providing a practical guide to the development of effective travel reduction strategies.

A brief review of the risks involved with each city is also provided, in addition to the appendices which provide details of networking activities with DANTE cities, general DANTE dissemination activities, and a short paper on the definition of the need to travel.

Figure 2. DANTE Evaluation Framework

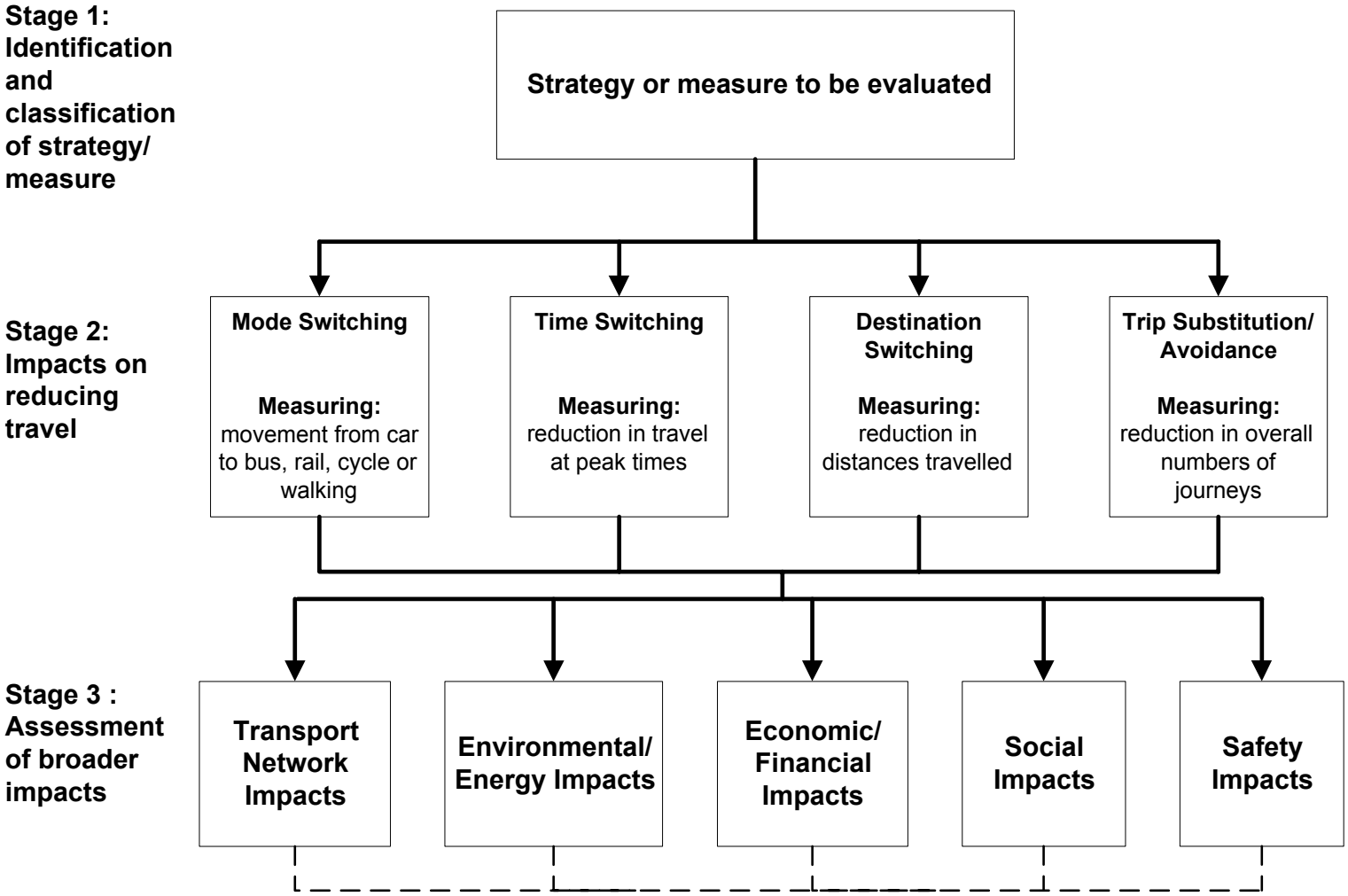


Table 1 Measures Available to Avoid the Need to Travel

TYPE OF MEASURE	SWITCHING			SUBSTITUTION		
	MODE	DESTINATION	TIME	LINKING TRIPS	TECHNOLOGY	MODIFICATION
Capacity Management						
Freeze on new road infrastructure	❍					
Road capacity restraint/ throttling	❍					
Integrated planning				❍		
Pricing/ Taxation						
Road pricing by location	❍	❍				
Road pricing by time	❍		❍			
Fuel pricing	❍	❍				
Information pricing		❍				
Parking charges, by location or time	❍	❍	❍			
Car ownership taxation	❍					
Tax concessions	❍					
Pollution pricing	❍	❍	❍			
Commuted payments - developers required to contribute to public transport schemes in lieu of parking spaces	❍					
Land Use Planning						
Urban concentration (discouraging peripheral development)		❍				
Mixed use developments				❍		
Development at public transport nodes	❍	❍				
Design of new developments to facilitate walking/ cycling	❍	❍				
Design of new developments to provide access to transport services	❍	❍				
Communications, Telecommunications and Technology						
Tele-working/ tele-commuting					❍	
Tele-shopping/ tele-banking					❍	
Telematics/ informatics- providing information remotely					❍	
Telematics - route planning and electronic guidance (passenger and freight)						❍
Electronic freight dispatching						❍
Telematics eg. VMS signs suggesting switching to park and ride	❍					
Vehicle technology - intermodality	❍					
Demand-responsive transport	❍			❍		
Provision of non-telematics travel information	❍					
Policy Measures (Public and Private)						
Public transport deregulation	❍					
Company car policy	❍					
Lift-sharing/ car pooling schemes				❍		
Company working hours policy			❍			

Company plans to encourage use of alternative modes e.g. provision of company bicycles	❍					
Park-and-ride	❍					
Encouraging opportunities for intermodality	❍					
Return goods optimisation (freight)				❍		
Use of alternative modes by freight companies	❍					
Restriction of trucking licences	❍					
Enforcement of road traffic regulations	❍					
Physical Measures						
Public transport priority	❍					
Public transport roadspace	❍					
Cycle priority	❍					
Cycle roadspace	❍					
Pedestrian priority	❍					
Pedestrian roadspace	❍					
Car pooling priority - High Occupancy Vehicle (HOV) schemes				❍		
Car pooling roadspace (HOV schemes)				❍		
Traffic calming - discouraging private car use	❍					
Subsidies and Spending						
Car pooling subsidies				❍		
Cycle subsidy/ increased spending on cycle networks	❍					
Walk subsidy/ increased spending on walkways	❍					
Public transport subsidy - public transport companies	❍					
Public transport subsidy - certain individuals/ groups	❍					
Public transport capacity investment/ increased spending on construction	❍					
Location/ time/ user restrictions						
Area access controls by user e.g. no lorries over certain weight, residents access only, total vehicle bans	❍	❍				
Area access controls by time e.g. access only in non-peak periods		❍				
Restrictions on city centre parking - reduced spaces	❍	❍				
Restrictions on company parking	❍					
Time or user restrictions on public parking	❍		❍			
Psychological/ Awareness						
Campaigns to promote walking/cycling/public transport	❍					
Increase awareness of public transport services	❍					
Other						
Home delivery of goods/ services						❍
Car sharing schemes (e.g. one car for several households)/ subscription car rental						❍
Improving access to public transport	❍					
Urban freight distribution centres - small loads delivered to collection point, and taken to city centre in one lorry				❍		❍
Freight logistics schemes - co-ordination of freight distribution trips between companies				❍		❍

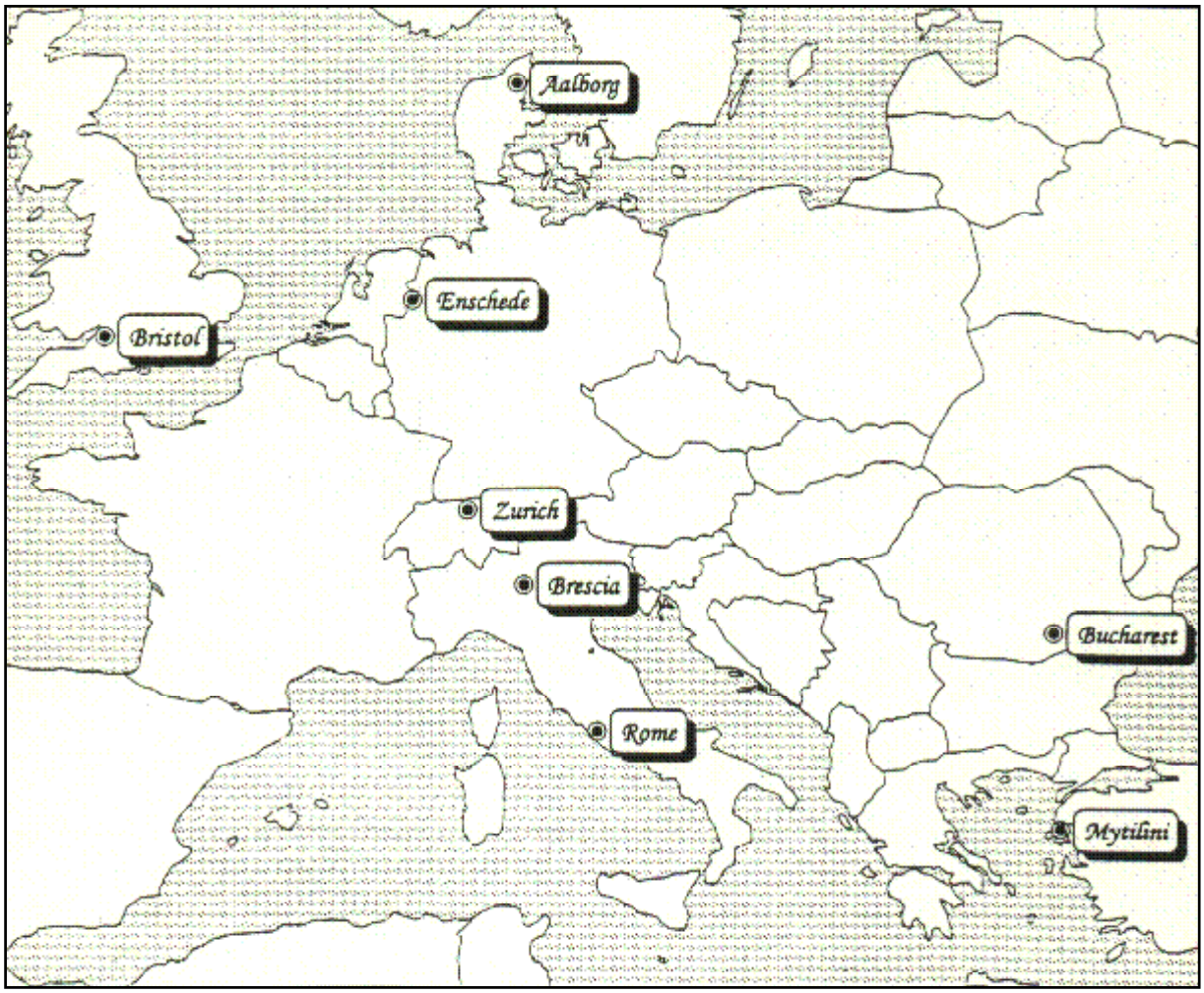
2.3 City Strategies and their Impact on Reducing the Need to Travel

The objective was to assess the nature and scale of changes which can achieve a reduction in the need to travel, using the DANTE cities and inter-urban corridor as case studies.

The DANTE case studies were as follows; illustrated in figure 3

- Aalborg (DK);
- Brescia (IT);
- Bristol (UK);
- The Bristol-Bath corridor (UK);
- Bucharest (RO);
- Enschede (NL);
- Mytilini - Island of Lesvos (GR);
- Rome (IT); and
- Zürich (CH).

Figure 3 DANTE Case Studies



BENCHMARKING DATA: MODAL SPLIT IN THE CASE STUDY CITIES						
%	**Aalborg**	**Bristol** *1*	**Bucharest** *2*	**Enschede** *3*	**Rome**	**Zurich** *4*
Car	54	55	4	42	53	28
Bicycle	15	3		38	0	7
Walk	9	11	6	17	20	28
Public Tram	10	27	90	4	27	37
Other	12	4		1	0	0

1= Calculated, 2 = Weekend trips by S Bahn and inter city S Bahn trips not included, 3 = Not in use, 4 = In built up areas only, 5 = Former Avon area

BENCHMARKING DATA: GEOGRAPHICAL DATA OF THE CITIES						
	Inhabitants: ***Admin. Area*** ***built up area***	**Size of admin area (sq.km)**	**Pop'n density in admin area**	**No of people in employment catchment area**	**No of jobs in admin area**	**Commuters** ***Inflow*** ***Outflow***
Aalborg	160000 125000	552	290	300000	85303	21300 9600 ('94)
Bristol	400000 550000	110	3650	980000	210000 1	80000 30000
Bucharest	2037278 ('96) N/A	228	8935	278541 *2*	878200 ('94)	300000 ('92)
Enschede	147832 129086	141	1046	600000	64260 ('95)	17818 ('94) 9322 ('94)
Rome	3660000 2760000	1307	2800	5185316	1033253	66728 15628
Zurich	360848 360848	91	4174	469800	311897	160284 49481

1= Calculated, 2 = Weekend trips by S Bahn and inter city S Bahn trips not included, 3 = Not in use, 4 = In built up areas only, 5 = Former Avon area

BENCHMARKING DATA: TRANSPORT FEATURE OF THE CITIES						
	Cars / 1000 habitants	**Cars / 1000 habitants for country**	**Trips / annum by public (mio)**	**Trips by public transport / inhabitant / annum**	**Total length of cycle tracks (km)**	**Length of cycle track / person (m)**
Aalborg	399	310	15.3 *1*	96	160	1000
Bristol	425(‘91)	374	58 *5*	N/A	N/A	N/A
Bucharest	162	93	924	454	5 *3*	N/A
Enschede	361(‘94)	361(‘94)	6(‘95)	41	152 *4*	1000
Rome	623	543	247	89	3	0.001
Zurich	364	450	341 *2*	947	205	0.6

***1*= Calculated, *2* = Weekend trips by S Bahn and inter city S Bahn trips not included, *3* = Not in use, *4* = In built up areas only, *5* = Former Avon area**

BENCHMARKING DATA: TRANSPORT PROBLEMS & POLICIES		
	Main transport problems	**Main transport policies**
Aalborg	High levels of traffic in the city centre Traffic prognoses show that there may be a need for a third crossing facility of the Limfjord channel	Provide satisfactory public transport. The public transport system should serve those with no access to cars. Public transport should help reduce the harmful effects generated by transport but without a significant reduction in accessibility to the city centre. Conditions for weaker modes of transport should be improved Support and promote sustainable and environmentally friendly modes of transport. Public transport should be an alternative to the private car in the city centre.

Bristol	Increasing traffic flows and congestion. Traffic related air pollution. The adverse impact of motor vehicle use on vulnerable road users. Relatively low public transport usage and concerns about accessibility.	Break the pattern of increased car use. Encourage alternatives to the car. Discourage car use where alternatives are available. Integrate transport, particularly public transport, with urban renewal and planned development. Improve national and international links.
Bucharest	Crossing the city by public transport is possible only with several transfers. The radial tram network is slow. Few appreciate policies for non-motorised travel modes. No highway lanes devoted to public transport. Expensive and undersize public transport system Obsolete traffic management. Reduced of road capacity due to poor parking.	Enforce restrictions on city centre parking. Sustain investors' interest in revitalising the historic commercial area. Economic policy resulting in fuel and energy prices comparable with international prices. A policy of physical measures implementation for surface public transport. Subsidy for public transport for social reasons. Renewal of public transport fleet.
Enschede	Growth of intra-urban traffic. Liveability in residential areas is at risk because of traffic safety, noise and greenhouse gases	Increase economic development and house building in the city centre. Stem continual growth of intra-urban car use. Make public transport more attractive. Improve the bicycle infrastructure. Discourage unnecessary traffic on city centre road network. Creating car restrained (city centre and residential) areas.
Rome	Increasing congestion and difficulties in traffic flow management. Increase in number of road accidents. Traffic related air and acoustic pollution. The need to save more energy. Inadequate public transport. Residents migration from downtown to the suburban areas and surroundings.	More attention to vulnerable road users. More pedestrian – priority zones and routes in the city centre, and restrictions to cars (ZTL). Local planning decisions made in the context of city wide policies. Making public transport more attractive. Priority management of road junctions. Improve park charge system and restrictions in free parking use

		Improve the park and ride infrastructure.
Zurich	There is no additional space for significant traffic expansion.	Adjust the existing space reserved for traffic. Encourage the switch from private to public transport. Parking only for local residents and traders.

A second inter-urban corridor between Brescia and Verona (IT) was initially planned. However, following co-operation difficulties with the Municipalities of Brescia and Verona it was decided to substitute the Brescia-Verona corridor with an urban case study - the city of Rome (IT).

It is very clear that an effective way to describe the transport situation in an area is by the modal split. Even though there are some differences in the methodology used in calculating the modal split, the variation in the modal split between the areas is so big, that it cannot be explained by differences in methodology. The differences range from 4% preferring car in Bucharest to 55% in Brescia. In bicycle use it ranges from 0% in Rome to 38% in Enschede, and in uptake of public transport range from 2.5% in Mytilini to 90% in Bucharest. Bucharest stands out with a transport system very dependent on public transport, and many transport-related problems. Also major difference between the other areas are found, with e.g. a high usage of public transport in Zürich and a high usage of bicycles in Enschede, which makes these areas interesting case studies for DANTE.

Of a large base of measures implemented in the DANTE areas 31 have been selected for detailed analysis as these had quantitative evaluation data available. 10 measures from other areas have also been included in the analysis as they also had good data available. The total of 41 measures have been analysed according to the effects they aimed at achieving modal switching, destination switching and substitution. The distribution of the measures on these three effects are shown below:

- Switching from car to other modes: 32 measures
- Switching to a closer destination: 4 measures
- Substituting trips: 5 measures

It becomes very clear that most measures try to achieve some kind of mode switching effect, while measures intended to achieve some kind of destination switching or substitution are more rarely used.
In measures intended to switch mode there is direct evidence of individuals actually switching mode in only 10 cases. More successful was destination switching, where three out of four destination switching measures succeeded in achieving the switching effect. Also, substitution measures were quite successful, as four out of five actually achieved substitution effect.

Even though the data shows that trying to achieve mode switching is much more difficult compared to the other two effects, part of the explanation of the difference between the success is due to lack of evaluation data.

The measures were also studied according to their primary objective. It was found that:

- about 1/6 of the measures were primarily aimed at reducing travel (R);
- about half were first and foremost directed towards promoting alternative modes or behaviour (P); and
- about a third attempt to cover both reducing and promoting at the same time (PR)

This means that about 85% (P+PR) of the measures include some kind of promotion of alternative modes to car, while 50% (R+PR) are intended to reduce travel by car.

While car usage is often the main problem, it seems as if most measures indirectly try to solve the problem by promoting alternative modes.

The data shows that most of the measures (34 out of 41) were successful in achieving their stated objectives. Only 2 out of 41 measures were directly unsuccessful in achieving the stated objectives.

Splitting the measures up into the three main categories of objectives, R, P and PR, we see the Promotion and combined measures have generally been very successful in achieving their objective, but reduction measures seems to have been relatively unsuccessful. Of 7 reduction measures only 1 has full success and 3 more limited success leaving 3 with no clear success. This is a success rate over 50%, but still much lower than the P and PR measures.

Most measures (33 out of 41 or 80%) achieved some sort of positive behaviour in terms of uptake of favoured modes either discernible at the individual or aggregate level. This is a rather high success rate, which is partly explained by the very soft criteria set up. Looking at the data it is clear that most measures achieving success with their objective also has success in achieving some kind of favoured behaviour. Of the 34 measures fulfilling their objective 30 also had some favoured behaviour, when looking at reducing traffic.

Looking at the success of the measures in achieving travel reduction measured as a total reduction in vehicle kilometres for the area or as a reduction in car kilometre or car trips we find that:

- 6 measures may be regarded as having been successful in reducing travel;
- 8 measures are partially successful in reducing travel;
- 3 measures show clear evidence of failure to reduce travel, and
- 24 measures showed no evidence of travel reduction.

This smaller success rate may be due in part to the fact that in many cases there is not enough evidence to confirm travel reduction has taken place - by contrast, it is relatively simple to demonstrate that, for example, travel by bus or cycle has taken place.

The smaller ‘success’ rate also arises due to the fact that a number of measures do not set out explicitly to reduce travel, and so success in their own terms does not necessarily lead to success in reducing travel.

Indeed, closer scrutiny of the table shows that those measures which are aimed at a combination of promotion and reduction, are relatively more successful in reducing travel, while those concerned primarily with promotion or reduction are relatively unsuccessful.

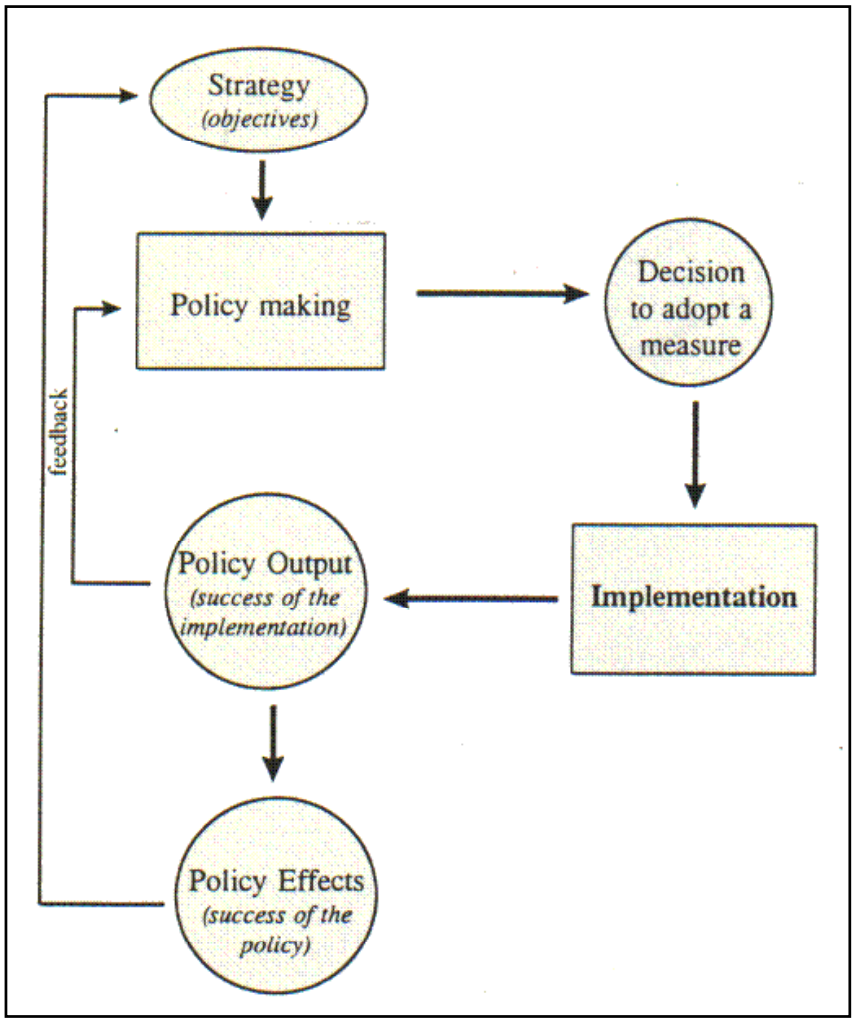
2.4 The Implementation of City Strategies and Measures Reducing Travel: Barriers, Potentials and Transferability

What is the implementation, potential and transferability of travel reduction measures? The research in DANTE was mainly based on interviews with decision makers and implementers in the case study cities. On the basis of this information for each case study a City Implementation Report was prepared.

Implementation
For the DANTE research, we define implementation as the process which starts after the decision to adopt one or more specific measures to achieve objectives. Figure 4 provides a schematic design of the process. It proves that:

- During policy making requirements for the day-to-day operation should be taken into account;
- Participation of the public in preparation of implementation or even policy making may increase public acceptability;
- Push measures are essential because the perceived advantages of car use are so great that there would be only a minimal transfer from car driving as long as car use remains unrestricted.

Figure 4 Process Design



Between measures, there are (more or less) levels of relationship:

- Stand-alone measures are part of the city's policy to reduce the need to travel, but can be implemented without direct connection to other measures eg. awareness campaigns, promotion of car pooling, city cards and company commuter plans;
- Relationships between measures: measures are supported by other measures to increase effectiveness eg. Park & Ride schemes supplemented by dedicated bus lanes, making the bus trip to the city centre more faster and the scheme more attractive;
- Relationship between (groups of) measures at the strategy level eg. push and pull measures, both discouraging car use and making alternatives available. Table 2 Illustrates the types of implementations represented in DANTE

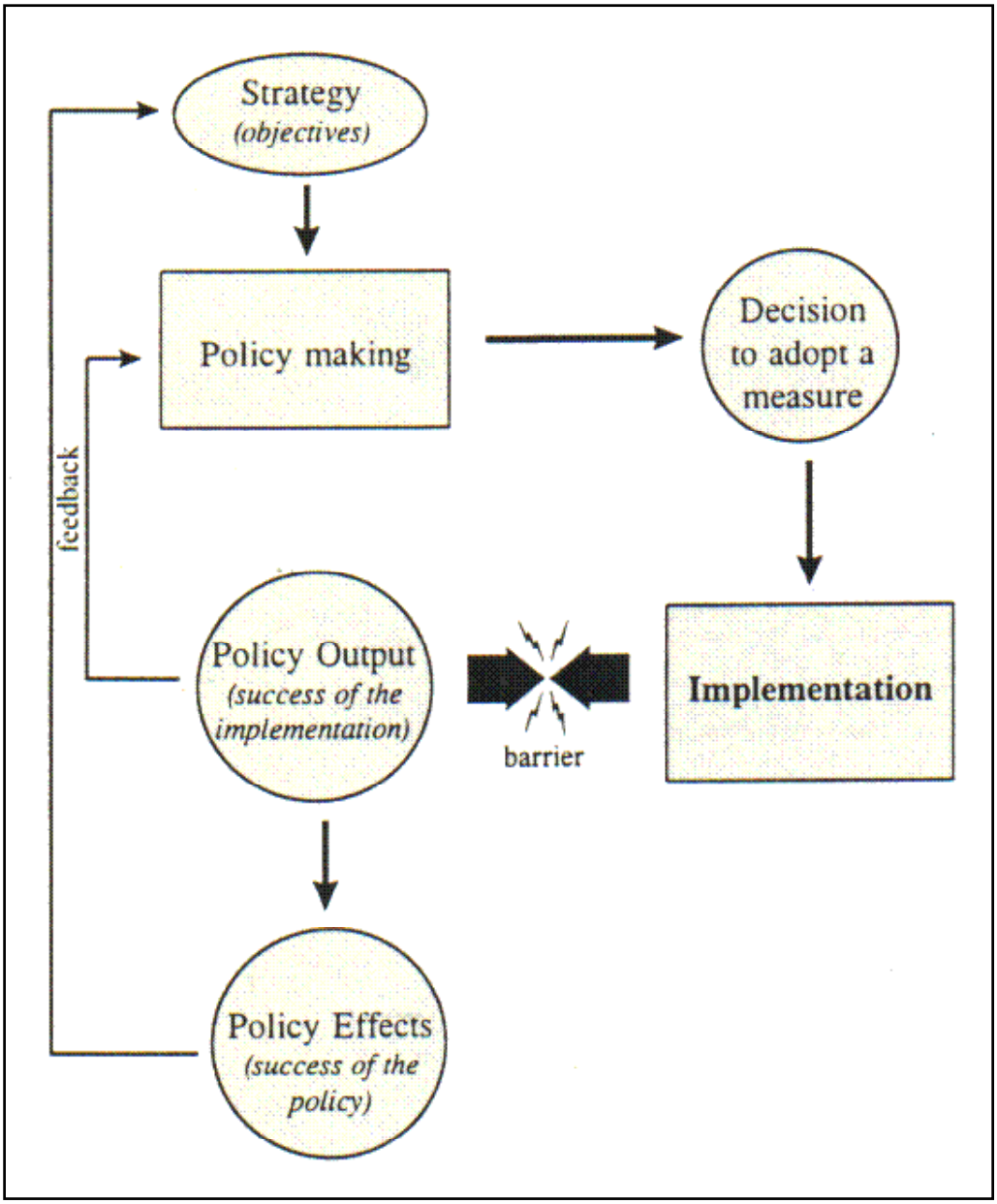
Table 2 Implementation types represented in DANTE

	Local or regional authority	Central Government	Non governmental organisation	Transport Company	Other private companies	Individuals	Number of cases
Aalborg	9	3		1			9
Brescia	3			3			3
Bristol	7		1		1		8
Bristol – Bath	4						4
Bucharest	4	1		2	1		4
Enschede	11	2	1	6	2	1	16
Lesvos	2	1		2	3		6
Rome	5						5
Zurich	7			1			8
TOTAL	52	7	2	15	7	1	64

Barriers

Implementation processes are subjected to barriers. Figure 5 again represents the process of implementation and barriers. These barriers could either reduce the potential of measures once implemented, or even make implementation impossible. Some barrier types are common. Institutional and policy barriers relate to problems with co-ordinated action between different levels of government, and to measures which are in conflict with other policies. Legal barriers occur when implementation is complicated by legal requirements or even prohibited by law. Barriers concerning resources (financial, human, physical) are very common. One should be aware of public resistance: a social barrier. Finally, side effects may hinder the implementation.

Figure 5 Implementation and barriers



Analysis of the barriers is shown in Table 3, it points following findings:

Resource barriers occurred most frequently, followed by institutional/ policy and social/ cultural barriers.

- In almost one fifth of the measures the seriousness of the resource barrier hindered good implementation. For other barriers this is about 10 per cent.
- Measures which promote alternative mode encounter several resource barriers.
- Measures which reduce or restrict travel by car are most likely to meet social/ cultural barriers, while measures of a physical nature are most likely to meet resource barriers.
- Barriers concerning mode and destination switching seem a little more serious than time switching and the substitution strategies.
- Barriers concerning land use planning and policy measures are both frequent and serious: many of those measures have to do with serious barriers.

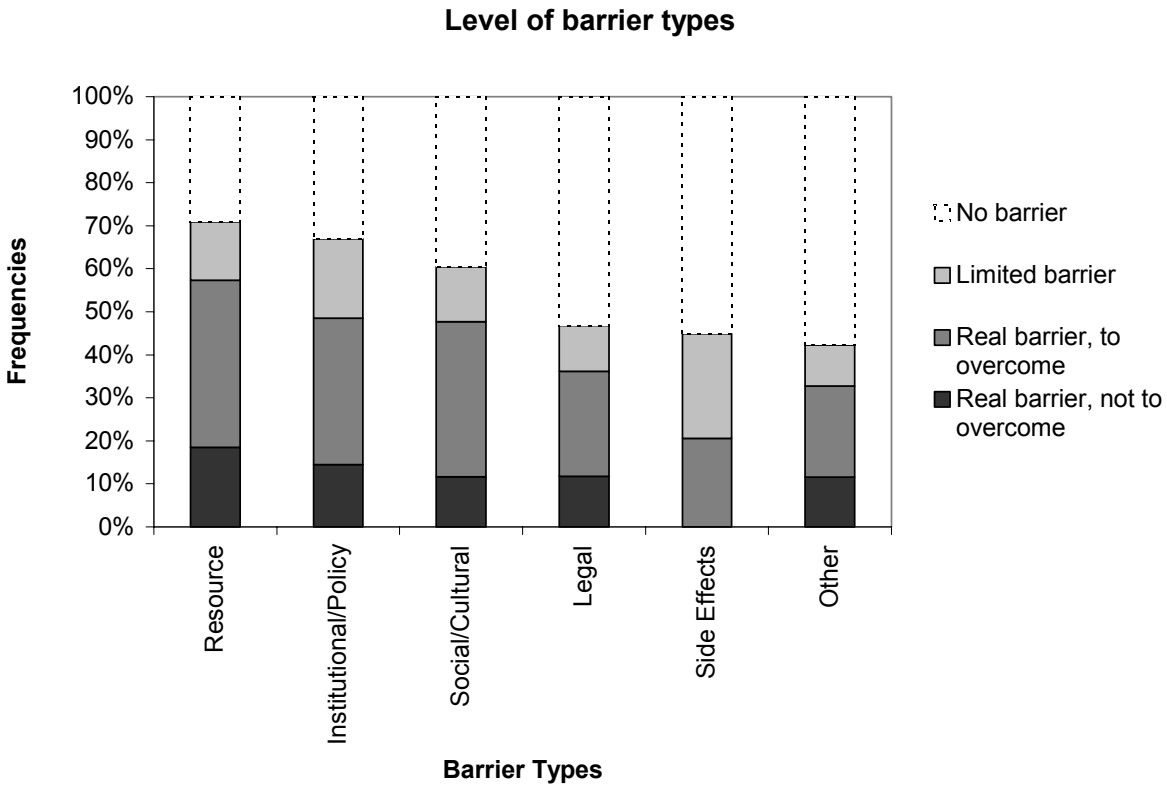
Table 3 Analysis of Barriers

Level of barrier types (52 measures: horizontal percentages*)				
Type of barrier	**No barrier**	**Barrier of limited importance**	**Real Barrier, but to overcome**	**Real barrier, not to overcome completely**
Institutional / Policy	34	19	36	11
Legal	58	8	24	10
Resource	29	11	42	18
Social / Cultural	40	13	37	10
Side Effects	59	18	23	0
Other Barriers	61	8	19	11
TOTAL	47	13	30	10

*** due to roundings, not all percentages are summed up to 100**

In figure 6 the frequencies, per rate of seriousness is stacked in a histogram for every barrier type. This shows the seriousness of barriers as thresholds

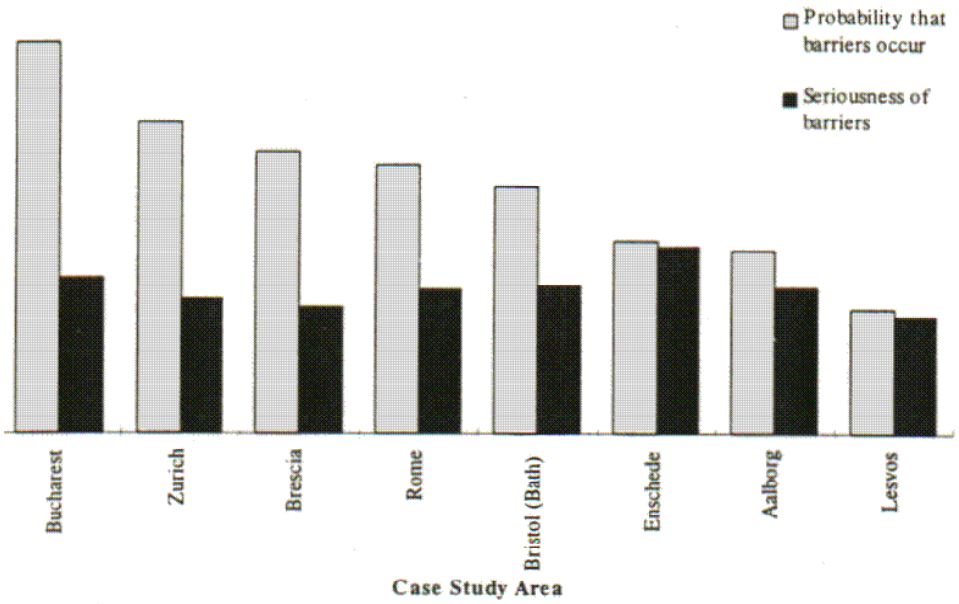
Figure 6 Level of barrier types



It is useful to analyse the probability, frequencies and seriousness of barriers to implementation by 4 parameters:

1. Case study area
2. Object type
3. Policy effect
4. Measure type

Figure 7 Analysis of Parameters

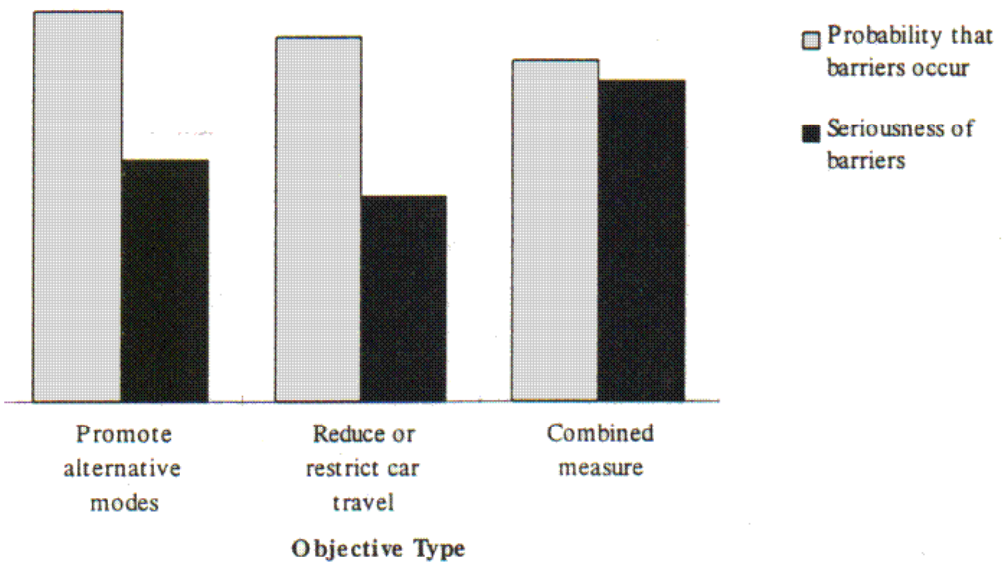


Case study area
Lack of resources was the main barrier in Aalborg, Brescia, Enschede and Bristol (including Bristol - Bath corridor). In Bucharest, Lesvos and Zurich institutional or policy barriers were more severe (both in terms of frequency and seriousness). In Rome, social and cultural barriers most frequently occurred.
Both Bucharest and Enschede stand out. Bucharest because there was a relative high number of barrier types per measure, especially institutional and legal barriers. Enschede because the level of seriousness is relative high. At Lesvos, the implementation of measures seems to be easy; only a small number of barriers occurred, while on average they were of limited importance.

Object type
There is some indication that measures which promote alternative modes encouter several resource barriers. These are mainly financial resources for investments in infrastructure for favourable modes; eg public transport prioritisation in Rome, Brescia and Enschede.

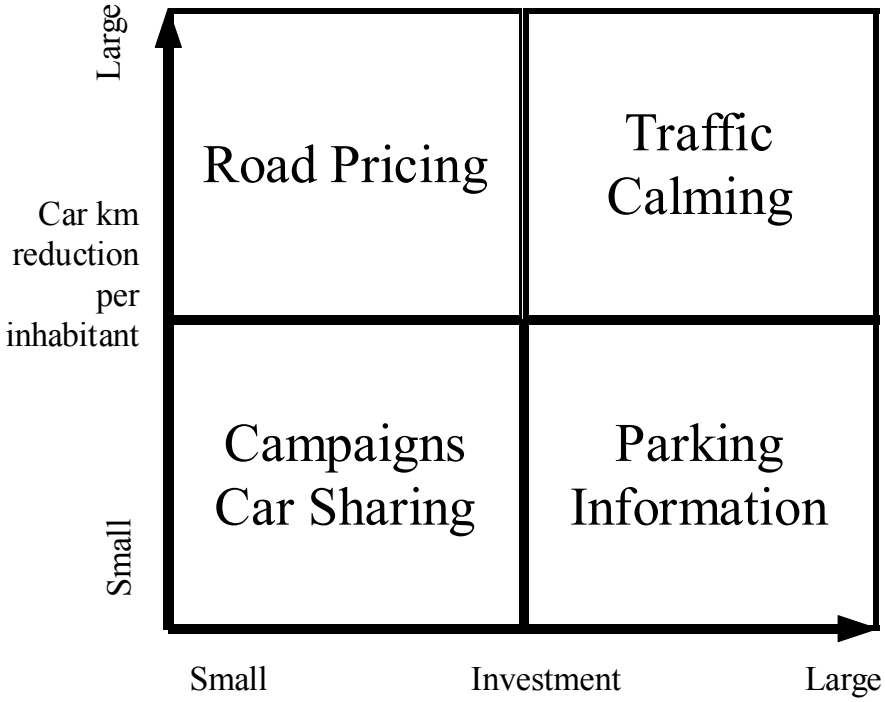
Measures which reduce or restrict car travel have often to cope with social or cultural barriers, most of then concern the lack of public support for the measure, particularly when a measure restricts car use or car parking. Examples are: the design of locations with few parking places; to pat different taxes for parking, depending from the distance to the city centre (Brescia)
It appears that measures that combine promoting alternatives and restricting car travel in conjunction have to cope with the most serious barriers.

Figure 8 Barriers and Object Type



As the difference between the effect of measure is often very large figure 9 groups together examples of measures. This is intended as an example of how to use the more qualitative method, and it should be noted that the location of the different measures might vary according to the conditions of individual cities.

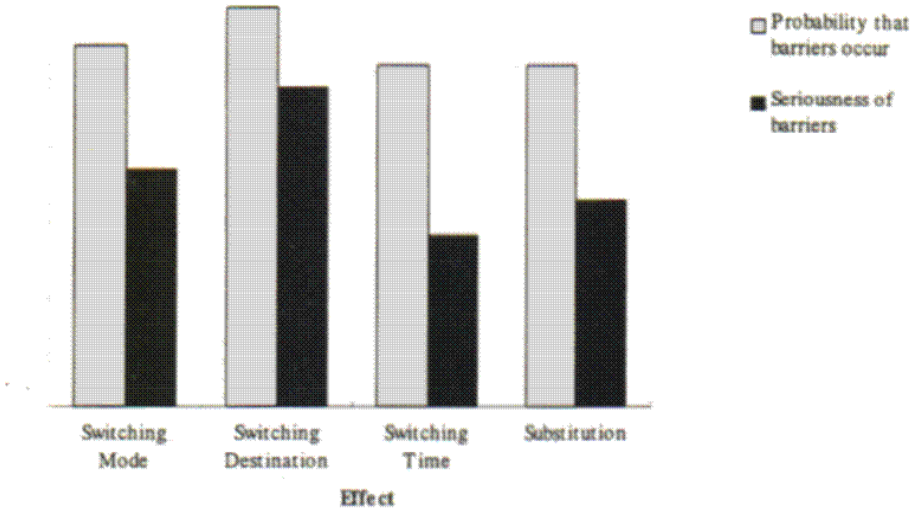
Figure 9 Investment and Effect



Policy effects

In comparing the desired effects by rateability and seriousness of barriers (the DANTE strategies) the main findings appears to be that the barriers of switching mode and destination seem more serious. In particular destination switching land use planning encounters many serious barriers. Figure 10 shows the frequency and seriousness of barriers per desired effect.

Figure 10 Frequency and seriousness of barriers

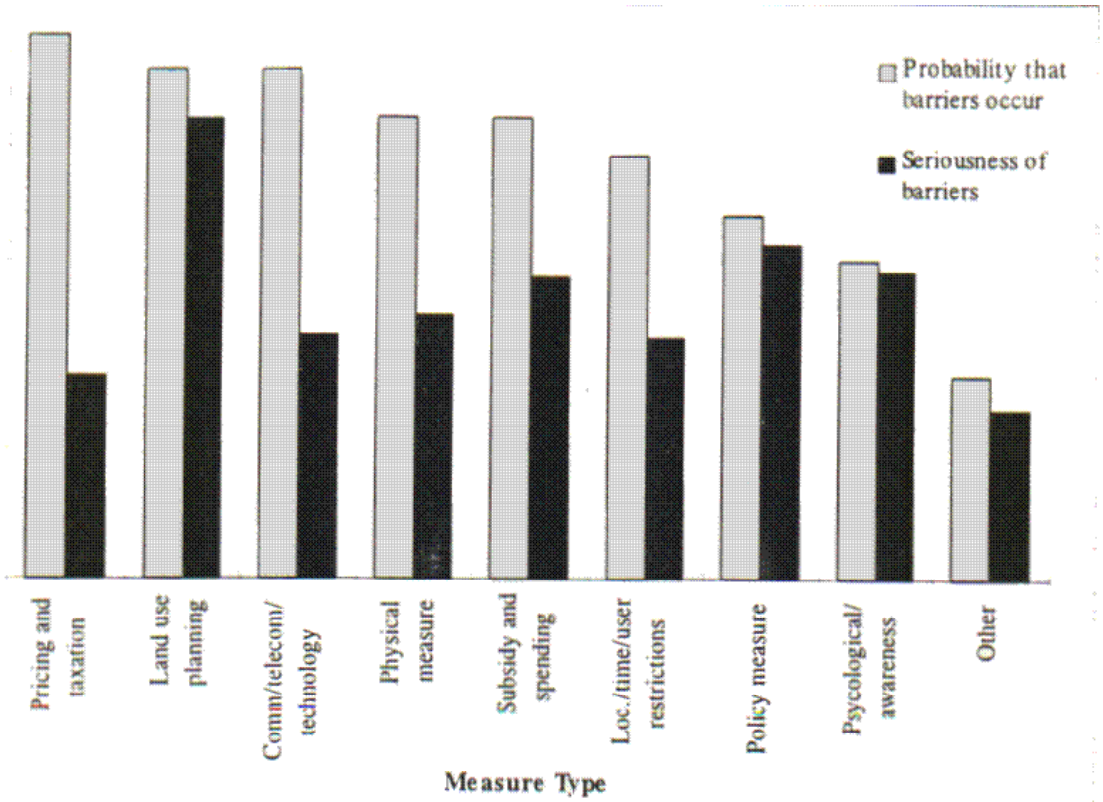


Measure type

At the level of measures it can be seen that the seriousness of barriers concerning pricing and taxation measure is low, but in fact this concerns only one measure; the absence of this type of measures, indicates that the barriers are just very strong. There seems always resistance to those measures, but it is not very strong.

Land use planning and policy measures are both frequent and serious. This means that most measures have to do with serious barriers. Although telecommunication and technology measures encounter many barriers, they have on average not a high level of seriousness.

Figure 11 Barriers and measure type



The most important message concerning barriers is: be timely aware of these barriers - forewarned is forearmed! However, the analysis of barriers shows also ways to overcome them. Moreover, most barriers were overcome.

Comparability

Some conclusions can be drawn from comparing types of measures:

- Physical measures are most likely to have an immediate impact after implementation, although this may not always lead to travel reduction.
- Measures aimed at changing travel behaviour will not show an immediate effect if there is no need to change behaviour eg. promoting mode switching needs restriction of car use.
- Most measures are not aimed at a specific target group. The target group which most frequently appeared were commuters.
- Transferability becomes more difficult when measures are to be implemented in another country because of institutional, legal and cultural differences.
- Simple and cheap measures are easily transferable, but do not have the highest potential for travel reduction.

- Measures which show success only in the long run are difficult to transfer to other countries.

Checklist and guidelines for transferability to other cities or countries
This checklist comprises (1) the choice for a measures; and (2) the way forward to good implementation.

Define the nature and extent of the problem. It is necessary to formulate the objective for a measure. Issues concerned are geographical scale; time periods involved; groups of the population involved and related problems eg. road safety, economic development. The main concern of the first step is to select a set of measures or measure types which have a high potential to solve the problem and obtain the stated objective.

Evaluate measures on their implementability. The issues at stake are:
- Type of implementor. The same type of implementor may have different responsibilities and
- resources available in different cities and countries.
- Does the measure fit into an existing administrative and legal framework?
- What are the resources (financial, manpower and technical) necessary for implementation?
- Make an assessment of the reaction to the public.
- Make an assessment of the possible side effects. There may be negative side effects on non-transport areas.
- Be aware of differences in social and cultural behaviour in different countries. Always try and associate with local habits.

Final conclusion
The implementation of travel reduction strategies must be seen as a process, from policy strategies and objectives through to policy outputs and effects. The major barriers to implementation come before the policy output stage. There are substantial differences in the priorities and the barriers between the DANTE cities. The greatest potential lies in the policies being packaged together so that the actual effects coincide closely with the intended effects. But the more comprehensive the package, the greater the possibility that the package will not be implemented in its entirety. Travel reduction strategies may be less effective when introduced individually, but the probability of successful implementation is higher. No city seems to have successfully resolved this dilemma.

3. ESTABLISHING GOOD PRACTICE IN TRAVEL REDUCTION

3.1 Development and dissemination of the Good Practice Guide

This task began with the creation of an explicit work programme to co-ordinate the production of the Good Practice Guide (GPG) and the roles of each partner. The early development of key concepts behind the structure, format and proposed contents of the GPG was also seen as important in guiding its evolution. It was decided that the GPG would take the form of a modular reference document, with a number of chapters or sections linked by a cross-referencing system to allow easy navigation of the document and the information it contains. This structure was based on an Internet format, with internal links mimicking the web site links.

Throughout the development of the guide, a central databank was used to catalogue and collate background information, images, and statistics. Source material was drawn from the case studies, the prior knowledge and experience of the DANTE consortium, and from site visits and meetings with local city representatives.

At a relatively early stage in the GPG development, a number of 'pilot pages' were produced for review at internal project meetings, and by the transport decision makers in the case study cities. Each member of the consortium conducted interviews with potential end users, to asses their requirements and the effectiveness of the proposed GPG structure, format and content. This market research was used to ensure that the final product would be useful and accessible to all potential end users. Information on the most appropriate medium for the GPG was also collected at this stage. It emerged that most end users were not yet ready for an electronic or Internet version, and that a paper document would be most appropriate medium.

Following this period of internal and external consultation, the key concepts behind the structure, format and contents of GPG were further evolved, and explicit worktask guidelines issued to all partners to support the production of allotted chapters. The work due to be carried out by the Greek partner TRENDS was successfully reallocated amongst remaining partners, following their departure from the consortium. Once each partner's contributions had been successfully completed, they were collated for editing and compilation in the final document.

A key feature of the GPG development was the production of a series of draft documents for review at internal meetings. By the time the final product was complete, it had been through a rigorous checking, reviewing and refinement process at every stage in its development. The final GPG was produced as an illustrated, desk top published document.

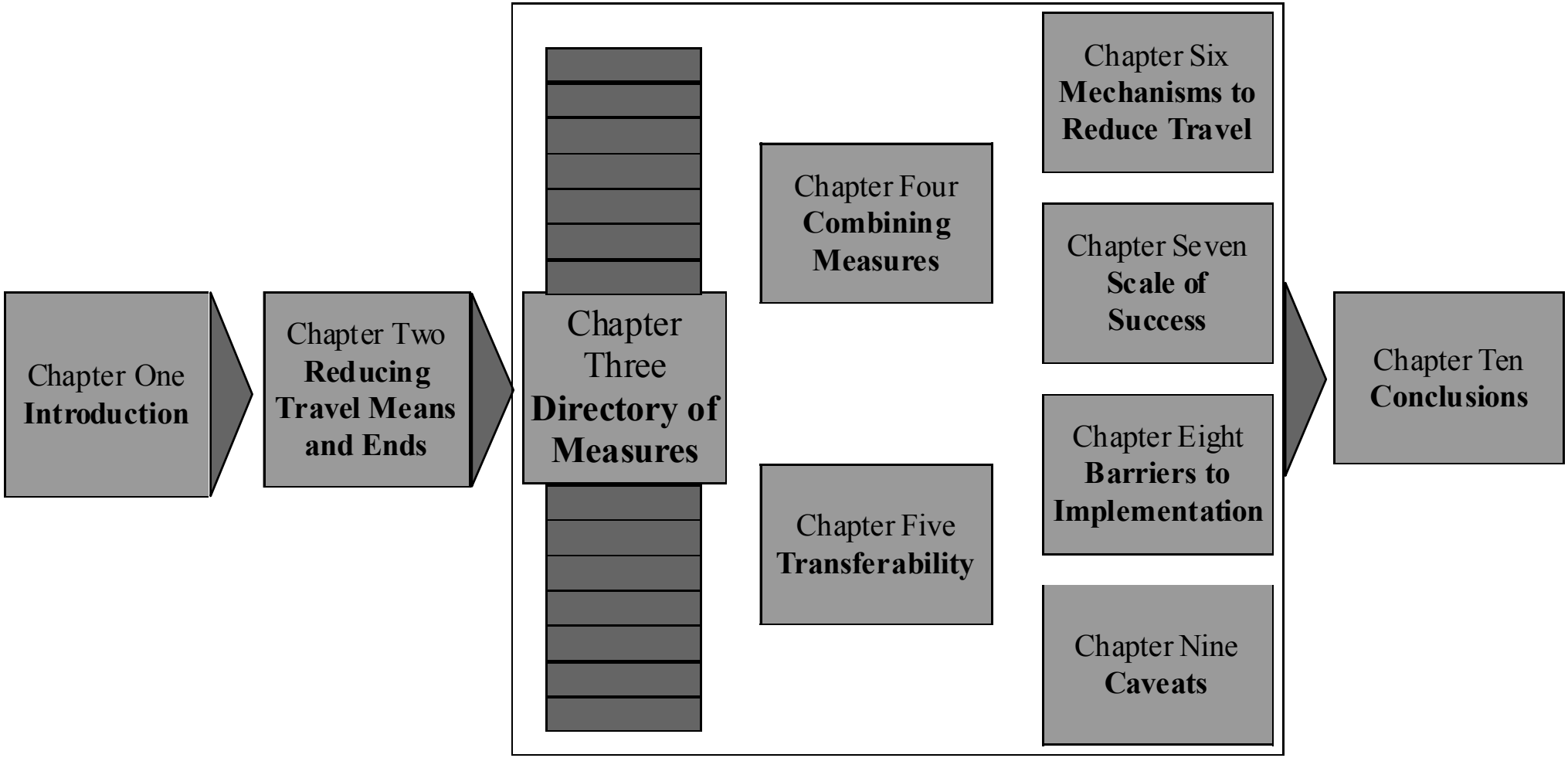
3.2 Content, structure and approach of the Good Practice Guide

DANTE Good Practice Guide is directed towards all of those who are responsible for, or otherwise concerned with, tackling the issues of travel reduction. It demonstrates good practice in achieving travel reduction across a range of strategies, including transport policy, land use planning and the use of technology. With its use of case studies, illustrations and cross-referencing, the Guide aims to present the complexities of travel reduction in an accessible format.

The Guide provides a directory of some thirty types of travel reduction measure, illustrating their use and effects by means of case studies. Comparisons across case studies are made, allowing conclusions to be drawn on the potential for transferability of results. The Guide also discusses the different kinds of barriers to implementation which might be experienced, and potential barriers to realising travel reduction outcomes. While primarily focusing on policy measures, the Guide also discusses the underlying mechanisms of switching and substitution involved in reducing numbers of vehicles, kilometres or number of trips, and the ways in which these might be combined to achieve travel reduction.

The Guide is arranged in a series of cross-referenced chapters. The structure of the guide is shown in Figure 12 firstly there is an **introduction** to the guide, followed by an **overview** of the main issues involved in reducing the need to travel.

Figure 12 Good Practice Guide Structure



The next three chapters provide examples of case study material:

- A directory of individual **measures: a comprehensive listing of potential measures, illustrated by means of case** studies arranged in alphabetical order;
- A demonstration of how these measures can be combined; and
- A analysis of the range of measures across different cities, to give an indication of the transferability of results.

The following four chapters provide **analysis** of the effects of the measures, including:

- The switching and substitution mechanisms by which travel may be reduced;
- The different scales of success in travel reduction that is achievable;
- Potential barriers to implementation; and
- Caveats or barriers to realising travel reduction outcomes in those measures which are implemented.

Finally, the concluding chapter provides **interpretation and synthesis** of the preceding chapters and draws out the main messages emerging on the potential for achieving travel reduction.

Structure

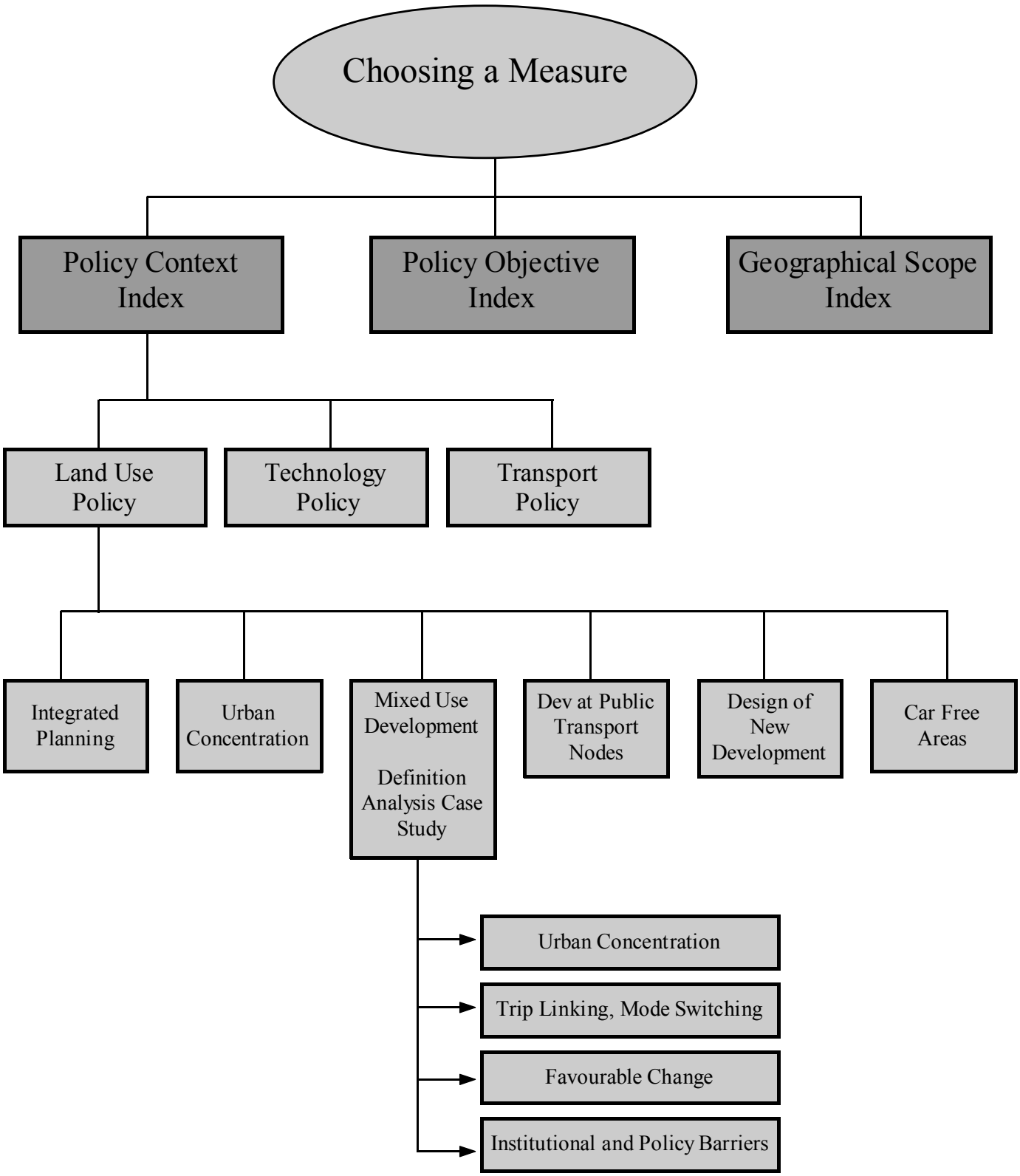
The Guide is structured to convey the complexity of the subject matter in an accessible format. It allows rapid access to detailed information which can be approached from a number of different entry points. The chapters and individual case studies are cross-referenced throughout, allowing the reader to browse and then follow a theme along a variety of lines of thought. Accordingly, the reader may choose to start with a specific line of enquiry, for example to investigate a particular type of measures, or to find examples from a particular country, or to look out for evidence of the most successful schemes in practice. The structure of the Guide enables such material to be rapidly located, and also aims to draw the reader into a wider web of issues and allow exposure to a variety of alternative perspectives which may assist with the ultimate resolution of their enquiry.

Approach

The Guide is not intended to be prescriptive, but rather to offer a range of examples of what has been achieved, backed up with evaluative findings. It aims to draw attention, both to the principles lying behind the successes and the context in which they were achieved, and so lay a foundation from which users may generate their own solutions.

The guide is designed to facilitate interrogation via 'pathways'. Figure 13 Maps out a 'pathway' through the guide that might be constructed using this measure driven approach. Through the Policy Context Index, someone interested in Land use policy measures could access the Mixed Used Development measure. As well as gaining an insight into this particular measure, the reader has the opportunity to compare and contrast with other measures; explore in greater detail the travel reduction effects of linking trips and switching modes. Rate the scale of success; or gain a greater understanding of the significance of barriers to implementation, through the hyperlink established to the section on Institutional and Policy barriers.

Figure 13 A pathway through the guide



The three fields of interest that are used as an index are:

- Policy Context
- Policy Objectives
- Geographical Scope

The scope of coverage within these are shown below in figure 14, 15 and 16

Figure 14 Policy Context Index

Policy Context Index

Land Use Policy
implemented using spatial planning and urban design tools.

3.02 Car Free Development
3.10 Design of New Development
3.11 Development at Public Transport Nodes
3.16 Mixed Use Development
3.30 Urban Concentration

TECHNOLOGY POLICY
utilising advanced information and communication technologies.

3.09 Demand Responsive Transport
3.12 Home Delivery of Goods & Services
3.14 Infomatics
3.26 Tele`activities
3.27 Teleworking
3.29 Transport Optimisation

TRANSPORT POLICY
'traditional' transport – led solutions.

Access and Use Management

3.01 Area Access Control
3.20 Peak Congestion Avoidance

Company Travel

3.03 Car Pooling
3.04 Car Sharing
3.06 Company Work Hours Policy

Design of Priority/Roadspace

3.07 Cycle Priority & Roadspace
3.13 HOV Priority & Roadspace
3.22 Public Transport Priority & Roadspace

Media campaigns

3.15 Media Campaigns

Parking

3.05 Commuted Payments
3.17 Park & Ride
3.18 Parking Charges
3.19 Parking Restrictions & Capacity Reduction

Restraint

3.24 Road Capacity Restraint & Reduction
3.25 Road Pricing
3.28 Traffic Calming

Subsidies

3.08 Cycle Subsidy
3.21 Public Transport Capacity Investment
3.23 Public Transport Subsidy

Figure 15 Policy Objective Index

Policy Objective Index

Increase Cycle Use

3.07 Cycle Priority & Roadspace
3.08 Cycle Subsidy

Increase Public Transport Use

3.05 Commuted Payments
3.09 Demand Responsive Transport
3.13 HOV Priority & Roadspace
3.17 Park & Ride
3.21 Public Transport Capacity Investment
3.22 Public Transport Priority & Roadspace
3.23 Public Transport Subsidy

Reduce CarUse

3.01 Area Access Control
3.02 Car Free Development
3.03 Car pooling
3.04 Car Sharing
3.05 Commuted Payments
3.12 Home Delivery of Goods & Services
3.13 HOV Priority & Roadspace
3.15 Media Campaigns
3.17 Park & Ride
3.18 Parking Charges
3.19 Parking Restrictions & Capacity Reduction
3.24 Road Capacity Restraint & Reduction
3.25 Road Pricing
3.28 Traffic Calming

Increase Sustainable Accessibility – *the configuration and location of uses and activities amenable to favoured modes of travel.*

3.02 Car Free Development
3.10 Design of New Development
3.11 Development at Public Transport Nodes
3.16 Mixed Use Development
3.30 Urban Concentration

Improve Mobility Efficiency – increasing the *intensity of use without generating additional demand for infrastructure and vehicles.*

3.03 Car Pooling
3.06 Company Work Hours Policy
3.14 Infomatics
3.20 Peak Congestion Avoidance
3.29 Transport Optimisation

Electronic Substitution – replace physical travel With electronic communication.

3.26 Teleactivities
3.27 Teleworking

Figure 16 Geographical Scope of Implementation

Geographical Scope of Implementation

Route – along a transport corridor

3.07	Cycle Priority & Roadspace
3.09	Demand Responsive Transport
3.12	HOV Priority & Roadspace
3.22	Public Transport Priority & Roadspace
3.24	Road Capacity Restraint & Reduction

Site – a specific location or nodal point

3.02	Car Free Development
3.10	Design of New Development
3.16	Mixed Use Development

District – local level

3.01	Area Access Control
3.11	Development at Public Transport Nodes
3.18	Parking Charges
3.19	Parking Restrictions & Capacity Reduction
3.28	Traffic Calming

Region – city or rural level

3.03	Car Pooling
3.04	Car Sharing
3.05	Commuted Payments
3.06	Company Work Hours Policy
3.08	Cycle Subsidy
3.12	Home Delivery of Goods & Services
3.14	Infomatics
3.17	Park & Ride
3.20	Peak Congestion Avoidance
3.21	Public Transport Capacity Investment
3.23	Public Transport Subsidy
3.25	Road Pricing
3.29	Transport Optimisation
3.30	Urban Concentration

Aspatial – coverage is flexible

3.15	Media Campaigns
3.26	Teleactivities
3.27	Teleworking

The approach taken by the Guide is straightforward: it is to examine existing good practice in the application of travel reduction strategies. In doing so, it presents examples of strategies which have actually been implemented, and demonstrates to what extent they represent good practice in achieving travel reduction. By studying actual cases it is possible to take account of barriers to implementation, and caveats which might prevent potentially promising measures achieving travel reduction in practice. The use of a wide range of case studies also allows comparative evaluation between countries, and hence conclusions on the potential transferability of results. The Guide allows users to identify those sectors of demand which are most amenable to switching or substitution away from the car towards more environmentally friendly alternatives. It provides a foundation from which those charged with transport and environmental policy-making are able to choose the most appropriate measures and strategies for addressing their own circumstances.

4. DISCUSSION OF THE RESULTS

In this report, we have demonstrated that travel reduction can be achieved over a wide variety of circumstances and by a variety of means. It has been achieved though policies for restraining car use, promoting alternatives to car use, land use planning and technological solutions. It has been demonstrated in all countries studied and at all scales of application. Travel reduction has also been shown to have been achieved through each of the six switching or substitution mechanisms identified. In this respect the demonstration of travel reduction possibilities can be considered a success.

The nature and scale of travel reduction has therefore been observed in a variety of forms:

- Travel reduction results have included a high proportion of changes in behaviour, such as a 90% increase in use of public transport in one case in Zurich, and 90% reduction in cars in the central zone of Enschede;
- Where individual instances of travel reduction may be modest, they can of course add up to a large travel saving in aggregate. For example, the 115m saving in trip length attributed to the Aalborg parking information scheme adds up to a saving of 280,000 vehicle kilometres per year. Similarly, the cycle subsidy scheme in Aalborg resulted in 18,000 bicycle kilometres replacing car travel;
- Travel has been shown to be reduced even when some use of the car is still involved. For example, in the Netherlands, 55% of car poolers transferred from single person car trips, while 31% of car sharers were previously car owners. In one case car sharing resulted in a reduction of over 2,000 km per person per annum - a substantial and direct manifestation of travel reduction.
- Finally, travel can be reduced through changed practices in daily life, as seen in the example of a teleworking experiment in the Netherlands. This showed that on a teleworking day the number of trips were about half, travel time about 40%, and the distance under a tenth, compared with a normal working day.

In this section, we focus on three of the main lessons that have come out from this project. Firstly, it has been seen that 'travel reduction' is difficult to quantify, as it cannot be measured directly. Only travel itself can be measured, and hence it is necessary to make educated deductions as to whether observed changes in travel patterns indeed represent a reduction in travel. This can make the assessment of success, and hence justification, of travel reduction strategies difficult.

Secondly, it has been seen that a net reduction in travel may often be difficult to achieve in practice. Thus, while the amount of travel might be 'pinned down' in one case, it might be 'released' elsewhere. Efforts may be concentrated in reducing travel by a particular mode or to a particular destination, but this may be offset by general growth in travel by other modes and to other destinations. Indeed, in some cases the act of reducing existing car traffic on a route may effectively release capacity to encourage travel by car on that route by other travellers not targeted by the travel reduction scheme. These considerations suggest that area-wide approaches may be necessary.

Thirdly, the process of travel reduction is not instantaneous, but takes place over a period of time. Even the direct impacts of a set of new measures will not necessarily result in immediately measurable results that will not change over time. Responses to measures will be variable and be adjusted as a result of the reassessment process undertaken by individuals.

More importantly over the longer period is the expectation that growing public support will lead to more fundamental changes in attitudes to the use of the car, particularly in areas where priority must be given to other users. The simple causality argument needs to be modified with a process of positive reaction, leading to a change in behaviour, and eventually being measurable as a travel reduction. In addition, there are strong social implications in the sense that certain locations, types of activities and modes can be more easily targeted.

Each of these issues is now discussed in greater detail, and this is followed by a more general debate on the necessary conditions for the successful implementation of travel reduction strategies.

4.1 Measurement of Reduction

Evaluation and measurement of travel reduction is complex. Prediction of travel reduction may be even more difficult as an understanding of behavioural response is also necessary. Part of the problem relates to the availability of data for before and after the policy implementation, but there are also important conceptual questions.

The overall picture is not yet complete. While measures such as public transport priority and traffic calming have been applied for many years, policies devised to reduce travel per se have been implemented only relatively recently. It is only recently that the very notion of trying to reduce travel has turned from being a rather radical proposition to a commonly adopted strategy. This means that evaluation data of travel reduction - which is not straightforward in the first place – is not readily available.

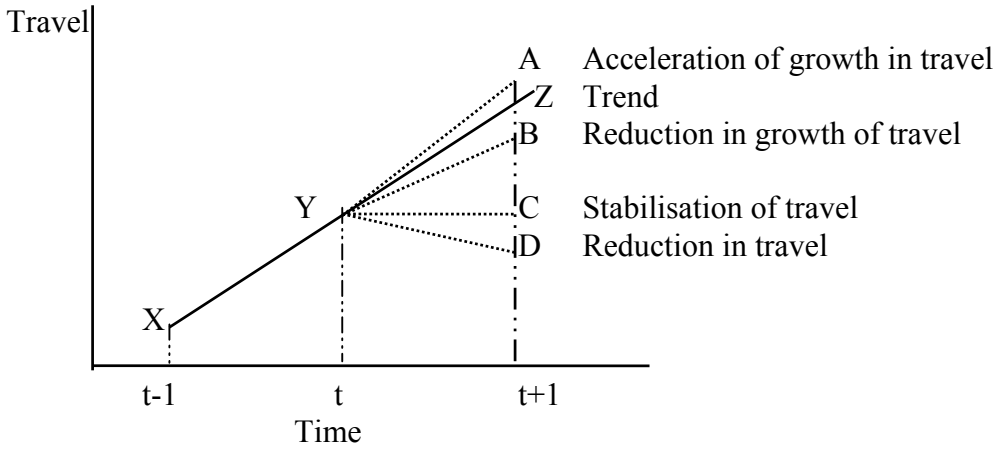
Indeed, there may be a data paradox. In some cases, the more diligently one looks for travel reduction, the less one finds. For example, if one simply assumes that a telecommuter stays at home and cuts out a work trip, then clearly travel is reduced. But if more data is found on non-work travel (e.g. more time being made available for leisure activities) and travel by other members of the household, making use of the freed-up vehicle, then it is likely to demonstrate the possibility that travel has actually increased. This example excludes any generated car trips as a result of the freed-up road capacity and the freed-up parking space at the workplace.

Taken together, it is possible to identify several 'barriers to evaluation' with respect to the measurement of travel reduction:

1. *No travel reduction data collected*, since travel reduction is only recently an explicit policy objective;
2. *Travel reduction cannot be measured directly*, but must be deduced, needing at least before and after data (two data points);
3. *Requirement, ideally, for a combination of aggregate* (scale and volume-at-point) *and disaggregate* (causal) *data*, some of which (naturally) does not involve travel at all (e.g. time and place of work activity);
4. *Paradox of data resolution* - in some cases, the more carefully you look for travel reduction the less you may find;
5. *Complexity of behavioural response* - travel behaviour is itself volatile, and short term and long term causes and effects are intertwined;
6. *Need to quantify the hypothetical* - while detecting absolute travel reduction needs two data points, deducing relative travel reduction needs three (see Figure 4.1).

Travel reduction may have to be measured against what might have happened. To measure travel, say the patronage of a new light rail service, we need only measure flow now (one data point). To determine if there is an increase or decrease in patronage, we need two data points (before and after). To prove or deduce that there has been a reduction in travel growth needs an estimate of what travel would have been had the travel reduction policy not been implemented (Figure 17).

Figure 17 Interpretations of travel reduction



The simplest definition of travel reduction would be to assess whether travel at point t+1 is less than that at point t (Y to D). From this logic, there has been an increase in travel at points A and B, whilst C represents a stabilisation of travel. But it is extremely unlikely that changes of this order will ever be found. So if these hard definitions of travel reduction are used, then no travel reduction will be found.

However, if three points are used, then the historic trend from X (t-1) through Y (t) to the future (t+1) can be presented as variations around the trend or predicted position (Z). This is a consequence of the do nothing situation and B now represents a reduction in the growth of travel. This could also be interpreted as achieving the aims of travel reduction. Positions C and D demonstrate substantial travel reduction. Point A now represents the negative outcome, where as a result of policy intervention, the growth of travel has been accelerated above the trend or predicted levels with no policy intervention. This kind of deduction has to be allowed for, otherwise we will be resigned to failure, since the modest but steady increase in population, growing levels of affluence and general mobility will always tend to push up the base level of travel regardless of policy intervention.

When it comes to evaluating travel reduction success, there has to be some give and take, since it is difficult or impossible to judge 'what otherwise would have been the case'. Therefore, there is some degree of latitude of interpretation in this project in deducing whether or not travel reduction has actually taken place or not.

Equally, it is important to emphasise that if a particular policy has not resulted in a measurable reduction in travel in the city, it does not mean that the policy has "failed". This partly relates to the measurement problem above, but it also relates to the softer benefits of strategies, which create a better quality urban environment. If there are fewer cars in the city centre, a more pleasant pedestrian environment, a cleaner air quality, and a vibrant feel about the urban space, then it is a successful achievement of travel reduction – at least in the target area, namely the city centre.

4.2 Reduction and Generation

It is unlikely that there is any universality in terms of the packages of measures best able to achieve travel reduction. We have spent a considerable time in this project exploring the underlying mechanisms at work, as well as the difficult issues of transferability and compatibility. The conclusion reached is that there is no magic solution as all cities are different, but that there are important lessons that can be learnt from the implementation of good practice. It is through building up that knowledge base and understanding the limitations of particular measures, that more widespread implementation can take place.

A crucial element here is the necessity to package measures together in imaginative ways so that a consistency and coherence of action is possible. Individual measures on their own may not achieve stated policy objectives, but when combined together, begin to actually work. This means that the simple dichotomy used in this project between push and pull policies needs to be replaced by a composite approach that uses both push and pull policies. This approach would achieve two fundamental objectives, namely more effective travel reduction and political acceptability.

The achievement of travel reduction over the whole of the city region is extremely difficult (if not impossible), as it requires different packages of measures to be applied in different locations. Improvements in one location may be an incentive to travel further, or to switch destinations to locations further away to avoid the city centre. In the inner city area, most of the restrictive (push) policies have been applied – road closures, pedestrianisation, carriageway narrowing, parking controls, and priority to particular users. The more positive measures (pull) have been applied in both the inner city and in suburban areas – public transport investment and priority, facilities for cycling and walking. Packaging of policies for the inner city seems attractive to maintain the vitality and accessibility of the centre. The objectives of the travel reduction policy are clear and there is a reasonable level of acceptance that something dramatic has to be done.

However, in the outer city, the options are much less clear as the problem is not perceived to be so great, but more importantly, the policies available seem to be much more limited. There are still the possibilities for investment in public transport and priority measures for green modes, but there is less support for restrictive measures on car use. In the surrounding region, there are even fewer opportunities, and if one car user switches to another mode, then the additional road space is quickly absorbed (Table 4). There are not the opportunities to package measures in the same way as is possible for the city centre. Secondly, as the public does not see the perceived severity of the problem as being so great, the policy priority is much lower. The car is seen as being the most appropriate form of transport for nearly all activities.

Table 4 The emerging pattern: policies and effects in the different parts of the city

	Inner City	Outer City	External
Policies			
Parking	Restricted, especially for commuters. Shoppers welcome, residents exempt.	No restrictions	(No restrictions)
Roads	Road narrowing, closures and pedestrianisation. Restricted access to cars; residents and businesses exempt.	No significant restrictions on mobility by road.	(No restrictions)
Public Transport.	Improved public transport from centre outwards, particularly in a radial pattern, including access to airport.		
Walking and Cycling	Walking and cycling promoted in general.		
	Improvements concentrated in inner areas (more of a walk/cycle friendly environment, shorter distances)	Improvements more diffuse and hindered by longer distances.	
Effects			
Travel effects	Stabilisation of travel and traffic levels	Travel growth	Travel growth, especially long distance car travel and travel by air

Source: Marshall (1999)

It should not therefore be surprising to find that that it is mainly in the inner city areas that traffic reduction (or at least, stabilisation) is realised. Thus, in Enschede, the level of traffic within the 'Singel' ring road has decreased by 8%, but the level of traffic outside it has increased by 25%. Travel has stabilised for residents, but increased for visitors. Similarly, in Zürich, traffic flows in the central area have stabilised, despite 'an increase in city employment and a *general increase* in mobility' (Maggi and Maegerle, 1999). The increase referred to is, of course, manifested in the outer areas of the city, particularly on the motorways, and the area around the airport to the north of the city. In Bristol, the modal share of cars has reduced, and that for public transport increased, in the targeted corridors, but elsewhere in the city traffic growth continues. In Edinburgh, just as 250,000 extra passengers have used the (radial) Greenways bus routes in a six month period, the edge-of-town Gyle centre has generated 200,000 extra car kilometres *per day* (Mittler,1999).

We can also see how the economic imperative is at work, by the lengths to which the cities work to maintain the accessibility of their centres. The restrictions on parking in the inner city are typically targeted at commuters. This frees up parking spaces for short stay visitors (the economically valuable shoppers and tourists), from both the outer city and the external areas, who could choose to take their custom elsewhere. In Aalborg, automatic information

systems direct shoppers to the most convenient parking areas, and in Enschede, the police direct German visitors to the park and ride site to ease their passage to the town's shops and market on bank holidays.

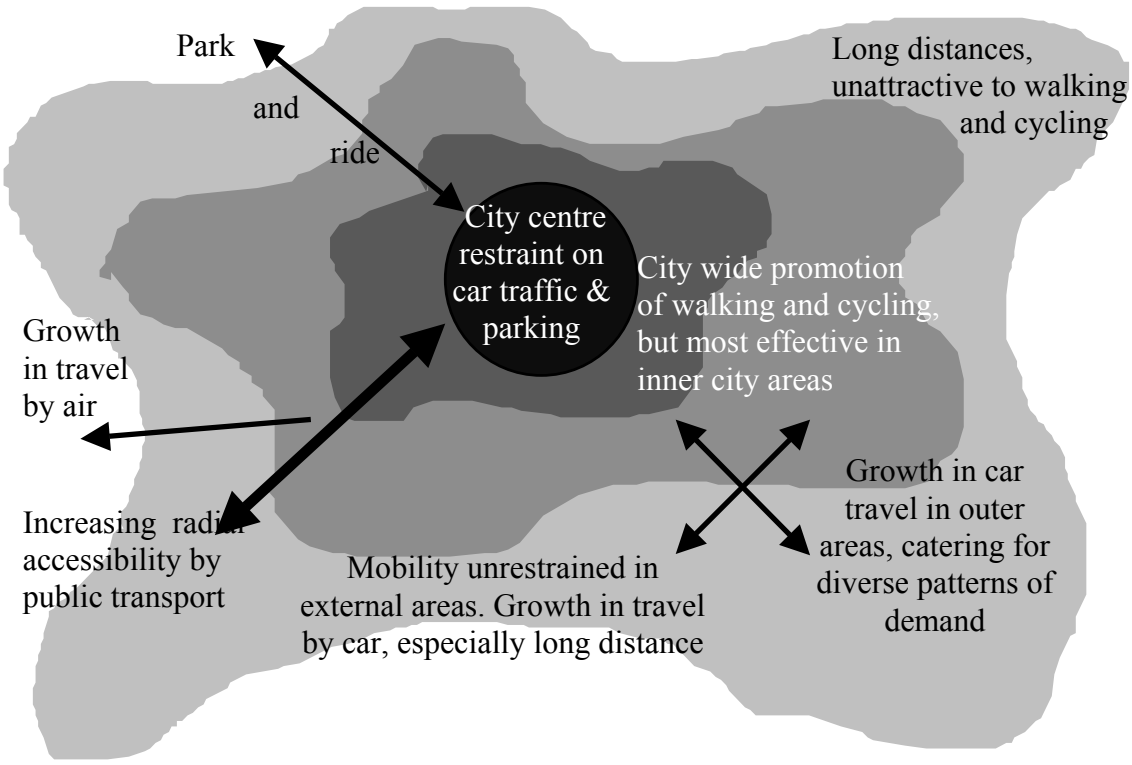
Meanwhile, residents and local business people are to some extent exempted from the more punitive measures in the centre. Residents and business proprietors are able to drive to and park in the centre (as in Enschede, and Rome). As we have seen, in Zürich, the mobility of residents by car has actually improved. The environment of the centre also improves, as road space is given over to the pedestrian or other landscape treatments.

The impression, then, is of city centres becoming carefully controlled 'fortresses' against traffic, safely enclosing ambulant, cash-dispensing shoppers and tourists, while outside, the traffic and development is left to grow wild, and in the 'free market' of convenience, the car is the winner. We can see that inner city residents benefit from a better local environment with less traffic (but still a parking place). For them, the compact, mixed-use city is a reality. They are able to access a wide range of services locally, on foot or by bike, and also find themselves at the hub of the public transport networks, allowing them easy access to other towns and cities, and to the airport.

In the outer city, things continue much as before. The outer city resident who works in the city might have to switch to public transport, at least for the inner part of their trip. Of those who already do not use a car in the suburbs, there is not much improvement, in terms of their own local accessibility or in a contribution to overall travel reduction. As long as the new and improved public transport services are filled by existing public transport users, no travel reduction will materialise.

In this caricature, the 'favourable' environment of the driver - fast, wide roads and big car parks - is hostile to the walker, and difficult territory to reach by public transport. Conversely, the 'hostile' environment of the driver (congested streets, road closures, priority surrendered to others) is the 'favourable' environment of those who use public transport, cycling and walking as a means of getting about (see Figure 18). The closer the driver approaches the centre of the city, the greater the repulsion, until ultimately travel there becomes impossible (after Bacon, 1975).

Figure 18 A caricature of the reduction and generation dilemma



Bacon (1975) distinguishes between 'favourable' environments and 'hostile' environments. In the urban caricature envisioned here, conditions become increasingly more hostile for the car driver towards the centre. Outwards from the centre, conditions become increasingly hostile for the more sustainable modes.

This is the great unresolved problem. We can think of exciting packages for the city centre, which have excellent implementation possibilities and measurable travel reduction (and other) benefits. But, it is almost impossible to devise similar packages for the suburbs and the regions around the cities where most of the traffic growth is now taking place. If people continue to move out of the cities, then travel reduction may take place in the cities naturally without any policy intervention. Perhaps it is the non-city locations where good practice is now desperately needed.

Example Scenarios

A. Switching mode only
   eg. travel to work by bus instead of the car

B. Switching desination only
   eg. driving to local shop instead of regional supermarket

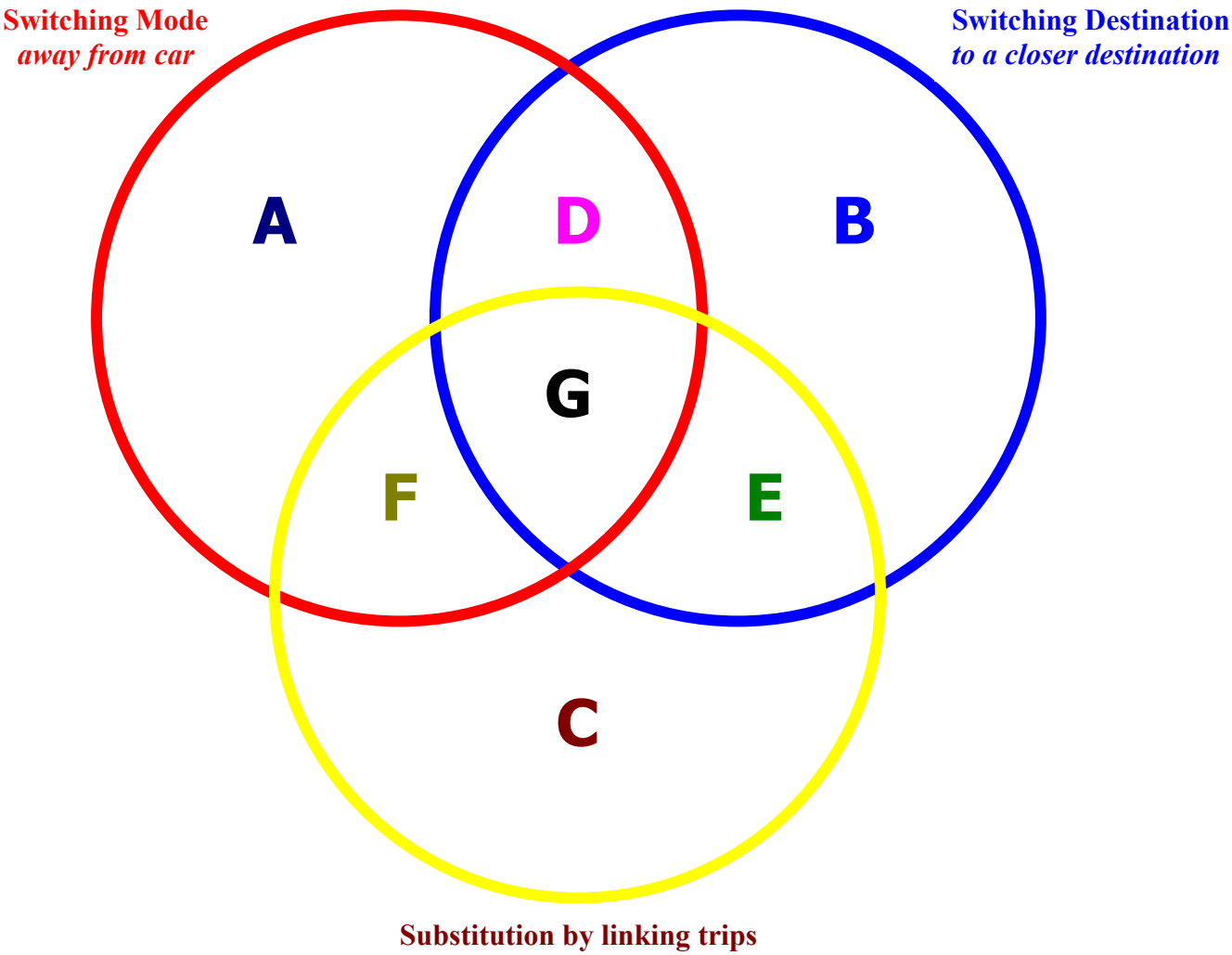
C. Linking trips only
   eg. visit the shops near work instead of separate shopping trip

D. Switching destination & mode
   eg. walk to local shop instead of driving to regional supermarket

E. Link trips while switching destination
   eg. visit local high street to do all shopping, instead of separate trips to different out-of-town superstores

F. Link trips while switching destination
   eg. link with others' trips, travelling to work by carpool

G. Link trips while switching destination and mode
   eg. walk to local high street to do al shopping, instead of separate car trips to different out-of town superstores



4.3 Social and Spatial Implications

The policies under consideration may also be interpreted in the light of concepts of elasticity and dependency, which are both related to the notion of user choice. Travel reduction policies (packages of push and pull measures) tend to be directed at relatively easy targets, in relatively 'inelastic' situations (i.e. the user has little choice), while the more 'elastic' situations are addressed by 'pull' policies alone. Dependency relates to the necessity for reliance on the car and the availability of choice of alternatives (e.g. modes, destinations, times, substitutes).

In terms of users, then, city authorities can afford to be hard on commuters, who are obliged to go to work, and cannot change their workplace very easily, while they actively court the footloose shoppers and tourists who would easily take their custom elsewhere. Public transport schemes may also be directed more towards *existing* users of public transport (e.g. in Aalborg), and do not necessarily address car drivers. Such an approach may meet general approval. Car drivers can be in favour of public transport, if it puts off gridlock or more drastic action for another year.

In terms of location, it is easier to single out the city centre for tough targeting of car use, since the city centre has such a magnetic pull in the first place. It is more likely to be a distinct or unique location, which is not easily rivalled locally or regionally. It is also likely to be the most accessible location by public transport, and convenient for walkers and cyclists. It can therefore afford to risk applying restraint to cars, especially when the very removal of cars can enhance its distinctive qualities and hence its attraction.

By contrast, accessibility is often the sole distinguishing feature of developments around the outskirts of cities. Since they are so dependent on the car, restricting car mobility could represent a terminal loss of accessibility. 'Big box' out-of-town developments with their car parks barred and converted to piazzas are not commonly observed. It can be concluded that policies to restrain car use (push policies) are generally only applied in the 'inelastic' cases, while the 'elastic' cases are better suited to accommodation of the car and promotion of the alternatives (pull policies) (Table 5).

Table 5 Elasticities and policies

	User purpose	Business location	Policy result
'Elastic'	Shopping, leisure	Local & peripheral functions	Pull policy only
'Inelastic'	Commuting	Central functions	Push (and pull) policy

Policy makers must be fully aware of the preferences of the public, so that their policies might succeed as planned. If the public are expected to pay more for something or give up something convenient, there must be a payback that relates in a meaningful way to their own aspirations. For the inner city resident, it is clear enough that in return for vehicular access being a bit more difficult, and a parking space a little harder to find, there are distinct advantages to 'inner city living', such as less traffic, walkability and a generally improved environment. For the residents of outer areas, however, there will not necessarily be any convincing incentive to leave the car behind. With the exception of radial travel, where

public transport may be a competitive alternative, all that the car user is really offered is a second best option. In these circumstances, it would be rather optimistic to rely on invoking the 'good of the planet' alone to change travel behaviour.

This brings home the nature of car dependency. It is, of course, not the car, nor any car user, that is dependent. Anyone with a car is effectively *independent* of the form of the built environment. Rather, it is the suburban dweller who is dependent on a particular mode of transport. Conversely, it is car-free individual who is 'built environment dependent'. It is they who rely on the short distances and concentration of facilities available in the inner areas, and who might find other areas of the city inaccessible.

As long as the suburban dweller is car dependent, then, any attempt to force them out of their cars would be seen as disenfranchisement. In accessibility terms, it is the same sense of disenfranchisement that would be felt by the inner city dweller if shops and services were closed and moved away from the traditional urban core. One would not expect either scenario to be tolerated without a fight from those affected. In this sense, suburban advocates of car use and the advocates of vital (traditional) town centres are making the same argument. That of maintaining their *own* accessibility (Table 6).

Table 6 Dependency and policy

		User location	
		Compact Inner city	**Outer city and external**
User mode	*Dependency*	Independent of any single mode	Dependent on car, where available
Car available	Independent of built form	Push policies	Pull policies
Car not available	Dependent on compact form, where available	Pull policies	Pull policies

The concepts of elasticity and dependency (both related to the issue of user choice and location) help to explain the problems of implementation of travel reduction policies. It also explains to some extent other important considerations in successful implementation. It is better to design in travel reduction policies in the layout of city centres, peripheral locations and housing developments, so it is clearly seen as part of the design process rather than good ideas that are retrofitted to the urban or peripheral location. Land use strategies are equally important in reducing travel as traditional transport policies, since location policies, decisions on opening hours, integration of land and transport all offer opportunities for packaging policies. The trip making requirements of individuals must be seen as an entity. If only the origin or the destination is suitable for another mode or another destination, then the car will still be used. This is the problem in non-central locations, as it is much harder to promote realistic alternatives to car drivers for their entire trip.

4.4 Involvement

We have already discussed the importance of packaging as a means to present combinations of imaginative and attractive policy measures. Packaging is an essential process to enhance measures and to achieve political commitment from all stakeholders. It also allows discussion and some understanding of the visible impacts of the proposed package to be assessed. Adverse impacts can be addressed and unintentional outcomes anticipated. In short, it is an essential prerequisite for successful policy implementation. These issues are further discussed in this section.

Encouraging travel reduction is not merely a matter for transport professionals. We have seen how both land-use planning and technological services can play a role in contributing to travel reduction. Nor is it merely a case for policy-makers. National and local authorities can certainly play a significant role in providing an important stimulus and an overall framework within which more local actions can be taken, together with necessary financial support. Involvement and responsibility for effecting travel reduction must be shared across a variety of actors.

Private companies and public utilities can also play a role in providing some of the services that are required to allow travel-reducing alternatives to be chosen. For example, public transport operators can promote not only the use of their own services but can promote cycling by providing cycle parking and accommodation for cycles on board where appropriate, and even cycle hire. Similarly, the provision of utilities, such as telecommunications services, is required before some travel-reducing options become possible.

Employers have an important role to play, not only in directly encouraging particular commuting behaviour, such as car pooling, but in allowing flexibility in the workplace creating opportunities to travel off-peak, or to work at home. Provision of showers and facilities for cyclists are some ways of demonstrating the importance attached to the initiative, as would the direct provision of bicycles themselves, or lap-top or home computers (perhaps in lieu of company car benefits). Local and national authorities may take the lead in promoting travel reduction through example, as these authorities are both major local employers, and providers of public transport and other services.

Finally, individuals themselves can take the initiative in altering their own travel patterns. Particularly important in this respect is necessity for the travel reduction message to get through to the public and to command their support. We return here to some of the necessary conditions for travel reduction. We have drawn attention to the primary arguments for travel reduction, mentioning transport and environmental arguments, together with the necessity to have political and public support. Here, we expand on this last requirement, by elaborating on certain key requirements for political and public acceptance of travel reduction strategies. There must be:

1. *Willingness to Change* - Unless individuals understand the importance of travel reduction objectives, and the pressing need for these to mitigate the environmental consequences of unrestrained mobility, then the effectiveness of travel reduction measures will be lost. For example, if obstacles are put in the way of the car driver, that driver must be convinced of the benefits of using an alternative to the car. Otherwise, they may simply take evasive action that allows them to continue to use the car. Such evasive action may actually involve taking a longer route or simply entail spending more time in congestion, which are both contrary to the objectives of travel reduction.

2. *Awareness of Benefits* - The willingness to change behaviour can also be encouraged if, in addition to the knowledge of 'global' benefits of an individual's action, they also are seen to receive a direct personal benefit. Thus, where individuals were given bicycles by their employer, this was a direct positive gain which could be realised through participation and use. In such cases the scheme's participant can feel that they are personally benefiting as well as helping the broader, indeed global environment.

   This sense of benefit need not be material, but may be realised through time and convenience. Thus, the urban structure of a settlement may be devised in such a way that routes on foot or by bicycle are more direct than those by car, enabling trips by the 'slower' modes to be made in times that are comparable with longer journeys by car. This case demonstrates how it is easy for the individual traveller to make the 'favoured' decision in walking or cycling to the shops rather than taking the car. In the case of Houten, it is interesting to note that this town has an above average rate of car ownership, and yet car travel within the town is less than in comparable towns. This suggests that travel within the town is made by non-motorised modes by choice (not simply due to the non-availability of the car) and demonstrates that it is possible to combine the mobility of the car with the mobility by alternative modes.

3. *Finding Alternatives* - It is important to make individuals aware that they can make a difference and that difference can (and should) be made now. It is not some global problem that will be only solved, at some remote time in the future. Thus, the raising awareness schemes can make a point of encouraging even relatively minor or temporary changes in behaviour, as in Bristol's cycle to work day or Enschede's campaign that 'the car can manage a day without you'. Although, the immediate tangible effects of a day not travelling by car may be slight, the willingness to participate in the scheme and the act of finding alternatives to the car is important. Included here, is overcoming the barrier of trying out unfamiliar modes, which may have an effect in the longer term, for example, when changes in individuals' lifestyles present new opportunities for alternative travel possibilities.

4. *Travel Decisions and Lifestyle* - This draws attention to the importance of considering that individuals make travel decisions within a wider context of activities and lifestyle. In particular, travel behaviour may become habitual for any given circumstances, and often the 'choice' to use a car on a particular occasion is not so much a positive decision, but merely the absence of consideration of the alternatives. Making those alternatives explicit, through publicity (information technology) and physical visibility (buses speeding past on dedicated lanes), is therefore an important consideration.

   Moreover, as noted above, life cycle changes can precipitate travel changes. For example, any location choice is effectively a travel choice also. Thus, the decision to move to the suburbs or out of town will imply particular travel consequences. Similarly, moving place of employment, or changes in household size, or increase in income (the ability to purchase a car) can all precipitate changes in travel behaviour. When such changes are made these can be an opportunity to take travel-reducing decisions rather than travel-increasing ones. In the case of the Hague business location, the siting of offices next to a railway node precipitated a modal shift away from the car to rail.

Similarly, to the extent that individuals may have a fixed 'travel time budget', we may argue that the amount of travel (time) available is constant, and by providing choice, we can make this travel less harmful. For example, we can encourage the use of slower modes over shorter distances, or we can use less fuel through travelling at more constant speeds outside peak periods.

5. *Creation of Choices* - What the policy-maker can do, therefore, is not so much force changes in behaviour, but rather create choices for people so that travel alternatives involving less travel become more desirable. By contrast, if the choice is not available - for example, to work at home, or to have mixed use development within a block, or to take the bicycle on the train - then travel reduction by these means is impossible from the outset.

It is possible to learn from the case studies and the wider travel reduction context and suggest a few principles or pointers, which may be used to summarise the messages of travel reduction emerging from this project. It has been seen that travel reduction is certainly possible in some cases, even if overall mobility may tend to continue increasing regardless. Given this reality, it then becomes a political decision as to what form of travel reduction is targeted - who is encouraged to change some element of their mobility, and by what means.

A simple example of this would be whether target reduction in a given number of vehicle kilometres was distributed between a few long distance journeys or several shorter ones; or between a few public transport journeys or several low occupancy car journeys. This kind of decision will be familiar to transport policy-makers balancing objectives between different transport related priorities.

However, policy decisions will also depend on what kind of city or environment we wish to live in. It is evident that for the same amount of mobility, some very different environments and travel regimes could result. An example would be the case where an attractive urban environment, amenable to walking and cycling, is contrasted with an urban environment, which is more hostile to the pedestrian or cyclist (indeed, to people in general). In this hostile environment people choose to telecommute, living further away from the city, and visiting it less frequently. Both possibilities might involve the same amount of travel, but very different environments result.

This is why it is important to pay attention to the wider policy context. For example, land use and urban design policies can create a favourable urban environment, which can sustain urban vitality and services for a cross-section of society. In addition to making a contribution to travel reduction objectives, this design-based solution can also allow more or less unrestricted mobility on foot or by bicycle. It is better to retain services and employment in central areas currently accessible to most people than to allow dispersal to peripheral locations, entailing longer distances and more travel by car, and then have to create commuter plans or road capacity reductions to mitigate these effects. In the former case, travel reduction is 'built in', but in the latter case, special pro-active or restrictive policies are required.

For the same amount of travel reduction success, we can operate with a different range of lifestyles, activity patterns and environments. The choice of which modes to use and which environments are preferred becomes significant. Moreover, the equity implications of travel reduction policies become important, as does the issue of which individuals have that choice of modes, and these choices all influence the wider environment. In this sense we can choose

to reduce travel not only for its own sake, but in ways which are complementary to wider social and environmental objectives, and hence contribute to sustainability in its widest interpretation.

5. CONCLUSIONS AND RECOMMENDATIONS

1. Recent travel trends in Europe point to the need for strategies to reduce travel by trip switching or substitution.

2. It is anticipated that combining individual travel avoidance measures into strategies will achieve maximum effectiveness.

3. Measures to encourage travellers to switch from private cars to alternative modes are considered to be valuable for future travel avoidance strategies. Despite the fact that measures of this type already have relatively high levels implementation in the DANTE countries, the wide range of modal switching measures available, combined with the ever increasing trend for car use and dependence in Europe, suggests that they still have potential for future travel reduction.

4. Further emphasis on measures which address travel reduction using methods other than modal switching is also required - these include measures designed to switch the time or destination of travel, substitute trips using technology, link trips, or modify trips. The fewer numbers of measures available in these categories, and lower levels of current implementation in the DANTE countries, suggests future potential both in terms of the development of further measures, and in terms of increased implementation of existing measures.

5. Due to their extensive responsibilities for the implementation of travel avoidance measures in Europe, aid and advice for the development of travel avoidance strategies is essential for local authorities and central governments.

6. In addition to involvement by local authorities, further involvement by all other relevant actors (particularly non-transport actors) is required to achieve fully balanced and effective strategies to reduce travel.

7. To help transport decision-makers choose the most appropriate measures to form effective travel avoidance strategies, they will require information on the potential travel reduction impacts, broader impacts, implementation processes, and potential barriers to implementation, of the measures available.

8. Further work to aid the development of travel avoidance strategies is recommended.

9. Although the assessment of individual measures is important, future work should place significant emphasis on identifying and assessing the most appropriate *combinations* of measures to form travel reduction strategies.

10. Future work should address a comprehensive range of travel reduction measures and strategies, including those designed to encourage travellers to switch mode of transport, the time of travel or the destination of travel; or to substitute some journeys by using telecommunications, link a number of trips, or modify trips. To ensure maximum impact on travel reduction, it is recommended that all these methods of travel reduction are considered and assessed.

11. The DANTE consortium recommends that practical advice for local authorities and central governments on the best ways to reduce travel should be provided.

12. The co-operation of all actors with the potential to contribute to the development of travel reduction strategies should be encouraged, for example by setting up working groups within which local authorities, transport operators, local businesses, pressure groups, and developers can collaborate.

13. Practical evaluations of measures to reduce travel are required to help transport decision-makers choose between travel avoidance measures on the basis of their past success. These evaluations should examine potential travel reduction impacts, broader impacts, implementation processes, and potential barriers to implementation, of the measures available.

14. Modal split is a very effective way to describe the transport situation in an area, particularly when comparing similarities and differences between areas. Clear differences stand out between the DANTE case studies, with car use ranging from 4% in Bucharest to 55% in Brescia, bicycle use ranging from 0% in Rome to 38% in Enschede and public transport use ranging from 2.5% in Mytilini to 90% in Bucharest.

15. Measures aimed at achieving mode switching are most common, while very few measures are implemented to achieve destination switching or trip substitution.

16. However, the results suggest that destination switching and trip substitution measures are more frequently successful in achieving their desired effect than measures designed to encourage mode switching (although it should be noted that lack of evaluation data makes it difficult to draw firm conclusions).

17. Measures were also classified according to their primary objective - reducing travel (R), promoting alternative modes/ behaviour (P) or a combination of the two (PR). It was found that, although car usage is often the main problem, measures which aim to solve the problem indirectly by promoting alternative modes are much more common than those which directly attempt to reduce travel by car.

18. The majority of measures were successful in achieving their stated objectives (not necessarily travel reduction), and also in encouraging positive behaviour in terms of uptake of 'favoured' modes. Promotion (P) and combination (PR) measures were generally very successful in achieving their stated objectives, whereas reduction (R) measures seem to have been relatively unsuccessful.

19. Measures which combine promotion and reduction (PR) are relatively more successful in reducing travel than those which promotion or reduction alone.

20. In total, 6 of the measures investigated may be regarded as having successfully reduced travel (with travel reduction measured as a total reduction in vehicle km for the area, or as a reduction in car km or car trips). A total of 8 measures can be regarded as partially successful, while 3 show clear evidence of failure to reduce travel, and 24 measures showed no evidence of travel reduction.
21. This low success rate is partly due to the fact that in many cases there was not enough evidence to confirm whether travel reduction had taken place. A number of other

measures may have achieved travel reduction, but the level of documentation was not adequate to prove the case one way or the other. In contrast it is relatively simple to demonstrate that, for example, travel by bus or bicycle has taken place. One of the main findings of this workpackage has been that measuring travel reduction, and particularly comparing measures in terms of their impacts on travel reduction, is very complex. Measures are often implemented on very different scales and in very different contexts, targeted towards different kinds of audiences and have widely varying levels of evaluation data available.

22. The low success rate may also be explained by the fact that many measures do not set out explicitly to reduce travel, but to boost economic activity, improve transport efficiency, or achieve other goals. As a result, success in their own terms may not necessarily lead to success in reducing travel.

23. Requirements for the day-to-day operation of measures should be taken into account during policy-making;

24. Participation of the public in implementation preparation, or even policy-making, may increase public acceptability of measures and strategies;

25. 'Push' measures are essential - the perceived advantages of car use are so great that there will be only a minimal transfer from car driving while car use remains unrestricted.

26. Stand-alone measures (eg. awareness campaigns, promotion of car pooling, company commuter plans) can be implemented without direct connection to other measures;

27. Measures can be combined to increase effectiveness eg. Park & Ride schemes supplemented by dedicated bus lanes;

28. Groups of measures can be combined at the strategy level eg. push and pull measures, both discouraging car use and making alternatives available.

Implementation processes are subject to many barriers, which may either reduce the potential of measures once implemented or even make implementation impossible. Institutional and policy barriers relate to problems with co-ordinated action between different levels of government, and to measures which are in conflict with other policies. Legal barriers occur when implementation is complicated by legal requirements, or even prohibited by law. Barriers concerning resources (financial, human, physical) are very common. One should also be aware of social barriers such as public resistance. Finally, side effects may hinder the implementation.

Analysis of the DANTE case studies points to the following findings:

- Resource barriers were most common, followed by institutional and social barriers.
- In almost one fifth of cases, the seriousness of the resource barrier hindered good implementation. For other types of barriers this figure was around 10%.
- Physical measures and measures which promote alternative modes are most likely to encounter resource barriers - while those which aim to reduce or restrict travel by car are most likely to meet social/ cultural barriers.

- Barriers to mode and destination switching appear to be more serious than those encountered by time switching and trip substitution strategies - while barriers to land use planning and policy measures are both frequent and serious.
- The most important message concerning barriers is: 'forewarned is forearmed!' The analysis of barriers in the DANTE case studies shows that most barriers can be overcome eventually.

Some conclusions can be drawn from comparing types of measures:

- Physical measures are most likely to have an immediate impact after implementation, although this may not always lead to travel reduction.
- Measures aimed at changing travel behaviour will not show an immediate effect if there is no need to change behaviour eg. promoting mode switching needs to be supported by the restriction of car use.
- Most measures are not aimed at a specific target group. Where a target group is specified, it is likely to be commuters.
- Transferability becomes more difficult when measures are to be implemented in another country, due to institutional, legal and cultural differences.
- Simple and cheap measures are easily transferable, but do not have the highest potential for travel reduction.
- Measures which show only long-term success are difficult to transfer to other countries.

Checklist and guidelines for transferability to other cities or countries

A. Choosing measures:

Define the nature and extent of the problem, and the objectives to be achieved. The areas which should be addressed are:

- Geographical scale;
- Relevant time periods;
- Target groups and related problems eg. road safety, economic development.

The main concern of the first step is to select a set of measures or measure types which have a high potential to solve the problem and obtain the stated objectives.

B. The way forward to good implementation:

Evaluate measures in terms of their 'implementability'. Factors to consider include:

- Type of implementor. The same type of implementor may have different responsibilities and resource levels in different cities and countries.
- Does the measure fit into an existing administrative and legal framework?
- What are the resources (financial, manpower and technical) necessary for implementation?
- What is the likely public reaction?
- What are the potential side effects of implementation. Note that there may be negative side effects on non-transport areas.
- Be aware of differences in social and cultural behaviour in different countries. Always try and associate with local habits.

The implementation of travel reduction strategies must be seen as a process, from policy strategies and objectives through to policy outputs and effects. The major barriers to implementation come *before* the policy output stage. There are substantial differences in the priorities and the barriers between the DANTE cities. The greatest potential lies in the policies being packaged together so that the actual effects coincide closely with the intended effects. However, the more comprehensive the package the greater the possibility that the package will not be implemented in its entirety. Travel reduction strategies may be less effective when introduced individually, but the probability of successful implementation is higher. No city seems to have successfully resolved this dilemma.

The project has demonstrated that travel reduction has been achieved over a wide variety of circumstances and by a variety of means: it has been achieved though policies for restraining car use, promoting alternatives to car use, land use planning and technological solutions, and has been demonstrated in all countries studied and at all scales of application. A range of agents and individuals can make valuable contribution to travel reduction, from local authorities and national governments to employers and transport operators.

Broadly, it can be concluded that travel reduction is most likely to occur where a series of policies are in operation which reinforce each other towards the objectives of travel reduction. Thus, examples have been shown in which strategy packages combine restraint on car use with promotion of alternatives (i.e. which include both 'carrot' and 'stick' measures).

The project has also identified three significant caveats. Firstly, it has been seen that 'travel reduction' is often difficult to quantify, and must be deduced indirectly. This means that the assessment of - and potentially the justification for - travel reduction strategies is not necessarily straightforward. Secondly, it has been seen that sometimes travel might be 'pinned down' in one instance, but might be 'released' elsewhere, or that any freed-up vehicles or roadspace may be used by others. This points to the need for a co-ordinated and consistent approach to achieve the best possible results. Thirdly, in some cases any travel reduction 'gains' are overwhelmed by travel growth in a relatively short period of time. Nevertheless, successes of a small magnitude have the potential to be replicated elsewhere to achieve greater travel reduction benefits on a wider scale.

Overall, it has been found that careful development and implementation of policies can create successful conditions in which travel reduction may be achieved. Awareness of potential barriers and pitfalls - cases where contradictory outcomes result - can help achieve success. The role of public information is also particularly important, in order to encourage a change in attitude to travel, and hence a shift in behaviour.

It is possible to learn from the case studies and the wider travel reduction context, and suggest a few principles or pointers which may be used to summarise the messages of travel reduction emerging from the Good Practice Guide:

'Things to Do'

- Use a package of several complementary travel reduction measures;
- In particular, combine restraint of the car with promotion of the alternatives;

- Start with low expectations - for example start with small, practical measures which have a high probability of demonstrable success;
- However, do not neglect land use planning measures, which may allow travel reduction to be 'built in' to communities without the need for ongoing pro-active travel reduction policies;
- Anticipate any potential barriers to implementation in order to avoid negative results;
- Get the public involved, and build on any local initiatives which are in line with travel reduction policies;
- Use public awareness messages to encourage people to want to change travel behaviour, as well as informing them of the available alternatives;
- Authorities (as employers and individuals) are in a good position to lead by example;
- Take the initiative by giving people the opportunities to work in different ways, providing facilities, bicycles etc;
- Where possible, demonstrate direct benefits to those changing behaviour.

'Things to Avoid'

- Avoid implementation of policies elsewhere which tend to increase travel, for example:
    - Promoting the efficiency of the traffic system without considering travel-encouraging consequences.
    - Creation of out-of-town centres which encourage longer, car-based trips.
    - Regulations which require minimum parking provision or forbid mixed use development.
- Avoid any changes which encourage or require short term increases in mobility by car (which may become habit-forming);
- Avoid appearing to be too hostile to the car user, as this may in turn receive a hostile public reaction. Rather, emphasise positive aspects - car users are also sometimes pedestrians;
- When promoting alternatives to the car, avoid promoting poor quality alternatives;
- Avoid introducing public transport too late into newly developed residential areas, as people are likely to have chosen to use the car. By then, it will be very difficult to change that habit;
- Wherever possible, avoid uncertainty when introducing restrictive measures such as area access control, as these may get a negative reaction from shopkeepers and businesses.

Annexes –

A4.1 Publications in refereed journals

Banister, D and Marshall, S (2000) Encouraging Travel Alternatives, London : The Stationary Office.

- Marshall S., Banister D., & McLellan A. (1997) *A Strategic Assessment of Travel Trends and Travel Reduction Strategies*, Innovation: The European Journal of Social Sciences, Vol.10, No. 3

- Marshall S. (1999) *The Potential Contribution of Land Use Policies towards Sustainable Mobility through Activation of Travel Reduction Mechanisms*, Innovation: The European Journal of Social Sciences (forthcoming)

- Marshall S., Banister D. (1999) *Travel Reduction Policies: Intentions and Outcomes*, in submission to Transportation Research: A

Built Environment special issue 1999 Volume 25(2)

- Marshall S. (1999) *Introduction - Travel Reduction: Means and Ends*
- Kristensen J.P. & Marshall S. (1999) *Mobility Management to Reduce Travel: the Case of Aalborg*
- Louw E. & Maat K. (1999) *Enschede: Measures in a Package*
- Maegerle J. & Maggi R. (1999) *Zürich Transport Policy - or the Importance of Being Rich*
- Mathers S. (1999) *Reducing Travel in the City of Bristol: Promoting Bus Use through Complementary Measures*
- Maat K. & Louw E. (1999) *Mind the Gap: Pitfalls on Measures to Control Mobility*
- Banister D. (1999) *A Walk in the Woods*
- Marshall S. (1999) *Reflections on Non-Travel*

A4.2 Other publications

- Encouraging Travel Alternatives: A Guide to Good Practice in Reducing Travel (December 1998)

- Various articles, press releases and coverage:
    - UK local and national press
    - Romanian national press and television
    - A world-wide business magazine
    - Car Free Cities newsletter

A4.3 Presentations, workshops and proceedings

- EAASS Second International Conference (March 1997). Paper published in proceedings.
- Presentation at NECTAR Euro-conference (June 1997). Paper published in proceedings.
- PTRC European Transport Forum (September 1997), Brunel University, UK: *Designs to Avoid the Need to Travel in Europe: An Assessment of Strategies and their Impacts.* Paper published in proceedings.
- IATBR '97 (September 1997) University of Texas, US: *Designs to Avoid the Need to Travel in Europe (DANTE): A Research Perspective*. Paper published in proceedings.
- Environment '97 (November 1997), Internet: *Travel Reduction Strategies and their Impacts*. Paper published in proceedings.
- Colloquium Vervoersplanologisch Speurwerk (November 1997), Amsterdam, NL: *Strategien voor mobiliteitreductie in enkele Europese landen.* Paper published in: B.Egter & N.Kalfs 1997: *Colloquium Vervoersplanologisch Speurwerk 1997*, Delft (CVS)1
- POLIS Conference (November 1997), Munich: *The Relevance of East-West Co-operation to Bucharest Transport Programmes.* Paper published in proceedings.
- Presentation at QUATTRO Project Seminar (March 1998), Budapest. Paper published in proceedings.
- Presentation at NECTAR Euro-conference (April 1998). Paper published in proceedings.
- 8th World Conference on Transport Research (July 1998) Antwerp, BEL*: Strategies and Measures to Reduce Travel by Car in European Cities*. Paper published in proceedings.
- 8th World Conference on Transport Research (July 1998) Antwerp, BEL. *How Central and Local Governments can Manage and Cut Back Automobile Use.* Paper published in proceedings.
- PTRC/ AET European Transport Forum (September 1998), Loughborough, UK: *Reducing the Need to Travel: A European Guide to Good Practice*. Paper published in proceedings.
- Colloquium Vervoersplanologisch Speurwerk (November 1998), Amsterdam, NL. Paper published in proceedings.
- DANTE presentation at day for DGVII Roads Programme.

DANTE: Traffic Reduction Strategies: putting them into action (June 1998) Bristol, UK

- The European perspective on travel reduction
- Bristol as a leading city in travel reduction measures
- Key issues in travel reduction strategies
- Workshop: Quality public transport and inter-modal transport solutions

- Workshop: The urban clearzones concept
- Workshop: Pricing for sustainable transport
- Workshop: Changing travel attitudes in a car dependent culture

Papers published in proceedings.

DANTE: 'Strategies for Travel Reduction' (June 1998), Bucharest, RO

- POLIS: incorporating Central & Eastern European countries
- Prospects for the Fifth Framework
- Workshop for Central & Eastern European countries: the benefits of networking
- DANTE Overview
- Findings of the DANTE project: City strategies and their impact on reducing the need to travel
- Findings of the DANTE project: The implementation of city strategies and measures - barriers and potentials
- Presentation by the city of Bucharest: the European Commission DGVII DANTE, CAPTURE, and STIMULUS projects
- Reducing travel in Europe - experiences of the DANTE cities: Aalborg, DK
- Reducing travel in Europe - experiences of the DANTE cities: Bristol, UK
- Reducing travel in Europe - experiences of the DANTE cities: Enschede, NL
- Reducing travel in Europe - experiences of the DANTE cities: Rome, IT
- Reducing travel in Europe - experiences of the DANTE cities: Zürich, CH
- Introduction to transport issues in Central & Eastern European countries
- Reducing travel in Central & Eastern European countries - statements from Central and Eastern European cities
- Why do we need a Good Practice Guide to traffic and travel reduction?
- Workshop: Transferring good practice between East and West - the role of European Commission research
- Workshop: How can POLIS better meet the requirements of cities in the Central countries?
- Workshop: Public transport strategies to reduce traffic

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