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THE INSTRUMENTS OF TRANSPORT POLICY

ABSTRACT

The work proposes the transport policy instruments, such as the infrastructure measures, management measures and information provision measures as the means that could reduce or eliminate transport problems. All these measures have been followed through the provisions for passenger cars, provisions for public transport, provisions for cyclists and pedestrians and provisions regarding transport. A range of solutions is given to reduce congestion, improve accessibility and improve the traffic conditions for those who depend on public transport along with the improvement of environmental conditions.

KEY WORDS

automobile, public transport, cyclists and pedestrians, freight, infrastructure, management, information

1. INTRODUCTION

The traffic engineers as transport planners have at their disposal a wide range of transport policy instruments. These are the means that can be used to achieve the following objectives:

- economic efficiency,
- environmental protection,
- safety,
- accessibility,
- sustainability,
- economic regeneration,
- financing,
- practicability,

and solve the problems such as congestion, pollution and traffic accidents which are the cause of wider public concern. These instruments can be categorized in several ways. In this work, they are considered under the following titles:

- infrastructure measures,
- management measures,
- information provision measures.

The provisions that satisfy the needs for usage are also considered:

- for automobiles
- for public transport
- for cyclists and pedestrians, and
- for freight transport.

The information about the area of transport policy instruments are quite scarce. Usually experience with some measures is used, such as right-of-way for buses and cycling lanes, which are only well documented through a number of demonstration projects. Even when the data are available, it is difficult to draw general conclusions, since the results valid in one urban context do not necessarily hold for another.

Lacking data from real life, the most common source of data is the research which usually uses computer models. However, these results are as reliable as the models that create them. Data will be provided about each of the main types of available measures with reference to the useful data sources.

In Table 1 the indicators have been proposed that most correspond to the present and future traffic issues whose solutions form the basis of the transport policy instruments.

2. INFRASTRUCTURE MEASURES

2.1. Provisions for automobiles

Provisions for the cars will be considered through the construction of new roads and new parking lots for cars.

New road construction

The construction of new roads is mainly justified by savings of even up to 80% which result from shortening the travel time, primarily for cars and commercial vehicles. By bypassing particularly sensitive areas, new roads can achieve substantial environmental im-

Table 1: Proposed indicators for different objectives of transport policy

Objective	Indicators
Economic efficiency	Delays for vehicles at intersections Delays of pedestrians at intersections Costs in money and time Variability in journey times Costs of operating different transport services
Environmental protection	Noise levels Levels of different local pollutants Visual intrusions Townscape quality Severance
Safety	Personal injury accidents Insecurity
Accessibility	Activities within a given time and cost Weighted average time and cost for all activities
Sustainability	Environmental, safety and accessibility indicators CO2 emissions for the observed area Fuel consumption for the area as a whole
Economic regeneration	Environmental and accessibility indicators per area and economic sector
Financing	Operating costs and revenues for different modes Costs and revenues for parking and other facilities Tax revenue for vehicle use
Equity	Indicators considered separately for different impact groups
Practicability	Problem assessment Options development Model Comparison of solutions Implementation Performance assessment

Source: C. A. O'Flaherty, *Transport Planning and Traffic Engineering*, New York, 1997, p. 56.

provements. They should contribute to the reduction in traffic accidents, transferring traffic to purpose-built roads whose accident rates should be much lower than those of typical urban streets.

These benefits will be eroded if the new road and its accessibility improvement attract new traffic, or if it is not well designed, then accessibility per direction may deteriorate, especially for cyclists and pedestrians.

New roads in urban areas are extremely expensive. According to research carried out in 2000 in Great Britain, the costs per kilometre amounted to £20 million. Even significant time travel and accident savings may be difficult to justify when set against such high costs.

The main practical constraints on road building are the time taken between the design and implementation due to strong public oppositions, and the restrictions imposed by the existing constructed form of the area.

New parking lots for cars

There are not enough data about their impact. However, additional parking lots can contribute to economic efficiency, due to the savings in fuel consumption while looking for a free parking space. Significant part of traffic in the urban centre is burdened by cars looking for free parking spaces.

However, lack of parking spaces may discourage the drivers to use cars and may redirect them to the usage of public transport. The parking locations have to be clearly marked in order to reduce on-street parking, thus positively influencing the environment and increasing travelling safety, without disrupting the townscape.

There may be, however, the problem of accessibility, especially for those who need to park close to their destinations. As with new roads, the cost of parking, the time scale and the land availability represent significant constraints.

2.2. Provisions for public transport

Provision for public transport for the reduction of transport problems is considered through the provision of conventional railways, light rail, guided buses and Park-and-ride system.

Conventional rail provision

The provision of conventional rail includes opening of new rail lines and new stations which would result in the reduction of travel time for the existing users and in attracting users from other modes. The rail infrastructure measures contribute to the accessibility of traffic, by reducing access distances to public transport and waiting times, and particularly by increasing vehicles speed, since the trains are separated from road congestion. It is very likely that the railway infrastructure designs will have positive impartial implications, since they offer a service which can be used by all. However, these benefits are limited to the corridors directly served.

Rail infrastructure designs vary substantially in cost. According to prices from 2000 in Great Britain, one new station could be constructed for less than £0.2 million, and a line can be opened for £3 million per

kilometre. Cost may therefore be a substantial barrier to implementation, and the main practical constraints for the infrastructure construction, are time-scale for implementation and land availability. Provision of conventional rail will be relevant only for the travelling in excess of 5km. Below this, they are not justified, since bus services with their more frequent stops and better connectivity with the urban centre, will offer shorter travel times. This in turn limits the application of conventional rail to urban areas with a population of over 250,000.

Light rail

Recently, light rail has become a very popular alternative to conventional rail. Its main differences as well as benefits as compared to conventional rail are that it can operate on street, have more frequent stops, i. e. provide greater accessibility and better servicing of the downtown area.

Moreover, minimal population that could justify such offer, would amount to more than 150,000. However, the finances are the main issue here, since light rail networks are extremely expensive and usually exceed £5 million per kilometre.

Guided buses

This vehicle provides a less expensive alternative to light rail. Most proposals envisage guideways only where buses need to bypass congestion. Specially equipped buses can then operate normally on the rest of their lines, offering more extensive suburban coverage than light rail.

Guided buses contribute to the reduction of congestion, impact on the environment and reduction of traffic accidents provided bus priority measures are implemented. The costs of introducing and operating guided buses are substantially lower than for light rail.

Park-and-ride

This will be successfully implemented in minor towns where the majority of working population works in the cities near-by. It allows car drivers to drive to the terminals on the main line. The parking facility itself provides an inexpensive way of using public transport, thus reducing the congestion, environmental intrusion, and accidents in inner urban areas. The net effect will depend on where the facility is located.

However, the parking lot does not provide substantial improvements regarding accessibility and equity since only car users who continue their travel by public transport can use them. More recently, it is financed as part of the construction of new shopping centres.

2.3. Provisions for cyclists and pedestrians

These will be considered through cycle routes and pedestrian zones.

Cycle routes

These offer infrastructure for cyclists, and extend their range of cycle priorities. Since they make cycling safer, they have been designed to attract more people to using cycling in preference of cars. This then results in the reduced use of cars. These methods have proven unsuccessful in our community, since they have not been widely used. The cycle routes achieve travel time benefits for cyclists, but do not attract more people to use bicycles.

Reduction in cyclist casualties on main roads has been balanced by an increase in casualties on minor roads. The costs will depend on the availability of suitable corridors and land availability.

Pedestrian zones

These provide improvement for pedestrians and have proved very successful in stimulating trade in many town centres. Apart from the benefits regarding environment and safety, they have positive impacts on the urban economy and on land use policy.

However, they represent problems regarding accessibility for car users and bus users, and particularly for goods deliveries, and for the disabled persons. They also potentially cause disbenefits by transferring traffic, and reduce the road capacity. These potential adverse impacts can be reduced by careful design. Aesthetic design is of crucial importance in maintaining trade and will increase the costs of construction.

2.4. Provisions for freight

Provision for freight will be considered through lorry parks, transshipment facilities and encouragement of other freight transport modes.

Lorry parks

Lorry parks that have been well designed in secure parking area, with banned night and day on-street parking, provide a means of reducing the environmental impact which maybe of great benefit.

Transshipment facilities

These provide a means of transferring goods from larger vehicles to smaller vehicles, less intrusive for the environment, for the distribution in town centres. In some richer countries, underground freight distribution is proposed, with additional costs. Previous experiences have shown that such solutions are not particularly attractive nor cost-effective for the carriers.

Encouragement of other modes

Attempts to encourage the use of other modes of freight transport have been focused on the freight transport by rail, but in some cases may be extended to water transport and pipelines.

All the modes are competitive solely over greater distances and for bulk freight, with additional costs for freight handling and final road distribution. Road distribution takes place in urban areas which results in traffic congestion.

3. MANAGEMENT MEASURES

3.1. Provisions for automobiles

These will be presented through conventional traffic management, urban traffic control, advanced transport telematics, accident remedial methods, traffic calming measures, regulatory restrictions on car use, parking controls, and car sharing systems.

Conventional traffic management

Included here is a wide range of measures such as one-way streets, redesign of intersections, banned turns and on-street parking controls, which have proved as beneficial impacts on the reduction of travel time and number of accidents.

If traffic is rerouted, the journey length is increased, and this may also cause environmental intrusion of the otherwise quiet streets. For a certain number of users, the accessibility is reduced, and in one-way streets there is the problem of the already existing bus service as well as the deliveries on the rerouted area.

The major practical consideration regarding overall traffic management focuses on the enforcement of measures.

Urban Traffic Control - UTC

These systems are an expert form of traffic control which extend the principles of traffic signalling control by integrating the control of all the signals over a wide area, using the control parameters of split cycles, cycle time, and offset of the start of the green phase, in order to optimize the given function of objective, such as minimization of the travel time.

An advanced time system can achieve savings in travel time as much as up to 15%. The vehicle-responsive systems at signal controlled intersections may achieve as much as a 20% saving. Such efficiency acts favourably on the environment and the travel safety.

Advanced Transport Telematics – ATT

These represent a series of applications of information technology in transport. This includes motorway access and queue management techniques. It also

includes the extension of priorities for buses, and their integration with information systems such as dynamic route guidance. Some technologies are still at the prototype stage, and will require further research.

Accident remedial measures

Accident reduction measures cover a wide range of possibilities, such as the black spot treatment, or skid-resistance surfacing. Measures for a wide area will have other impacts and will be considered as part of the traffic calming.

Traffic calming measures

These measures are intended to reduce the adverse environmental and safety impacts of car and commercial vehicle use. They have traditionally focused on the streets in residential areas and include two types of approach:

- segregation, in which insignificant traffic is eliminated, and
- integration, which allows traffic.

Segregation may be achieved by the use of one-way streets, closures and banned turns, which create a labyrinth thus making the through traffic more difficult and redirect it to the surrounding streets. The extra traffic on surrounding streets causes congestion and environmental intrusion, so that this possibility has to be taken into consideration in the design phase.

Integration measures include speed limits, speed humps, pinch points, resurfacing and planting, with the aim of encouraging the drivers to drive more slowly and cautiously. These measures generate significant benefits regarding environment and safety, not having any adverse influence on the accessibility. The key issue occurs in establishing a balance between the cost of their implementation and the efficiency of the visual quality.

Regulatory restrictions on car usage

These have been used as an alternative way of reducing car use. In several Italian cities, permits have been allocated to those who can justify needing their cars in the centre, whereas others are banned. In Athens and Lagos an “odds and evens” system operates, in which cars with odd number plates can enter on odd dates, and those with even number plates can enter on even dates. Jakarta has its own regulatory system – “three in one”, in which only cars with three and more occupants are permitted on certain roads.

Permit system has proved expensive in terms of resources required to check the validity and issuing of permits. The experience with “odds and evens” which is easy to implement, is less effective, since drivers tend to own two cars.

Parking controls

These provide a more efficient way of controlling car use. Controls can be by reducing the supply of spaces, restricting duration and opening hours, and by charging. These controls cannot be imposed on private parking which in the West account for 40 per cent to 60 per cent of the entire town parking space.

Performance will depend on the way in which controls are applied. Reducing the space is likely to increase the amount of time spent searching for parking space without restrictions, which would have negative impact on congestion.

Car sharing

Car sharing offers traffic reduction, at the same time retaining many of the advantages of private car travel. The carried out research has aimed to encourage drivers to "car pool" with others, by taking it in turns to drive. Unfortunately, the number of those who are willing to share their cars does not exceed 5 per cent.

3.2. Provisions for public transport

These contain bus priorities, high-occupancy vehicle lanes, and bus service management measures.

Bus priorities

The most common measures are those with bus lanes in the direction of the traffic flow, exemption from banned turns, selective detection at signals, traffic signal timing adjusted to favour buses, bus access to pedestrian zones, allowing them to avoid congestions, and therefore providing shorter travel times.

The main practical disadvantages with bus lanes are the lack of space suitable for an extra lane, since others are reserved for other vehicles, and the need for effective enforcement.

A somewhat more recent phenomenon in bus priorities is the use of "red routes" which is being applied in London, in which bus lanes are combined with intensive and well controlled parking restrictions. Travel time savings are great, whereas the results about the effects on frontage access and trade are somewhat poorer.

High Occupancy Vehicle (HOV) lanes

HOV lanes include car sharers, taxis and commercial vehicles. These offer greater advantages than conventional bus lanes, provided that the delays to buses are not great.

Bus service management measures

Measures must be designed in such a way as to improve the reliability of bus services, in order to reduce operating costs. Measures that improve reliability of operation, and reduce time travel and waiting times

resulting from irregular services, have to generate significant advantages regarding efficiency, because only then can they potentially contribute to reduced car use.

3.3. Provisions for cyclists and pedestrians

These are studied through cycle lanes and priorities, cycle parking and pedestrian crossing facilities.

Cycle lanes and priorities

They serve the same function as cycle routes, reducing the accidents involving cyclists, and they can stimulate increased use of bicycles. They are easier to implement than bus lanes since they require less road space, but they still represent a problem of frontage access.

Cycle parking

Provisions of cycle parking need to increase accessibility and safety for cyclists. In some countries, as e.g. Japan, bicycles are provided for the use to citizens, who, after the use, leave them in the spaces at entrances to or exits from other transport modes.

Pedestrian crossing facilities

These are primarily safety measures which must at the same time shorten the walking time. Determining the signal timing and linking of pedestrian phases may achieve efficiency benefits, as well as displaying the time on the traffic control remaining for pedestrian crossing thus increasing the safety of crossing the road.

Parking control and footway widening may improve the environment and safety of pedestrians.

3.4. Provisions for freight

Provisions regarding freight are analysed through lorry routes and lorry operation bans.

Lorry routes and bans

This type of traffic management is primarily designed to reduce the environmental intrusion of heavy lorries. Lorry routes can be mandatory, but are more frequently advisory, thus reducing the freight accessibility.

Bans can be area-wide, or limited to particular roads, or may be limited to sections, forming a screenline or cordon. They can be complete or limited to certain time and certain sizes of vehicles or with exemptions for access.

Restrictions on lorries have good impact on the environment and safety, but they increase the costs of operation.

4. INFORMATION PROVISION

4.1. Provisions for cars

Provisions regarding cars in providing information, as one of the instruments of transport policy, are considered through the conventional direction signing, variable message signs, real-time driver information systems, parking information systems, telecommunications, and public awareness campaigns.

Conventional direction signing

Good direction signing can provide benefits for the car users, as well as for other traffic, since it reduces the journey lengths and travel times. Studies have shown that 6 per cent of travel time can be accounted for by wrong routing, and that inadequate direction signing can even double the travel time. Direction signing can be used to divert traffic and reroute it away from environmentally sensitive locations.

Variable message signs

These enable drivers in diverting from the known but unpredictable congestion. The benefits and drawbacks are specific and depend on the location of their application. Potential benefits lie in the probability that drivers will divert in order to avoid environmental and safety problems.

Real-time driver information systems

Advanced transport telematics is developing very rapidly, and it is used to send messages over radio or on the in-vehicle display, about standstills, and they propose routes to avoid congestion. Receiving information requires additional equipping of the vehicle.

Research has shown that the drivers who are familiar with the route are most likely to prefer the received information, but will choose their own route, whereas drivers who are not familiar with the route, will prefer and use the guidance in order to avoid traffic congestions. The research results have also predicted reduction in travel time by 10 per cent in urban areas as well as the reduction in traffic accidents.

Parking information systems

These are further application of the advanced transport telematics, planned to reduce the search time for a free parking space in urban centres. Detectors identify car parks that are full or almost full, and activate signs indicating the route to the nearest available parking space.

Timely received information results in significant reduction of time spent finding a parking space, which does not mean a reduction in the planned number of travelled kilometres. The benefits of efficiency and accessibility resulting from the reduction in the search time, can be related to the reduction in environmental

intrusion, number of accidents, but will depend on the local circumstances.

Telecommunications

The modern communication technology offers alternative travelling for everyone, but research has focused on the use of car travel. As example, teleworking (working by means of computer at home) has been taken, where employees can do work at home. It is more widely studied and already implemented in the USA and the Netherlands. Teleworking reduces the use of cars since teleworkers work at home two days a week, not using the car when they stay at home.

The interest exists also for the distant purchasing (teleshopping) and teleconferencing. Such reductions may have efficiency benefits, and will contribute to environmental and sustainability objectives. They will not reduce accessibility, since teleworking provides an alternative to travel. However, their influence is limited by the willingness of the employer and employee to permit, i. e. agree to working at home.

Public awareness campaigns

Very often local authorities develop a campaign as a way of informing in particular car users and make them thus aware of the effects of the car use on the environment. They are alerted to the existing alternatives, including the use of other modes of transport, and the need to change the destination and the frequency of travelling.

The results of carried out surveys emphasise the conflict between individual preferences of car use and the concern over the impacts of car use. There is a possibility of channelling the resulting sense of guilt into more environmentally appropriate travel behaviour. It is too early today to assess the impact of the public awareness on the choice of the transport means.

4.2. Provisions for public transport

These provisions are presented through service information, real-time passenger information and operation information systems.

Service information

Timetabling, as the basic form of services information provided for the public transport users, has become degraded in many areas in Great Britain, due to the bus deregulation. Studies of deregulation have resulted in the lack of service information, aggravated by more frequent changes in the timetables. This is claimed to be one of the main causes of losing the users, since lack of reliability and travel changes create sense of insecurity in passengers.

Improved real-time informing would increase the number of users thus bringing benefits in the accessibility and equity, and potentially in reducing car use.

Real-time passenger information

Such information need to be provided not only at the main terminals, but also at individual stops for buses, trains or trams. Information about delays and alternatives may allow passengers a time saving by using alternative routes.

However, their main influence in reducing the uncertainty and stress associated with the delayed services. Studies on the London Underground have attempted to assess the advantages of such information in order to avoid losing their users. In many systems in the world information is provided on a display about the arrival of the next transport means and the percentage of its occupancy, which provides the possibility of choice for the users, i. e. whether they will get on this one or wait for the next vehicle.

Operation information systems

Operation information systems use fleet management facilities based on the advanced transport telematics, which are based on identifying the locations for buses and rescheduling of services in order to reduce the influence of unreliability. The costs of equipment are high, and there is little interest for their wider application.

4.3. Provisions for cyclists and pedestrians

Provisions for cyclists and pedestrians have been analysed through static direction signs.

Static direction signs

Conventional signs are virtually the only available measure, but can be used to enhance the use of cycle priority routes and to improve access within pedestrian zones for the disabled pedestrians. Tactile footways are a further facility providing specifically for the visually handicapped pedestrians.

4.4. Provisions for freight

The fleet management systems are considered here in order to achieve a major economic effect by reducing the number of empty journeys.

Fleet management systems

These systems have been introduced widely for freight vehicle management, allowing them to respond more rapidly to the variable demand of the planned just-in-time deliveries, and reducing the number of empty return journeys.

Local authorities play a minor role in their implementation and operation, since the majority of such systems has been introduced by freight operators.

Table 2 shows, in the form of matrix the interaction of the strategy measures with the aim of choosing those measures that are likely to supplement each other in one of the offered ways.

5. CONCLUSION

The aforesaid shows clearly that no single measure on its own can offer a solution to the urban transport

Table 2: Matrix of interaction of strategy measures

	Highways	PT infrastructure	Park-and-ride	Parking supply	Traffic management	Bus priorities	Traffic calming	Parking control	PT service levels	Information system
Highways						C	C			
PT infrastructure								C/P		
Park-and-ride		C						C		
Parking supply							C	C		
Traffic management						C	C		C	C
Bus priorities					C		C		C	
Traffic calming	C							C/P		
Parking control		C	C	C		C			C	C
PT service levels			C				C	C/P		
Information systems			C		C		C	C	C	

Source: C. A. O'Flaherty, Transport Planning and Traffic Engineering, New York, 1997, p. 74.

Key: Measures in the left-hand column can reinforce the measure in the appropriate column by:

C - complementing it,

P - making it more publicly acceptable

problems. The majority of measures have at least one contribution in reducing the travel time, environmental intrusion or traffic accidents. However, they have adverse impact on the accessibility of traffic or equity. Some of the benefits, such as traffic calming, may have advantages at one location and cause damage at another. Bus and cycle priorities would be more efficient if the traffic management measures could influence the choice of the transport means.

For all the mentioned reasons, the package of measures would probably be more efficient than the choice of any single measure on its own. One measure can eliminate the drawbacks of the other, or avoid transferring problems to another area, another measure may reinforce the influence of the first one, e. g. stimulating shift of transport modes and creation of a greater number of benefits.

In this way the unity of measures can be achieved, i. e. the overall benefits are greater than the addition of parts. Finding out measures that might achieve such unity is the essence of successful urban planning. This is the principle in which the authorities that make decisions on traffic, are stimulated to find packages of complementary measures that might be financed and that could be jointly influenced for successful satisfaction of solving traffic problems.

Obvious examples are the park-and-ride offer in order to increase the number of rail and bus users, traffic calming, in order to increase the advantages of constructing by-passes, public transport offer, in order to emphasise the influences of traffic restrictions and motivate the construction of railway infrastructure.

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SAŽETAK

INSTRUMENTI TRANSPORTNE POLITIKE

U radu su predloženi instrumenti transportne politike, kao što su mjere infrastrukture, mjere upravljanja i mjere pružanja informacija kao sredstva pomoću kojih bi se umanjili ili otklonili transportni problemi. Sve ove mjere praćene su kroz mogućnosti za osobne automobile, mogućnosti javnog transporta, mogućnosti za bicikliste i pješake i mogućnosti glede transporta. Dat je raspon rješenja smanjenja zagušenja, poboljšanja pristupačnosti i poboljšanja uvjeta prometovanja za one koji ovise o javnom transportu uz poboljšanje ekoloških uvjeta.

KLJUČNE RIJEČI

automobil, javni transport, biciklisti i pješaci, teret, infrastruktura, upravljanje, informacije.

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