SUSTAINABLE INTER-URBAN ROADS FOR TODAY AND TOMORROW

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TECHNICAL COMMITTEE 2.2 INTERURBAN ROADS AND INTEGRATED INTERURBAN TRANSPORT

INTRODUCTORY REPORT

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EXECUTIVE SUMMARY

The scope of the work for Strategic Theme 2 brings together the themes of sustainability and integration of different transport modes across the scale of roads in rural and urban areas

The goal of transport planning is to support sustainable community development and the transport system in such a way that people and goods can travel as needed safely and economically. Client-oriented transport planning can integrate the various needs of clients and society in different types of travel environments. The purpose of this type of analysis is to ensure that all the main issues are included, that their links and contradictions are identified, and that the attention is turned from construction of roads to people's everyday mobility needs and the transport needs.

A multi-stage principle is suggested as a general approach to develop the road transport system rather than a strict planning model.

In the first stage, measures are sought which affect land use, traffic and transport needs, and choice of travel mode in order to control traffic growth and its consequences. Greater focus needs to be directed towards creative methods that integrate the technically rational level with the political, strategic level:

- Create bridges between the strategic, political level and the technically rational level,
- Create a connection between visions, needs and need for and choice of transport mode, efficient use of the existing system, minor improvements and new construction.

Intermodal terminals play a critical role in permitting the most appropriate mode of transport to be used, combining the flexibility of road operations with the line-haul efficiency of rail transport. The integration of transportation modes is an important element of this stage.

In the second stage, measures are sought which enhance the use of the existing road network to keep transport route capacity utilised as fully as possible. In this stage operational an access management will be important considerations:

- Operational Management is about using the infrastructure as efficiently as possible. Currently most of this is accomplished by installing infrastructure on the road-way (such as signals, signs and other control devices) that rely on drivers responding appropriately. The natural extension to this trend is likely to involve taking the means of control into the vehicle.
- Access Management is "the systematic control of the location, spacing, design, and operations of driveways, median openings, interchanges, and street connections to a roadway". Access Management aims to manage and mitigate the relationships of roadway operations and the side impacts through the control, design, and location of the interactions.

In the third stage, minor road improvement measures for solving the problem are studied. This stage comprises investments in the existing transport route network to improve safety, or load-bearing capacity, or modest traffic capacity enhancement.

Only in the fourth stage are new investments and major renovations considered. This stage comprises projects for expanding the transport route network.

Public participation, the coordination of transport planning and land use and spatial planning as well as cooperation between the public sector and private interests needs, is essential trying to affect the demand for road transport.

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1. INTRODUCTION

Central to the committee's work has been finding a way of incorporating the complex interaction between integrated transport planning, regional planning and land use planning in the approach to the management and development of inter-urban roads. Several countries are making efforts to secure the provision of a broad, highly integrated, coordinated needs based approach to land use and transport planning. The aim of this being to determine solutions that provide more efficient and long-term sustainable transport for citizens and businesses. To this end a Four Stage principle has been developed and represented in a model denoted in this report as the "Cube".

The main report describes this four stage principle and the cube model. Case studies are used to test the model and demonstrate how it works. Three particular means of improving the efficiency of interurban roads (Operational Management, Access Management and Intermodal Terminals) are considered in more detail in separate chapters and linked to the cube model. Case studies are also used in these chapters as the basis for drawing out trends and predictions and making recommendations for the future.

2. THE FOUR STAGE PRINCIPLE

The Four-stage principle currently used in, for example Nordic countries, is a general approach to develop the road transport system rather than a strict planning model. It points at four stages in the road planning process:

1. Measures which affect the transport demand and choice of transport modes
2. Measures that give more efficient utilization of the existing road network
3. Improvements and minor rebuilding measures
4. New investments and major rebuilding measures

The intention is to solve transport system problems primarily by using measures of the first stage. If they are not suitable or if they do not bring the desired results, measures of the next stages are used.

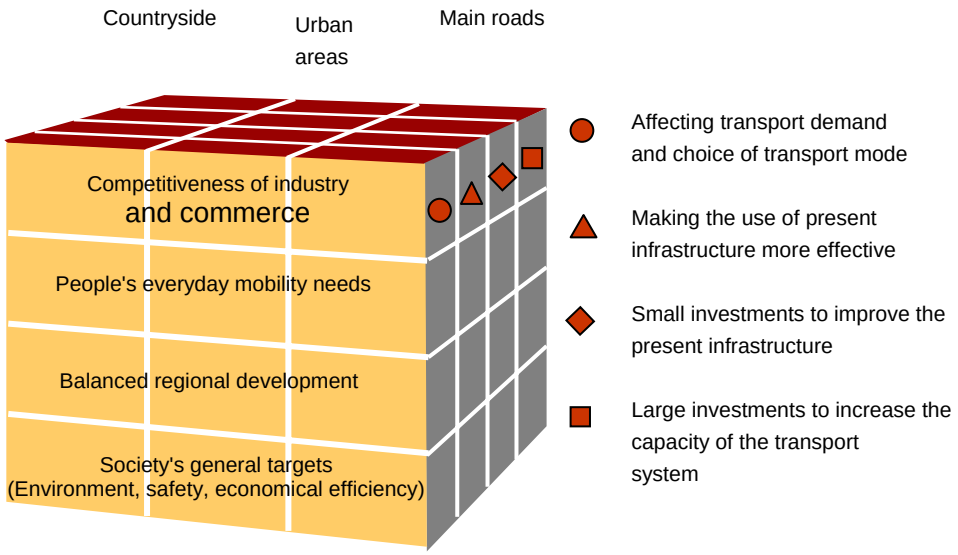
In the first stage, measures are sought which affect land use, traffic and transport needs, and choice of travel mode in order to control traffic growth and its consequences. It comprises planning, guidance, regulation, information, and focusing of impacts within the transport system and society in general. In that respect, the need for traffic and transport is reduced or travel is steered to space-saving, safe, and environmentally friendly travel modes.

In the second stage, measures are sought which enhance the use of the existing road network by means of maintenance, transport management, and traffic control measures in order to keep transport route capacity utilized as fully as possible. It comprises planning, guidance, regulation and information, and the focus is on efforts to make more efficient, safe, and environmentally friendly use of existing parts of the road transport system.

In the third stage, minor road improvement measures for solving the problem are studied. This stage comprises investments in the existing transport route network to improve safety or load-bearing capacity or modest traffic capacity enhancement.

Only in the fourth stage are new investments and major renovations considered. This stage comprises projects for expanding the transport route network. Those projects often require new areas, such as new sections of roads.

Satisfying people’s everyday mobility needs and the transport needs of economic life is a very significant aspect of transport policy. Compared with other viewpoints, these two viewpoints can most clearly be connected to customer-oriented planning. Nevertheless, goods transport and passenger traffic connections also need to be viewed from the standpoint of regional needs. Although the Cube model presents people’s mobility, commercial transports, and regional/community development as a separate viewpoint of society’s objectives, they are always linked to safety, environment and economy.



FRAMEWORK FOR THE PLANNING PROCESS – "THE CUBE"

The primary transport needs of economic life are trouble-free, punctual transports in international trade, and high cost-efficiency in all transports.

The role of transport route services in regional development is to support the implementation of regional development goals set by regional organizations, either to promote, or prevent ongoing development. From the standpoint of transport, regional development needs may be linked to maintaining a certain level of transport service or to investment-based transport route management in a growth area.

Road safety is a central goal among society's objectives. The significance of the environment has already long been increasing. Economy and efficiency represent accountability for tax revenue, and accountability for asset management ensures long-term economic sustainability.

The nationwide main road network connects regional centres to each other and to metropolitan areas, provides transport routes to the most significant industrial centres, ports, and border stations, and it is part of the international road network. The primary task of main roads is to serve long-distance traffic and transports. Good main road connections shorten travel time between regions and make it possible to provide equal services to different regions.

When formulating national transport policies it is important to ensure wide-ranging and open interaction and dialogue with key influencers, customer groups, researchers and developers. Transport issues widely affect citizens, businesses and society. Political choices and decisions must be based on sufficient information about transport needs as well as the various solution models and their impacts. Transport policy decisions form the main direction of the political dimension of the Cube. All of the stages included in the four-stage principle are strategically present at this transport policy level. There are major opportunities to influence stages 1 & 2.

As there is regional variation in transport development needs, opportunities and prerequisites, policies should be targeted at different types of traffic environment. Regional objectives interpret and prioritise national objectives on the basis of the region's needs. The need for extensive interaction calls for identification and development of inter-organisational and regional cooperation methods to ensure better coordination of measures and resources of those involved. The transport system planning level involves all of the stages of the four-stage principle and still allows significant focus on the first stages.

Decisions on regional transport system planning set the starting points and objectives for sectoral planning and programming. The feasibility study level in this problem-oriented model still involves varied reviews of the selection of tools that could be employed to solve the problem. The focus is here on stages 2 to 4 of the four-stage principle - there are limited opportunities for influencing transport needs and choice of transport mode. At the subsequent project level, measures can include those found in stages 2 to 4, viewed as a development path towards the overall target.

By applying the Cube model, the needs of clients and the goals of society are dealt with at the same time and with the same weight. The model emphasizes client orientation instead of product orientation which has been the most dominant orientation earlier. The model provides a more itemised view of the current state and objectives, for example by client group. Alternative solutions to problems are examined at different levels according to the four-stage principle. The different levels of the framework assess of the impact of alternative measures in a systematic way.

The third dimension of the cube mode - the four-stage principle - is an expression of the ambition to develop new attitudes in the approach to the road transport system. Its strength is its very weakness. While the simple step-wise form is clear, it is also too simple. The planning process requires iterative feed-back between different action programs and between the four stages. If it is used as a working model for a technically rational action analysis, it becomes an expression of oversimplification of planning which in fact demands considerably more complex processes.

The strength of the four-stage principle is that it clarifies how traditional measures within road transport planning must be related to measures under the control of other players and sectors.

The need and demand for transport is governed to a large extent by measures and attitudes that are found outside the traditional transport sector. When applying the approach contained in the four-stage principle in planning interurban connections, the need for a well developed planning process that promotes cross-sector cooperation becomes evident.

The Cube allows the political authorities and people in charge of the transport infrastructure planning of a country, or of a region, to adopt a structured approach, by avoiding the simplistic or narrow visions, focused on a restricted number of parameters of development. In emerging countries, even if the need for creating new infrastructures at the local level is a priority task in the short and medium term, it is advisable to have a longer-term vision to allow a progressive integration of new infrastructure within this wider vision. This should take into account particular prospects for regional, even for international interconnections, as well as the needs for regional planning and allow a more progressive spreading out of the investments.

3. OPERATIONAL MANAGEMENT FOR SUSTAINABILITY OF INTERURBAN ROADS

Essentially operational management is about using the infrastructure as efficiently as possible and fits into stages two and three of the four-stage principle. To help identify the operational measures that work best and the benefits that they might be able to achieve a number of case studies have been assembled drawing on the committee members experiences. Details of the case studies and further contacts are given in the main report and available on the PIARC website.

- On developed mature networks the focus is on reducing congestion by either squeezing more capacity from existing infrastructure or managing demand. (all but two of the case studies were from developed countries).
- On less mature networks (based on very limited evidence) the focus is on improving safety and pavement durability by vehicle regulation and access controls.
- All except two case studies claim varying degrees of success. The two failures involved attempts to implement traffic management that were thwarted by funding and organisational problems.
- Of the capacity enhancing measures, the special lanes (peak, plus and buffer) tried in the Netherlands appears to offer the highest return with up to 30% more traffic handled, although dependant on local circumstances.
- There is evidence that dedicated lanes for use by buses increases demand for public transport (by up to 8 times in the case of Madrid), but the effect on general traffic flow is not clear. Public acceptability is an issue.
- There is good evidence that controlling vehicle speed with mandatory speed limits achieves capacity and safety improvements.
- Better asset and operational management by improving strategic maintenance processes and incident clearing procedures can significantly reduce congestion if well planned and executed.
- Toll variation can significantly influence demand although effect depends on the available demand elasticity.
- Weigh_in motion is an effective means of improving pavement service life (up to 25%) with benefits to speed limit compliance (up to 50%), safety and delays. But it is essential to combine this with complimentary measures such as law enforcement and driver training programmes for optimum effect.

Based on these studies we see a picture of increasing control, discipline, rationing of the available road-space and pricing to favour particular users, influence behavioural change and demand. Currently most of this is accomplished by installing infrastructure on the road-way (such as signals, signs and other control devices) that rely on drivers responding appropriately.

Looking ahead, the natural extension to this trend is likely to involve taking the means of control into the vehicle, perhaps even taking control of the vehicle out of the drivers' hands. So issues for the future are likely to include how best to facilitate road-side to vehicle communications, the need to coordinate vehicle and road design taking account of emerging communication technology and managing the increasing loss of freedom to the road user. Already some experiments in this field are in progress.

One example is a Dutch pilot project called ISA (Intelligent Speed Adaptation) which could lead to an introduction of external speed intervention combined with the navigation system in the vehicle. All these trends include the need for real-time information on the traffic conditions on the network to optimise the regulation of the vehicles separately and the traffic flows in general.

4. ACCESS MANAGEMENT

Access management is "the systematic control of the location, spacing, design, and operations of driveways, median openings, interchanges, and street connections to a roadway. It is an important strategy that fits into stage 2 of the four stage principle. By managing the access on major highways, leads to a longer useful life for the roadways that are built. This occurs because a good portion of traffic congestion and crashes is caused by vehicles entering and leaving the roadway in poorly spaced and poorly designed driveways and side streets.

Access management requires the understanding the relationships of roadway operations and the impacts those activities on the roadsides take. In order to make roadways operate as safely and efficiently as possible, activities at the edges of your roadway must be understood. These activities happen through driveways, buildings, parking lots and intersections. These activities have a very large impact on the roadway.

Access Management aims to manage and mitigate these impacts through the control, design, and location of the interactions between the traffic on the main roadway and those that come from the sides. When an interurban roadway is improved or built, it is usually designed to handle a certain amount and type of traffic. Since this roadway usually improves mobility between areas of markets, products, homes and jobs, there is pressure to encroach on the highway to get further benefits from this new mobility. Whether this encroachment is a new shopping centre, squatter villages, or a new city, it all has a major impact. This impact takes some of the capacity, good operations, and safety away from the interurban roadway.

The relationship between good access management and safety has been well established in the research over many years. Crashes are decreased by decreasing the number of "conflicts". The "right angle" crash is the most severe of the crash types because a vehicle is struck on the side of vehicle. This is where driver and passenger are located, and with little "cushion", such as provided by the engine or the rear. These types of conflicts lead to the highest number of injuries and fatalities. Access management, by limiting the number of conflicts and separating those conflicts, can lead to a significant decrease in the number and severity of crashes.

Access management can also help the economy by protect the investment in roadway infrastructure. Studies have shown that applied access management helps move more traffic with less delays for more years than roadways that have allowed driveways, intersections, and strip development from taking over the activities of the roadways. Another way access management benefits the economy is by increasing the market area of our commercial centres. People will only allow certain travel times for trips and when the trip becomes too long, they look for other markets. Because access management can increase efficiency and travel time along the major corridors this allows more customers to support businesses in your communities.

In addition to driveway design, it is important to manage the spacing of driveways since each of these connection points adds conflict and “friction” to the use of the highway.

The practice of access management is being instituted in the more developed nations, due in large part because of the support given to the practice by national transportation organisations. However, the developing nations have only recently started to consider the benefits of access management programs. There are trends and conditions in the developing world which will have an impact on how access management is instituted there. The practice of access management will need to find a way to address the special conditions and trends in developing nations.

5. INTERMODAL TERMINALS

An intermodal terminal is the location for the transfer of passengers or freight from one transport mode to another. At an intermodal terminal, freight transfer may occur between two modes, such as road and air, or multiple modes such as road, rail and sea. There is increasing interest in the development of road and rail intermodal terminals within the freight logistics chain. In this report the focus is on freight.

With the movement of freight by a variety of modes, and mounting pressure to ensure that the integration of these modes is efficient and effective, the role of intermodal terminals is increasingly important. Road congestion, along with the community and environmental impacts of road transport has created a greater desire for the increased use of other transport modes in freight transport. The role for intermodal terminals is vital in increasing the role of rail in the freight task. In this context, waterborne transport should also be considered as one of the transport modes contributing to efficient and sustainable intermodal transport outcomes. In continents with suitable internal waterway systems, freight transport can be facilitated by efficient intermodal terminals which make use of waterborne transport as a component of the total transport chain.

In recent times, a range of developments in market globalisation, restructuring of rail networks, improvements in national rail and road networks, and the evolution of transport companies into providers of logistics services have changed the focus of the transport logistics industry. As the need for efficient movement of freight becomes more crucial, pressure mounts to ensure that the integration of transport modes is efficient and effective, and the role of intermodal terminals in the distribution system becomes more strategically imperative.

Intermodal terminals are important because they play a critical role in permitting the most appropriate mode of transport to be used for different elements of the transport task, combining the flexibility of road operations with the line-haul efficiency of rail transport.

The location of an intermodal terminal must take into account access to freight traffic and proximity to adequate road and rail links. It is also preferable that the site should incorporate sufficient buffers to minimise conflict with adjacent uses, particularly where residential developments are located. An intermodal terminal must have proximity to appropriate freight volumes moving on defined routes. This can range from a specific cargo moving to a particular site (such as a port), through to an intermodal terminal fulfilling the role of a distribution hub, receiving and sending freight to multiple locations.

Value-adding terminals provide additional services associated with terminal operations, from maintenance and repair work to freight forwarding, customs and quarantine services, and storage facilities. The value adding approach improves the level of services on offer to the cargo owner. In regional areas, this approach can provide a significant improvement of local employment. Complimentary industries, such as manufacturing, warehousing and distribution centres are often co-located. Additional space for future expansion is also advantageous.

Intermodal terminals require a suitable throughput for the terminal to be viable. Along with the total volume of cargo passing through the terminal, the distribution of cargo available throughout the year is also an important consideration. For terminals located in regional areas, the capture of freight from the local surrounding area is important. Often this freight will be seasonal, and further freight flows will be needed to ensure year round efficiency.

Train lengths are increasing as rail operators strive for greater efficiencies, and double stacking of containers on selected routes is now in place. This has impacts on the size requirements of intermodal terminals, with sufficient area needed to store long trains within the terminal, so as not to disrupt train movements on the operating tracks. The terminal must have sufficient capacity to deal with the freight and vehicular traffic entering the site. Room for future expansion is also advantageous.

By facilitating a greater use of rail transport, intermodal terminals can yield benefits for the community and governments by reducing externality costs such as greenhouse gas emission, road trauma, road maintenance, and noise emissions. An intermodal terminal may also offer economic benefits for the local community, including the creation of employment.

The use of alternate methods for transferring freight between modes has provided efficiencies to be gained in some circumstances. Road freight trailers are driven onto purpose built rail trailers with specific rail bogeys avoiding the need for specific loading and unloading activities at each end of the rail journey. RoRo operations or Container-on-Barge operations are used in inland waterway situations. Other work is being done in Europe into investigating horizontal transhipment technologies, which will allow containers to be moved horizontally opening the potential for use in shunting yards and sidings where the use of traditional terminal cranes is not possible.

Terminal access, either multi user or single user, is a fundamental issue in intermodal terminal operation. The ability of multiple users to access the terminal will have implications for the establishment of terminals.

6. CONCLUSIONS AND RECOMMENDATIONS

Roads are a fundamental structure in the development of society, yet societal planning often takes place with little or no acknowledgement of the cross sector interactions. A crucial issue for the design and planning of interurban connections in the 21st century will be good cross-sector coordination and cooperation. This can be achieved with a well developed planning process, supported by methodologies such as the four stage principle and cube.

The four-stage principle and the cube are tools that can be used to high-light a way of thinking. They turn attention from road construction to the need of transport in society and to socio-economic, efficient and long-term sustainable transport support for citizens and businesses.

The aim of the four-stage principle for improving the transport system is to ensure measures in the first stage are exhausted to avoid unnecessary employment of the subsequent stages. In the first stage, measures are sought which affect land use, traffic and transport needs, and choice of travel mode. Some key success factors for the approach are:

- Cooperation across sector borders
- Creative involvement of citizens
- Clarity in the relation between community development, the function of the corridor and authorities, enterprises and interests
- Support at managerial level in each organization
- Shared vision basis for coordinated successive implementation.

The world has to face climate change and petroleum resources decrease. The huge effects will only appear in the very long term (thirty or forty years). The danger is to forget to take into account these major challenges in the next projects. Goods transport is increasing very rapidly, more than GDP. The decoupling question of transport and economic growth/trade has so far proved illusive. The targets of Kyoto Protocol will be very difficult to reach. So they require new economic policy but also specific analysis in every transport project. The first stage of the cube model is the right step to make analyses in this regard, particularly about the real mobility needs in the long term when the transport costs will be much higher than now.

In planning for integrated and sustainable transport, decision makers need to be aware of the role of intermodal terminals and of the factors which lead to successful terminals.

Once the second stage of the four-stage process is reached operational an access management will be important considerations. Recommendations for operational and access management include:

- Operational management should be considered as an integral part of the road design process
- There needs to be closer cooperation between road administrations and vehicle designers in order to maximise the efficient use of road-space and in particular the opportunities for new technology
- Maintenance should be fully integrated and coordinated into the operation of the road network
- Road administrations are increasingly changing from traditional asset managers to network operators, which requires more effective dynamic communications with users. This requires careful planning and resourcing with new skills.
- Controlling overweight vehicles is an extremely important tool for improving operational efficiency
- Access management pays dividends, helping to help create safe and efficient highways, especially in developing countries and should be an integral part of the design philosophy.
- The benefits of access management and implementation techniques should be promoted through increased sharing and encouragement of creativity. Training seminars with experts from a wide range of countries would help accomplish this, along with an on-line network of experts in access management. PIARC's "World Interchange Network" (WIN) would be an ideal vehicle.
- One of the important features of access management is that it recognizes that activities away for the roadway can have many impacts on the roadway itself. Thus a technical/professional education process which combines land use planning with engineering would not only help promote access management, but also break down some of the cross-sector barriers.