EFFECTIVE DESIGN OF P&R SYSTEM IN METROPLOLITAN AREA

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ABSTRACT

The paper describes a methodological approach and the first result of the designing of the Park & Ride (P&R) system in the metropolitan area. P&R systems with co-modality features have to represent an important part of the new transport policy. Using the experience from American and European projects and the new complex system methodology approach, P&R systems can be developed as a part of urban transport infrastructure. P&R services must be well coordinated with the public transport system (bus and tram lines, light rail system, etc.) in order to minimize the trip times, boarding times and fares and to maximize the frequency of service. In the process of choosing P&R locations, it is necessary to define the type of the P&R system and estimate the user demand. The function of the P&R system locations is to limit traffic flows in the city centre and the surrounding area. Fully functional P&R system depends on well organised public transport system and its accessibility, comfort, speed, accuracy, etc.

KEYWORDS: *traffic and transport infrastructure, Park and Ride, systems methodology*

1. INTRODUCTION

Parking program has become one of the most important measures to solve traffic problems in urban areas, especially as the number of vehicles is increasing fast and most persons access the city centre primarily by cars. The Park and Ride system (P&R) is an effective way in reducing the number of individual travels to the city centre and the surrounding area, as well as in solving the parking problems in urban areas. A user parks the vehicle on a P&R location and continues the journey using services provided by public transport companies, or a car pool is formed among users. By doing this, every vehicle parked on a P&R location reduces the number of travels by two (in and out of the city) and saves one parking space in the city area.

P&R solutions must be well integrated with the public transport system (bus and tram lines, light rail system, etc.) in order to minimize trip times, boarding times and fares and to maximize the frequency of service. Fully functional P&R system depends on real time traffic information and well organised public transport system as well as its accessibility, comfort, speed, accuracy, etc.

2. DEFINING THE FUNCTION AND STRUCTURE OF P&R SYSTEM

Park and Ride services are integral elements of the public transport system. If carefully planned and integrated into a comprehensive transportation system, the Park and Ride systems can encourage a shift from the single occupancy vehicle to higher occupancy modes and in that way they can limit number of vehicles in the city centre and the surrounding area. From the functional point of view (Figure 1), P&R systems can be:

1. Classical
2. Combined.

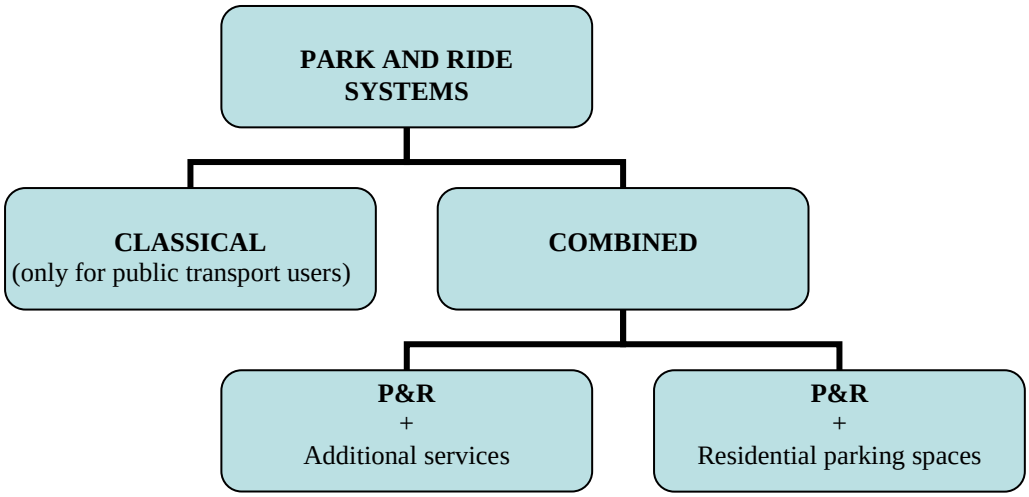

Figure 1. Functional segmentation of P&R systems

Past experience from American and European projects indicates the need for integrated development and control of P&R systems, thus avoiding certain problems regarding planning, implementation and exploitation.
To define the structure of a P&R system, it is important to recognize the following six components:

1. Vehicle
2. Location
3. Public transport
4. Users
5. Destination
6. Environment.

Between these six components there are complex interactions: physical, informational, organizational and institutional. Therefore their interaction is more than an architectural problem; it is primarily a problem of traffic and transport.

Park and Ride facilities can be classified as multimodal and intermodal transfer facilities because they include a portion of the trip to Park and Ride lots. The trip begins by a private car, motorcycle, bicycle or a walk, etc. The next phase is internal circulation at parking lots (parking cars and transfer to public transport stops) and finally, the trip continues to the destination by public transport like rail, tram and bus. The main factor of a successful P&R system is the possibility to quickly change transport modes in the P&R intermodal interfaces (Figure 2).

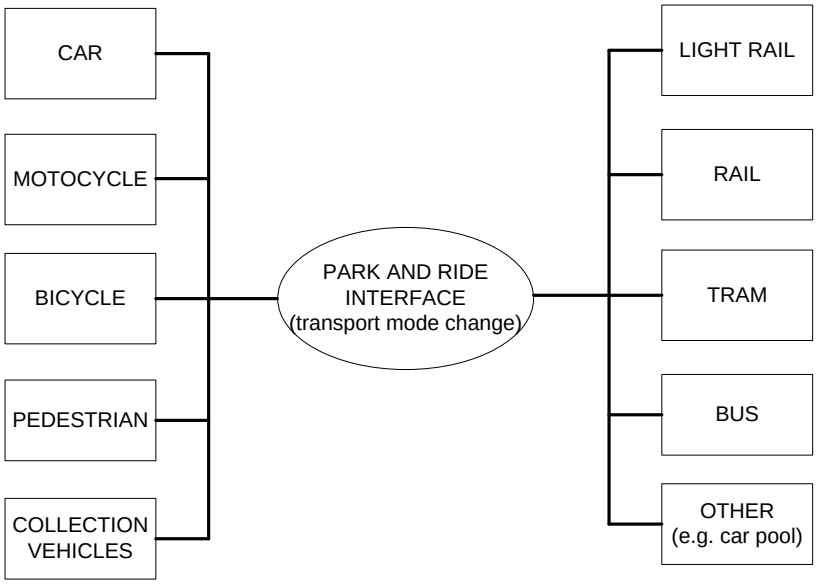

Figure 2. P&R system and traffic subsystem interaction

3. METHODOLOGICAL APPROACH IN P&R SYSTEM DESIGN IN METROPOLITAN AREA

Definition and development of the P&R system in the metropolitan area must be observed as a part of comprehensive traffic, transport and logistics development study and city strategic development as a complex, integrated and open system.

In the early stages of P&R system development, it is important to determine the user demand, to be able to identify P&R locations and capacity, P&R interface inputs (type of incoming transport mode), etc. Park and Ride demand estimation has always been a difficult issue within the transportation planning, largely because of the lack of research in this area. Determination of the Park and Ride demand is heavily dependent on the modal choice selected for use within the overall transportation modelling structure. Based on this modal choice theory, some commuters will decide to use Park-and-Ride as an alternative to the private car mode, if it is a quicker and cheaper mode of travelling between their origin and destination. Key activities in projecting user demand are:

1. Identification of origin - destination zones;
2. Assessment of daily number of travels between zones;
3. Assessment of number of line travels;
4. Assessment of number of travels using the P&R capacities.

After the initial concept and user demand have been defined, system requirements are being developed for functional design of P&R system. Some of the initial steps are:

- Locating Park and Ride facilities;
- Determining potential design constraints – topography, site dimensions, other constraints;
- Possibility of site access from adjacent roadways – for personal and transit vehicles;
- Opportunity for shared-use with existing land uses;

- Forming the P&R locations on the outer ridge of the metropolitan area near public transport lines and along main road arteries;
- Accepting the fact that P&R locations can be relatively near each other (few kilometres) if there is enough user demand;
- Determining the size or parking capacity requirement for a Park-and-Ride facility (computing the number of vehicles that will utilize the facility and converting that number of vehicles into the number of parking spaces, e.g. 50, 100, 200, etc.);
- Capacity of P&R locations must be sufficient for the current demand and future expansion;
- Construction of P&R locations in a unified way to ensure faster deployment and similar design;
- Harmonization of the physical and logical interfaces with the environment;
- Deployment of additional services can increase the attractiveness and cost-effectiveness (restaurants, shops, banks, etc.);
- Establishment of maintenance and control of P&R locations to ensure long life cycle and user/property safety;
- Realizing that the fully functional P&R system depends on well organised public transport system.
- Safety and security issues – lights, gates, fencing, cameras and surveillance equipment.

5. FUNCTIONAL, STRUCTURAL AND STRATEGIC INTEGRATION

Before the implementation of the Park & Ride system, it is important to describe requirements for functional, data and structural (institutional) integration. Main actors included in the Park & Ride process are:

A1) Provider of P&R services,
A2) Provider of parking services,
A3) Collector of traffic data,
A4) Road toll collector,
A5) Environmental data producer,
A6) Producer of map data.

Providers of the Park & Ride services have to collect map data and information of the real-time traffic patterns, public transport routes, real-time positions of vehicle and available parking spaces. Collected data are processed to form information that can be transmitted to the user through various telecommunication network facilities. Actors and data collection process for P&R services is given in Figure 3.

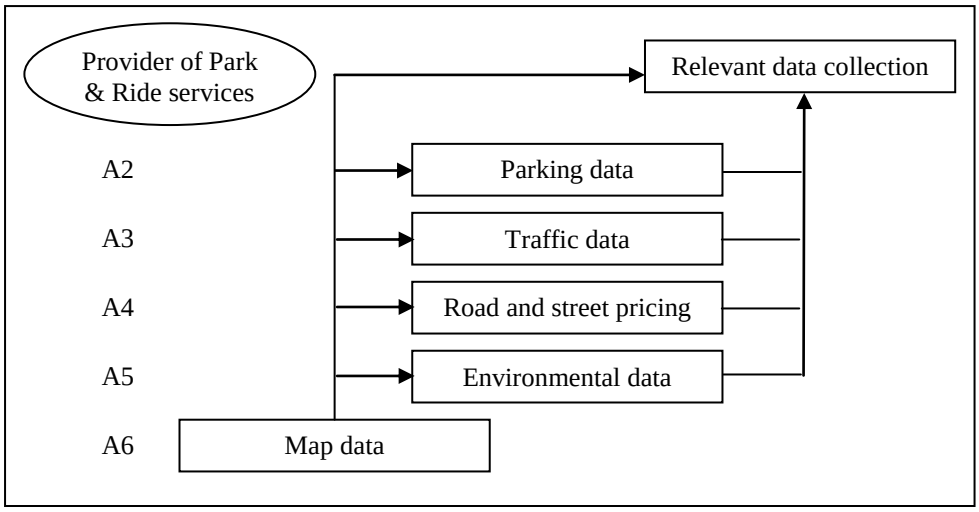

Figure 3. Actors and data collection process for Park & Ride services

In many cases the data and information collected from public institutions will be merged with the data from privately owned companies. New value to the collected and process data can be added such as:

- Route guidance service,
- Integrated ‘’smart card’’ services,
- Intelligent Transport System (ITS) services of passenger and vehicle protection,
- Analyzing and formatting for specific user needs, etc.

Final functional design of P&R system must be fully strategically integrated and compatible with the national ITS architecture, especially with the separate field of ITS – traffic and transport management. To do this it is important to establish the technical, technological, organizational and institutional interoperability.

5. BENEFITS OF THE P&R SYSTEM

Potential benefits of the P&R system should be observed through four groups as shown on the Figure 4.

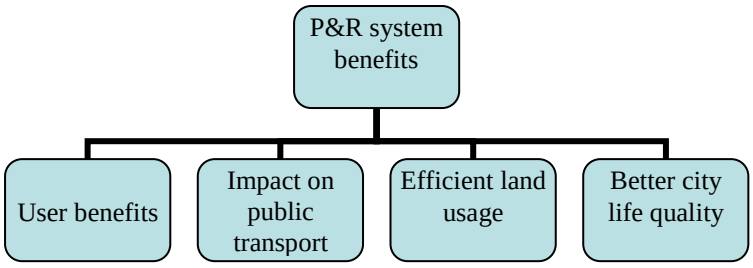

Figure 4. Potential benefits of P&R system

By detailed analysis of these four potential benefits, concrete benefits of the successfully designed and implemented P&R system can be identified:

1. Reduction of the number of vehicles and levels of traffic congestion in the city centre;
2. Less fuel consumption and distance travelled by the user's vehicle;
3. Less air and noise pollution.
4. Shorter travel time;
5. Reduction of the number of traffic incidents;
6. Stress reduction and better comfort using public transport system;
7. Predictability of public transport system arrival/departure times;
8. Efficient use of traffic infrastructure e.g. improving the accessibility to city centres;
9. Decreasing demand for parking spaces in the city centre;
10. Reducing long-time car parking in the relevant city centre;
11. Freeing city centres for other uses;
12. Generating new opportunities at the site.

The benefits of the newly built Park and Ride facilities must exceed the costs.

6. CONCLUSION

The function of the Park and Ride system is to limit traffic flows in the metropolitan area. The P&R system can represent a very effective way in reducing the number of individual travels to the city centre and surrounding area, as well as solving the parking problem in the city centre. Definition and development of the P&R system in the metropolitan area must be observed as a part of comprehensive traffic, transport and logistics development study and city strategic development as complex, integrated and open system.

For successful deployment of the P&R system, parking locations must be identified and their capacity must meet user demand. P&R locations need to be close to the public transport lines to ensure quick and efficient transport mode transfer in P&R interfaces.

Final design of the P&R system must be integrated with the national ITS architecture, to ensure interoperability and new value added services based on real time information. Further researches include P&R functional design with co-modality solutions.

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