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Information Technology Services for traffic control and visualisation

POLICY ADVICE NOTES

The CIVITAS Initiative is a European action that supports cities in the implementation of an integrated sustainable, clean and energy efficient transport policy. Lessons learned during the planning, implementation and operation phases of the activities are summarised in twelve Policy Advice Notes and give an idea on how to cope with urban transport problems which cities of the European Union have to face in the future.

Information Technology Services for traffic control and visualisation

Innovative tools for optimising traffic management

Within CIVITAS II (2005–2009) numerous measures were implemented that introduced Information Technology Services (ITS) in order to visualise, control and manage traffic. The objectives of the measures are to optimise traffic flow, to reduce congestion and to enhance traffic safety. The experiences made during the implementation of the measures and other important information concerning those technical tools and instruments are summarised in this Policy Advice Note in order to support and inform local politicians and other decision-makers interested in these actions.

Overview

DESCRIPTION OF THE MEASURES

To optimise the traffic and passenger flows and to improve system management, integrated real-time information on the traffic situation in the urban area (e.g. concerning parking spaces, congestion, public transport) can be provided.

To achieve these goals, as a first step systems are needed to collect data on the conditions of the transport network. Amongst others, data can be collected by:

- Automated systems, such as automatic traffic count sites (e.g. automatic number plate recognition systems, congestion monitoring loop detectors in the surface of the roads)
- CCTV (Closed Circuit Television), which means the use of video cameras transmitting information to a set of monitors
- Using data from different sources and actors (police, medical emergency department, injuries, etc.) collected with a uniform methodology for measuring a coherent set of performance indicators to give a complete picture of road operating characteristics but also taking into account data security

Several systems are known to transfer collected data:

• GNSS (Global Navigation Satellite Systems), such as GPS (Global Positioning System) from the USA or GALILEO (in operation 2013) in Europe, which are global navigation satellite systems for the worldwide determination of spatial position

• EGNOS (European Geostationary Navigation Overlay Service), which is a satellite-based augmentation system to supplement the Global Navigation Satellite Systems (GNSS)

• GSM (Global System for Mobile communications) is a cell-based network actually used for mobile phones. Currently, it is often also used for data transmissions, e.g. by using GPRS (General Packet Radio Service)

• WLAN (Wireless Local Area Network) systems, for example, a Wi-Fi System

Gathered data, which were collected or are provided by different operators, should be made available in a common data base, which can be used for the following activities:

• Integrated control centres using real-time information on the private and public transport network can be established to improve traffic flows, car parking distribution, bus headways and passenger flows

• Traffic signal control systems can be aligned to the current traffic situation

• Positioning systems can be used for goods delivery and public transport vehicles to show the exact location and are useful to automatically produce authorised electronic freight documents and reports, status messages, etc.

• A computer-aided tool for public transport can be developed, which can process data from the common database in order to offer real time information on public transport vehicles to the users. This data can be provid-

ed at different sources, e.g. in the internet, at the public transport stations or as messages on mobile phones.

• Electronic visualisation systems can be applied to control access restrictions and parking regulations

• To enhance road safety in the urban area, a monitoring or traffic management centre can be established, where collected data are used to analyse and prevent road accidents, to provide assistance with the development of a network incident strategy and to improve the methodology and technological aspects of accident data collection and management

• The collected data can also be used to display information on transport network conditions in easily understandable graphical format on variable message signs at different locations in the city

• The database can (partially) be made available for the public (e.g. in the internet), which allows people to plan journeys, covering all transport modes and, therewith, fostering intermodality

TARGET GROUPS

Citizens, in particular transport users, are defined as a target group as they benefit from the introduction of these measures due to less congested roads, reliable public transport systems and an optimised real time information.

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POLICY ADVICE NOTES
**INFORMATION TECHNOLOGY
SERVICES FOR TRAFFIC CONTROL
AND VISUALISATION**

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IMPACTS AND BENEFITS

For the public

The public will profit from the measures be-cause the road infrastructure is used more effi-ciently through traffic management, congestion can be addressed and, thus, negative impacts of traffic (e.g. pollution, noise, accidents) can be reduced. This is possible without investing in new road infrastructure. If breakdowns occa-sionally occur in the transport network or large-scale events are taking place, traffic can be re-routed accordingly. Unnecessary mileage driven searching for available parking spaces is reduced.

Access and parking management measures can be enforced more efficiently and, there-fore, the positive effects of these actions will be enhanced. Also the reliability and the quality of service of public transport can be improved, affording passengers time savings. Further-more, the road safety can be improved when dangerous locations and situations that can cause accidents are identified and improved with the help of the tools described.

For individuals

Individuals can benefit from less congestion and reduced travel times effected by the im-proved traffic management. Fewer people are injured in traffic accidents, reducing personal harm and associated costs.

For companies

Goods delivery companies introduce ITS often because they especially benefit from the com-bination of GPS-techniques with existing lo-gistics programmes. The use of logistics soft-ware can significantly increase the efficiency of delivery trips. Additionally, public transport operators can increase their effectiveness and reduce the overall operational costs by using the logistics and positioning tools, particularly benefiting from the diminished time needed for management. As a long-term benefit, an increase in the number of passengers can be expected due to the better service and reliabil-ity of public transport.

FRAMEWORK CONDITIONS FOR SUCCESS

If the measures described are to be introduced in a city, then it is necessary to analyse the framework conditions in order to ensure the successful implementation of the actions. The following prerequisites are conducive to the success of the measures described:

- Notable success can be achieved by the measures if the transport situation features an already highly loaded arterial road net-work, in which small incidents may lead to considerable traffic disturbances, e.g. acci-dents and work sites or large-scale events cause serious impacts on traffic flow. If this framework condition is not given the meas-ure will bring only small benefit in relation to the high costs.
- Traffic control and visualisation measures should be integrated into already existing systems of other urban departments and or-ganisations, such as the fire brigade, police, rescue service, etc.
- In case of implementing a control system based on data collection by video cameras (e.g. CCTV) adequate legal framework con-ditions on data security are a pre-requisite allowing these type of data to be collected and fines levied on the basis of these data (e.g. photos)
- Establishing a clear chain of command and controlling procedures to act in an efficient way in case of incidents

Implementation steps and timeline

**When introducing traffic control and visu-
alisation systems in a city, the following
considerations need to be taken into ac-
count, as well as supportive measures
and a reasonable timeline for implemen-
tation.**

WORKING STEPS

1. Information basis

- Analyses of the current transport networks
  and problems, traffic flows and congested
  road sections, location of restriction zones,
  use of parking spaces, parking spaces re-
  served for delivery, accident hotspots, etc.
- Research user requirements for transport
  information systems
- Review of possible technical solutions, col-
  lecting information about their character-
  istics and costs as well as about possible
  suppliers
- Study existing databases established in the
  city from other operators (e.g. rescue serv-
  ice, police)
- Establishment of the most relevant territorial
  boundaries for the management system on
  the basis of traffic data

2. Formal decisions

- Decision about the overall strategy and the
  kind of technical equipment to purchase
- Decision about the establishment of a per-
  manent organisation for the management of
  a traffic control centre and the operational
  model (BOT – Build-Operate-Transfer, PPP
  – Public-Private-Partnership)

- Appointment of a consultant and/or the
  supplier of equipment
- Creation of institutional agreements and bu-
  reaucratic protocols needed for integration
  with administrative systems

3. Design of the technical project

- Identification of areas, junctions and roads
  with a high need for action
- Agreement on the data collection system
  (GPS, GPRS, Wi-Fi, CCTV, etc.)
- Software developments for the proper
  working of all systems (a lot of standardised
  software packages for traffic signal control
  or for monitoring the public transport vehicle
  fleet are on the market already)
- Establishing an integrated monitoring or
  control centre
- Designing a website containing information
  on the current as well as forecasted traffic
  situation
- Development of a common database con-
  sidering the following issues:
  - ☐ Setting targets and specifications of the
    database
  - ☐ Decision about the data to be integrat-
    ed (accidents, road conditions, weather,
    etc.)
  - ☐ Decision about the different data sources
    to use and development of a plan on how
    to integrate data from the different origins
  - ☐ Identification of methodologies and
    standards for the data collection, defini-
    tion of the data exchange format
- Identification of optimal locations of cam-
  eras, loop detectors and other technical
  equipment necessary

4. Tender for technical equipment and additional services

A call for tender for the technical equipment and other services has to be initiated. Prior to the purchase, prototypes have to be tested during this phase.

5. Installation of the technical equipment

• Purchasing the equipment, based on a tender process
• Starting the necessary work as a precondition for the installation of the facilities in the streets
• Installation of the technical equipment, e.g. in the vehicles, in the control centres
• Establishing the software and internet platform and connecting the database and instruments as planned

6. Test, evaluation and monitoring

• Testing the quality of the data collected as well as the functionality of the equipment
• Evaluation and monitoring of the impacts on traffic flow, number of accidents, travel times, etc.
• Adaption of the system, if necessary

7. Operational training to the system operators

• Creation of a manual on the usage of the systems
• Organising training courses on the handling, analysis and usage of the data collected
• Organisation of the maintenance of the system by the operators

8. Educational, promotional and communication campaigns for stakeholders and citizens

To raise awareness for the measures and their positive impacts, information should be disseminated to the general public and stakeholders. Amongst others, this working step is important to convince potential external users of the advantages of an integrated database for companies involved, such as transport operators. To exchange experiences and to update the information systems, it is advisable to foster intensive communication. However, contractual obligations may be necessary in addition in order to guarantee an integrated approach.

ACCOMPANYING MEASURES TO AMPLIFY POSITIVE EFFECTS

Accompanying measures supporting more sustainable mobility in a city (e.g. parking management in the city centre, awareness raising campaigns or improving the public transport supply) are necessary to ensure that the traffic volumes will not increase due to better traffic conditions caused by the new system (so called rebound traffic). Otherwise, the traffic control systems can be counter-productive and will not work effectively.

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TIMEFRAME

Within CIVITAS II different traffic control systems were implemented. Depending on the type and the size of the measure the duration of establishing these systems ranged widely. The following examples were experienced within the CIVITAS II projects:

- 11 months for a satellite position system for 20 vehicles of a private carrier (Malmo, Sweden)
- 36 months for the installation of 12 cameras (including monitoring centre) to control access restriction (Venice, Italy)
- 40 months for establishing a monitoring centre for road safety and accident prevention using existing data from several sources, such as police department, public transport operator etc. (Krakow, Poland)
- 45 months for an overall traffic monitoring system at ten traffic signals (Malmo, Sweden)

What are
the investments
involved?

Since the systems support the better exploitation of the existing road network, the need for building new expensive infrastructure will decrease. Nevertheless, the systems are complex and the operational costs for collecting and evaluating data are relatively high. Amongst others, the following costs for traffic control and visualisation measures need to be considered:

- Planning and managing the measure's implementation
- Costs for the involvement of technical experts and consultants, if required

- Purchase and regular update of software
- Investments in the hardware as well as the technical equipment (e.g. transmitter and receiver of data for vehicles and the control centre, information signs)
- Operational costs for the control centre (personnel, lease costs, etc.)
- Maintenance and operational costs for technical equipment

Within the CIVITAS II measures different experiences were realised. The following levels of funding were needed:

- EUR 7,500 were spent for hard- and software for a safety monitoring centre (Krakow, Poland)
- EUR 36,000 were invested to establish a modern traffic control room (Burgos, Spain)
- Between EUR 350,000 and 500,000 were needed for the purchase and installation of 12 video cameras (Venice, Italy)
- Between EUR 500,000 and 750,000 were spent for a satellite control system for a public transport service (GPS-GPRS) (Venice, Italy)

However, revenues can be expected from the payment of fines associated with traffic offences. Furthermore, the human, social and economic costs caused by accidents should decrease and outweigh the costs for the improvement of road safety.
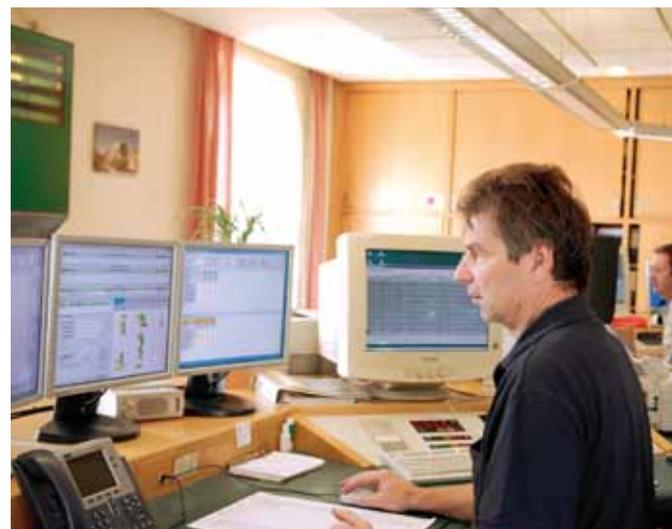
Main drivers that serve as precursors to success

The following factors are the main drivers for the initiation as well as for an efficient and successful implementation of the measures described above:

- Good project management and political support
- Direct involvement of other urban departments and organisations, such as the police, rescue services, road management department, highway authorities, etc.
- Close cooperation between all project partners and agreement on the responsibilities and obligations of each partner
- Early training of responsible staff
- The use of innovative data entry devices (PDA – personal digital assistant, tablet PC)
- Taking into consideration requirements of potential users of the new systems, especially concerning the user interface
- Using experiences of other cities versed in introducing the systems

Strategies for a successful implementation

Within CIVITAS II experiences were made concerning successful strategies to overcome barriers during the measure implementation. It was found out that the following elements need to be in place in order to maximize the likelihood of successful measure implementation.

Acceptance

It is important to involve the potential users of the systems (e.g. police, fire brigade, general public) in order to ensure that the technical equipment as well as the internet platform is adapted to their requirements and will be used. Therefore, close cooperation with those stakeholders has to be created from the very beginning of the project.

Concerning the introduction of new road signs and displays it has to be ensured that the installation is accepted and considered even after the initial high level of attention of car drivers ebbs and the "habituation effect" sets in.

The positive impacts of the systems have to be intensively communicated in order to prevent a lack of participation of relevant departments and stakeholders. Communication campaigns are also necessary to overcome negative reactions on the installation of cameras to control access and parking restrictions. Those installations can be refused by the citizens because they might be afraid of constraints to their privacy.

Financial management

To successfully implement the measures described here, it is necessary to ensure that the budget for the installation, equipment and additional applications is available. Therefore, funders need to be assured that the benefits for the city are essential (e.g. by a technical committee of the project). If not enough funding for the measure is available at the start, establishment of a limited information technology system can be considered, which provides reliable traffic data to support the operation and cycle timing in the integrated traffic management centre.

A long-term financial and business plan has to be set up in order to ensure that after the initial phase the service can be offered to the users. It is advisable to apply for private, local or national funds. Also European funds are available to support the measures, for example:

- Seventh Framework Programme for Research, Technological Development and Demonstration (RTD) (2007–2013, 50 to 100% funding, link: http://cordis.europa.eu/)
- LIFE+ (2007–2013, up to 50% funding, link: http://ec.europa.eu/environment/life)
- URBACT (http://urbact.eu)
- Structural and cohesion funds in general
- European territorial cooperation programmes (former INTERREG, supporting interregional cooperation (A), transnational cooperation (B) and interregional cooperation (C))

Legal framework condition

Before the new systems are introduced, it must be ensured that they are consistent with the current legislation of the respective country. For example, there can be restrictions concerning the use of variable message signs in some countries. Also, regarding the use of cameras for controlling the compliance of regulations and restrictions, different legal framework conditions exist in European countries which have to be analysed in advance.

Technical aspects

It has to be considered from the beginning of the project that the systems are complex, the amount of data needed is great and that various problems with technologies and their application can occur. To avoid impendence associated with technological problems, the work plan has to be updated continuously in the light of any potential delays. To avoid delays caused by the suppliers of technical equipment it is helpful to integrate certain obligations concerning this issue in the contract. It is also important to very carefully specify the needs and functionalities of the technical equipment in the tender. Therefore, comprehensive in-house knowledge should be used or an external expert should be involved.

As often many different data sources are used for the traffic management systems a close co-operation between all project partners is essential in order to achieve a common agreement on the format of a compatible data integration tool.

KEY ELEMENTS TO BE CONSIDERED

- The measures can help to use the road infrastructure more efficiently through traffic management
- When collecting data by video cameras it has to be ensured that legal framework conditions allow the levying of fines based on these data
- It is advantageous to use consistent methodologies and standards for the data collection and the data exchange format
- Communication with the public is necessary to overcome negative reactions and to counteract the possible refusal of the measures caused by the fear of loss of privacy

Who are the key people to be involved?

STAKEHOLDERS

To make the measures successful it is crucial to involve different stakeholders, including:
- Regional and national administrations and politicians (e.g. national department of transport) who usually support the introduction of the systems
- Private consultants and experts for technical support
- Parking service providers
- Police, fire brigade, rescue service, etc. (may also be direct partners of the project)
- Transport trade associations
- Freight transport companies
- Car drivers, public transport passengers as well as cycling or walking groups (to ensure that the needs of all user groups are considered)
- Service providers of technical equipment and data needed

MAIN PROJECT PARTNERS

The following key partners should be involved in the implementation process of traffic control and visualisation measures to ensure the success of the activities:

Decision makers and operators
Within the CIVITAS II measures, the role of the decision-maker and operator usually was assumed by the local administration (city council, transport department, street and parking department); however the regional administration can also be the leader of the project.

If management and monitoring systems for public transport networks are introduced, the public transport operator can likewise be the initiator and manager of the measure. If the innovative systems address the freight transport in a city, the decision-maker can be a private good transport company.

Other participants
To ensure that the current state of the art in the field of traffic control and monitoring systems is applied to the implementation of the measure, it is advisable to involve a university or another research institution in the project. This project partner can also be responsible for the evaluation, e.g. of the quality of the data collected.
In order to ensure that the necessary data is available, numerous partners can be involved, such as:
- Transport department (traffic data)
- Environmental department (air quality data, data about weather conditions)
- Police (data about accidents, traffic offences)
- Regional health office (data on costs attributable to road accidents)
- Rescue service/first aid (data about first aid for people involved in accidents)
- Fire brigade

Those project partners should also be involved in gaining information on the requirements concerning an integrated database, which should support them in their daily work. Experts should be involved to provide support concerning technical aspects (e.g. experts for traffic signal installation, private companies working in the field of satellite navigation). Public transport operators can be partners in the project if this transport mode is affected and information is integrated into the database. They can also be assistants for the installation of on board equipment.

Enumeration of practical examples
from CIVITAS II

Within CIVITAS II 10 cities implemented measures dealing with Information Technology Services for traffic control and visualisation:

Burgos (Spain): Traffic visualisation system

Genoa (Italy): Monitoring centre for road safety and accident prevention

Krakow (Poland): Monitoring centre for road safety and accident prevention

La Rochelle (France): Implementation of a common transport information data base

Malmo (Sweden): Satellite based traffic management for SME's (small and medium-sized enterprises), traffic monitoring

Ploiesti (Romania): Development of the GPS system for the public transport fleet

Preston (United Kingdom): Data collection, management and control, development of common database

Stuttgart (Germany): Event-oriented traffic management in Stuttgart

Toulouse (France): Demonstration of EGNOS/ GALILEO services use for the public transport control and information system

Venice (Italy): Electronic control of restricted access zone, management decision support system for waterborne traffic, satellite control (GPS-GPRS) for water public transport services, clean urban logistics

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The CIVITAS website contains information about CIVITAS-related **news and events.** It provides an overview of all **CIVITAS projects, CIVITAS cities** and maintains **contact details** of over 600 people working within CIVITAS.

In addition, you get in-depth knowledge of **more than 650 innovative showcases** from the CIVI-TAS demonstration cities.

Visit the CIVITAS website and search for **prime ex-amples of experiences** in sustainable urban trans-port currently being undertaken in cities. If any of the ideas suit your city, or you are just interested in learning more, you may then contact the relevant person responsible for this measure.

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