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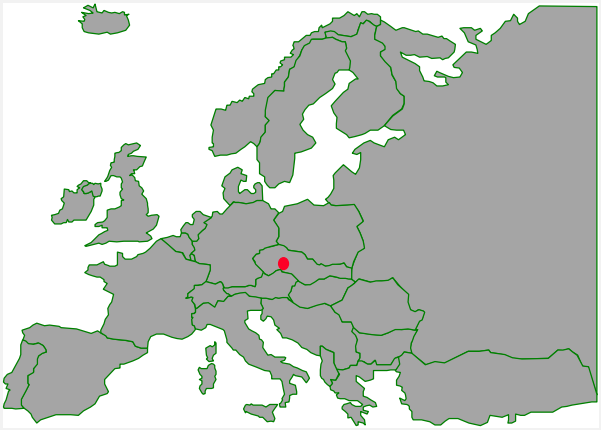
| DEMONSTRATION SITE: | ZLIN/CZECH REPUBLIC  |
| NAME OF THE DEMONSTRATION PROJECT (CASE STUDY): | ZLIN PUBLIC TRANSPORT CONTROL AND PASSENGER INFORMATION SYSTEM |
| DURATION OF THE PROJECT: | 1995 - STARTED<br>1996 - SYSTEM WORKING RELIABLY. |
| NAME OF THE TAP PROJECT: | INDEPENDENT ACTIVITY OF PT COMPANY |

## URBAN PROFILE

Zlin is an important Moravian city in the South East of the Czech Republic with a population of about 83 thousand inhabitants and a land area of over 12 thousand hectares. The city has a large industrial base and is famous for being the former centre of the Bata shoe empire; to the present day it has a strong footwear base with a full vertical chain of related industries. Car traffic has been growing rapidly in Zlin since 1990 and given its urban design, with many industrial work places located in a concentrated area near the centre of town, retention of a well used public transport system is key to acceptable and sustainable development in the city.

## ABSTRACT

The Zlin PT control and passenger information system uses radio communication between a central dispatch unit, radio beacons placed at important stops and in-vehicle transmitter / receiver units. The radio beacon contains information on schedules and is on the look out for signals from passing vehicles. Information on PT vehicle timing in relation to schedule is relayed simultaneously to drivers, the dispatcher and passengers at main stops. Detailed information on PT performance can be analysed using special evaluation software.

The basis for the project was the identified need to increase attractiveness of PT at the time when PT has been in steady decline since the beginning of the 1990s in terms of passenger numbers and service efficiency. The project was initiated and conceived by the City Transport Department and has been supported and financed by the PT Company. Realisation was carried out by two Czech developer / supplier companies.

Although no information on PT performance could be collected or analysed before the system was implemented, the results so far analysed after implementation show very satisfactory punctuality levels and very low levels of "two buses arriving at once" (bunching). Positive feedback from dispatchers and drivers indicates the utility of the information for keeping precisely to schedule and for providing evidence in the case of disputes over punctuality.

The system has great transfer potential as it was developed in a modular way by local developers and therefore at a cost which should be acceptable for many cities in the region.

The system has become an integral part of the overall PT information system and also provides input into vehicle records and driver files. In connection with the TAR vehicle occupation measurement system, the system will also provide objective and accurate data for medium and long-term PT planning. These developments arise from a principal of the project which was to use the data in as many ways as possible. Many technology projects are failures because the data gathered and recorded is not utilised as it should be. This approach has not only increased the credibility of the project but also has helped to maximise benefits.

## BACKGROUND AND OBJECTIVES

The basis for the project was the identified need to increase the attractiveness of PT at a time when it has been in steady decline since the beginning of the 1990s in terms of passenger numbers and service efficiency. To make PT a competitive alternative as a passenger mode it has been deemed necessary to focus on and enhance its potential positive sides such as journey time reliability and comfort (no parking, less congestion effect).

The main objectives of the project are to provide data on PT flow in real time through a permanent data connection between dispatcher and vehicle and present useful information to the passenger at key stops in the centre of the city. The primary aim in terms of results is to achieve high punctuality of PT vehicles and reduce the numbers of arrivals of buses in pairs (bunching).

The system should also act as an information source and catalyst for the following :

- To remove the time gap between surveys, evaluation of data and application of results.
- To improve fixed schedules and update schedules to meet true demand.
- To start active traffic management and longer term planning of PT in the city.

## PRESENT STAGE OF IMPLEMENTATION

The system is currently in a state of full daily operation, with vehicle information being provided to drivers and dispatchers and to passengers at main stops. Data on the movements and timing of PT vehicles are constantly being measured and recorded. Currently there are 11 radio beacons placed on the network (9 at selected important stops on radial routes into the centre) and all PT (over 100) vehicles are connected up. The expected final state is 31 beacons at important stops all over the city.

The project idea was initiated at the city level and was accepted by the public transport company, who accepted the need and desirability of a public transport operational management system. An initial needs analysis was made, identifying the priorities and information needs of the PT company and its passengers (what information to who and when). On the basis of this analysis, an initial specification of functional and physical system parameters and data processing and analysis software was determined. The system was conceptually developed in co-operation between the city and the contractors.

It was clear from the beginning that the project was not going to be a simple purchase of equipment but the modular development of a product new to the local market and so far not offered by local suppliers. Therefore a bottom-up development and implementation strategy was chosen involving gradual introduction of a modular "building block" system starting with a limited network scope and isolated and thorough individual testing of all component parts through a small pilot implementation.

The first step was a 2 month functional testing of the basic system parts in operation, evaluation and tuning of their performance. (The starting pilot system was 4 radio beacons - 2 at the depot and 2 at entrance points to the centre of the city and connections to 18 of the trolley buses on one line). The next step was to develop data processing and analysis software and

integrate the system into the software control system used to cover other public transport management functions including driver time sheets and vehicle maintenance planning.

Future plans include the following steps:

- Evaluation of traffic data and changes to the schedule and connection plan.
- Introduction of further radio beacons to improve monitoring outside the city centre. The final state should include 31 beacons including the important end stops where drivers wait between runs – between 1999 and 2002.
- Improvement of compatibility of the system with the system of traffic lights at junctions in the centre of the city to prepare for intelligent application of public transport priority - 2000.
- By integrating in the TAR system (electronic vehicle occupation measurement) it will be possible to optimise link frequencies, which will better correspond to the demand for PT - 1999 / 2000.
- Use of radio beacons for other purposes (e.g. parking monitoring).

**Financing and Resources Used**

The total cost of purchasing the whole system has not yet been meaningfully quantified as the system is still in development and it works only on the most important part of the traffic, which is the centre of the city. The system was developed by 2 local Czech contractors who constructed the basic technology elements (beacons, information tables and in vehicle display and receiver / transmitter), the communications system and operations and evaluations software.

To give an idea of the order of costs, ready in-vehicle transmitter / receivers cost about 400 EUR a piece, radio beacons 6600 EUR each and information tables 800 EUR each.

The main part of financing was covered by the PT service provider. No other institution took part in the financing and it was not a part of any official governmental research project or grant. No special conditions were attached, the financing was considered to be part of basic I.T. investment and the commitment to improved public transport management.

## TECHNICAL PROFILE OF PROJECT

The Zlin system utilises radio data transmission between a central dispatch unit, strategically located radio beacons (at key stops), information tables placed at important stops (where beacons are located) and in-vehicle transmitter / receiver units. The radio beacons contain information on schedules and are on the look out for signals from passing vehicles.

The vehicles constantly transmit a coded message giving basic information on the vehicle. When the vehicle passes the beacon, the beacon picks up the signal, compares the timing with the expected schedule and sends information back to the driver via an in-vehicle display on how he compares to schedule.

All information is also sent back to the dispatcher operations computer, where it can be viewed for each vehicle on a computer screen. With information in hand, the dispatcher may then communicate with the driver on the basis of classic radio communication. Information on the actual position and timing of the vehicle is also relayed from the beacon via dispatching to electronic signs at the relevant next stop giving the expected actual arrival time of the bus. At other times the signs display next bus information on the basis of the fixed schedule.

Information relayed to the dispatcher is recorded in files and can be analysed using flexible evaluation software that allows summaries to be made of vehicle punctuality. The system is fully integrated into the business operations computer system. For example vehicle kms and hours worked by given drivers are all drawn from the system.

Currently there are 11 beacons - 2 at the depot for exit and entry and 9 at important stops on radial routes with connected passenger information displays. All PT vehicles are fitted with receiver / transmitters. There are 2 computers at the dispatch office, one dedicated operations computer and a second evaluation machine.

## RESULTS & IMPACTS

Little formal assessment has so far been made. There is some difficulty arising from the lack of comparison data as before the system was introduced no measurements were made, so it is hard to formally measure improvement. Analysis of punctuality data show that schedules are very well kept and further analysis shows improvement of co-ordination of connected bus services.

Because of the lack of comparison data, no formal economic analysis could be made either. It is expected that economic benefits may be identified at the time of the first major data analysis, which is planned for late 1999. This will analyse the punctuality and occupancy figures which could lead to a reduction in the number of buses required (a saving of one bus would exceed the whole development costs of the system).

Information provided to passengers through electronic signs is reliable, relevant and real-time and although no survey of satisfaction has been carried out, from anecdotal evidence it is clear that this information is valued by passengers and adds to the comfort and attractiveness of PT.

Clear impacts can be seen at the dispatcher level, where initial caution has been replaced by enthusiasm and praise because of the management value the system brings both immediately for intervention and over time for assessing driver performance. The drivers also find the information given to them directly in-vehicle useful as it helps them to concentrate on keeping good time and on their driving. The system also provides objective data for elimination of arguments between employees or public and the service provider over the performance of PT.

With regard to the objectives defined earlier, it can be stated that so far only faster evaluation and improving schedules have not been achieved satisfactorily although work on this is beginning this year on the basis of data collected so far.

## BARRIERS & CONFLICTS

There were no really difficult issues in project planning. There was good consensus between all parties involved and the system does not really challenge the operation of any other system.

The main obstacles were in overcoming the wariness of drivers to “interference” with their freedom and the caution of the dispatcher team, which had to run 2 systems simultaneously during testing and therefore had a temporary double work load. There was also some dissatisfaction during the testing phase when the system did not work reliably and gave drivers garbage data.

Most problems described above have now been overcome, the dispatchers now run only one system which is more efficient than the old one and the drivers have been won over as the system works reliably. The only weak link in the system is with using the evaluation software where there has yet to be found an enthusiastic and committed operator. This is obviously a limiting factor for long-term performance evaluation and planning.

## TRANSFERABILITY

Transferability should not be a problem. The system does not rely on any special local considerations although special technical specifications (especially software) need to be solved individually. The costs should certainly be affordable for other Central and Eastern European cities given the focus on value for money by using locally developed technologies made fit for

purpose. The city and public transport company can provide demonstrations, advice and commercial contacts for any aspect of the project.

## LESSONS LEARNED

A critical factor in success was gaining support of all actors at an early stage. This was achieved by having a good design and quick implementation of the pilot scheme, which after bugs were straightened out showed clear benefits. It was also crucial that the drivers received information in-vehicle. Through this step they began to appreciate the system and not consider it just as a "big brother" device for monitoring them.

It was also important that the relation between initiators and contractors was healthy. The initiators of the project (City and PT company) had a good idea of what was needed and was capable of communicating this to the contractor. This ensured that only necessary technology at a minimal but suitable level of cost and complexity were developed and applied.

The whole approach should be a little more formal. This project was developed quickly and was driven by a good idea and belief. This meant that there was inherent risk in the project and such an approach may not be appropriate for a larger plan or where the conditions of the investor are more rigorous.

Three important recommendations come out of the project :

- Have a well considered implementation plan and clearly define the expected end products.
- Get the system and tested and reliably in some form as quickly as possible and so that benefits are visible.
- Plan to use the information provided in as many ways as possible to maximise benefits from the application (emphasis on data analysis applications).

## ADDITIONAL INFORMATION

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