APPLICATION OF VARIABLE PARKING PRICING TECHNIQUES TO INNOVATE PARKING STRATEGIES.

THE CASE STUDY OF BRESCIA

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Torino, 15 settembre 2015
VARIABLE PARKING FARE SCHEMES

The introduction of variable parking fare schemes is mainly linked to the necessity of managing the occupation levels of parking areas and therefore the users’ turnover.

- **VARIABLE PRICING**: the fare variation is generally linked to the parking duration, to the hour of the day and to the day of the week;

- **PERFORMANCE BASED PRICING**: the fares variability depends on the number of occupied parking places respect to the total available ones. The maximum value is established by the parking manager company as performance objective to be achieved. The fare calibration is made on a regular basis (for example monthly), basing on the occupation data and is a static operation;

- **DYNAMIC PRICING**: respect to the performance based pricing, fares are dynamically calibrated. This kind of scheme is possible only with the support of Intelligent Transport Systems (ITS) for the real time occupation data collection and elaboration, for the determination of the hourly fare and for its communication to users.
ITS APPLICATIONS FOR THE PARKING MANAGEMENT

ITS are advanced applications which are able to:

- collect data;
- manage and elaborate databases;
- Communicate information to users (or to the competent authority).

The so called *Advanced Parking Management System (APMS)* is composed by the following elements:

- sensors;
- software-hardware for the data elaboration;
- supports for the information transfer;
- devices for the electronic forms of payment.
SFpark is an experimental programme carried out by the San Francisco Municipal Transportation Agency (SFMTA) for the application of performance based pricing schemes to in/off street parking areas, with a two-monthly calibration frequency.

- Expected performance: 60%-80% occupation levels.
- In literature, the optimal occupation is 85%.

Source: sfpark.org
Main programme features

- Use of **sensors** for the real time data collection.

- Real time updating of the **georeferenced parking database**.

- ITS for the communication to users (VMP, smartphone applications and a dedicated web site) and for the **data collection** (wireless and wired connections).

Source: sfpark.org
Main results in the pilot areas:

(data referred to June 2014; variations respect to the situation before the beginning of the experimentation)

- on-street parking availability: + 16%;
- use of the off-street parking structures: + 11%;
- time before finding a free parking: - 43%;
- traffic volumes: - 8%;
- the short stay parking increased respect to the long stay one (which is generally linked to commuters).

*Fonte: sfpark.org*
SFMTA (San Francisco Municipal Transportation Agency) developed a prediction model called *Sensor Independent Rate Adjustment (SIRA)* for the fares calibration without the use of sensors.

The SIRA model generates *correction factors* which take into account many variable elements, namely:

- the difference between the number of payment transactions and the number of parked vehicles (the first resulted lower than the second one, not only for reasons relating to the fee evasion);
- the variation in the parking demand during the working and holy days;
- the different methods of payment which is possible to use.

SFMTA should have applied the SIRA model to the pilot area in the Sfpark programme, since July 2014. The final objective consists in applying such model to an increasing number of areas.

Other cities are experimenting variable pricing schemes, basing on historical data series (for example, Calgary in Canada)
ISSUES CONCERNING THE APPLICATION OF PERFORMANCE PRICING SCHEMES IN ITALY

- Legislation issues:
  The Italian current set of laws does not include the parking fare variability nor the concept of performance pricing schemes. In the US laws have been modified.

- Issues related to the existing parking:
  On-street parking usually have more competitive fares respect to the off-street ones.

The «parking fare lever» is effective only if integrated with parallel actions such as:

- Public spaces requalification favouring the vulnerable road users’ safety and security;
- dedicate the spaces, which were previously occupied by parking areas, for the pedestrians/cyclists mobility.
In the parking management, Public Engagement (PE) procedures could support decision makers in the identification of the most adequate fare scheme.

Thanks to the involvement of the community in the policy planning and design, PE assures a wider acceptance among the population.

In literature, the Public Engagement (PE) process is divided into 5 phases.

1) Stakeholders identification phase;
2) Listening phase, to understand the stakeholders’ needs and expectations;
3) Diffusion of the information phase;
4) Consultation phase, to collect different points of view and to eventually revise the project;
5) Participation phase, to extend the consultation to a directly involved groups of people, which become «partners» of the project itself, influencing choices and the implementation phase.
THE CASE OF THE “ARNALDO” PARKING IN BRESCIA

With the new Parking Plan (September 2014):
• parking structure fees decreased (- 0.70 €);
• on-street parking fees increased

### PARKING AREAS

<table>
<thead>
<tr>
<th>PARKING AREAS</th>
<th>INVOLVED STREETS</th>
<th>FARES AND VALIDITY</th>
</tr>
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<tbody>
<tr>
<td>On-street Zone A</td>
<td>Arnaldo Square</td>
<td>2.40 €/hour&lt;br&gt;Mon-Sat: 9:00 – 20:00&lt;br&gt;Maximum duration: 2 hours</td>
</tr>
<tr>
<td>On-street Zone B1</td>
<td>F.Ili Lechi Road, “Goito” Parking, Venezia Boulevard</td>
<td>1.50 €/hour,&lt;br&gt;Mon-Sat: 9:00 – 13:00; 14:30 – 19:30</td>
</tr>
<tr>
<td>On-street Zone C1</td>
<td>Spalto San Marco Road</td>
<td>1.20 €/hour,&lt;br&gt;Mon-Sat: 9:00 – 12:30; 14:30 – 19:30&lt;br&gt;All day: 5,00 €</td>
</tr>
<tr>
<td>Off-street parking</td>
<td>“Arnaldo” Parking</td>
<td>1.00 €/hour,&lt;br&gt;Night time (20:00-7:00): 2.00 €</td>
</tr>
<tr>
<td>structures</td>
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*Fare scheme introduced by the 2014 Parking Plan for the pilot area*

*Source: Department of mobility, architectural barriers removal and public transport of the Municipality of Brescia*
Ex-post data shows that the new parking plan (new fares + administrative actions) produced a general increase of the parking occupation levels:

- On working days +19% (increase by 135%);
- On Saturdays +26% (increase by 76%);
- On Holy days +13% (increase by 60%)
HYPOTHESES:

• Application of a **Performance-Based Pricing scheme**;

• The application of the variable pricing scheme is simulated **only to the “Arnaldo” parking structure** and not to the on-street parking areas;

• Adoption of other **administrative initiatives**, such as:
  - extension of the LTZ and of the “prevalent pedestrian area” also to the Arnaldo square;
  - elimination of the non-regulated on street parking in Brigida Avogadro Road.
For the observed pilot area, the following time intervals were established:

7:00-13:00       13:00-15:00       15:00-20:00       20:00-7:00

As first simulation, into each time interval the following fare scheme was applied:

• Occupation index ranging between 80% and 100% the base fare increases by 0,25 €;
• Occupation index ranging between 60% and 80% the base fare does not change;
• Occupation index lower than 60% the base fare decreases by 0,25 €;

The minimum fare (beyond which a fare reduction is not acceptable) is 0,50 €.
The maximum fare equals the minimum on-street parking fee and is 1,50 €.

If the same results of the San Francisco experimentation were obtained (considering ONLY fee variations), the application of the above mentioned scheme would produce an increase of the occupation rate:

• by 11% during the peak hours
• by 14% during the off-peak hours.
The obtained results implied the implementation of administrative actions together with the fare scheme variation.

Except for Saturdays, these potential results are still far from the ideal occupation range (60 – 80%).
Another simulation was made using 0.50 € as calibration interval.

According to this further new simulation (considering ONLY fee variations) it is expected an increase of the occupation rate:

- by 18% during the peak hours
- by 24% during the off-peak hours.
INNOVATIVE SERVICES FOR OFF-STREET PARKING STRUCTURES

Electric vehicles recharging systems

The National Plan for the diffusion of the electric powered vehicles recharge infrastructures (GU 2-12-2014 - SG n. 280), according to the International Electrotechnical Commission standards, defines 4 recharge modes:

- **Mode 1** slow charging from a household-type socket-outlet (for cycles/motorcycles);
- **Mode 2** slow charging from a household-type socket-outlet with an in-cable protection device (for passenger cars);
- **Mode 3** slow or fast charging using a specific EV e PHEV socket-outlet with control and protection function installed (for parking open to public, with alternating current and dedicated socket);
- **Mode 4** fast charging using an external charger (for parking open to public, with direct current and two power levels: up to 40 kW and up to 100 kW).

**Inductive recharge systems**

Example of an inductive recharge system
SOME FINAL CONSIDERATIONS

The application of variable pricing schemes is able to optimize the parking structure use, aiming at reaching the desired occupation levels (60-80%), but it should be integrated with **incisive administrative actions**.

The increase of the parking structure use would allow the reduction of the on-street parking and the **requalification of the public spaces**, especially addressed to the non-motorized road users.

A **constant monitoring** of the parking occupation levels is required, as data are the basis on which calibrating the fares variation. In this direction, the further evolution of the ITS and their diffusion will contribute in reducing the monitoring costs.

The success of the variable pricing techniques depends also on the effectiveness of the **communication strategies** to users (e.g. social media).
Thank you for your kind attention!

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