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Civitas MIMOSA project. Mobility Credit system in Bologna

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Abstract

Incentives are effective tools when people should be encouraged to change their behavior. This is also true for travel behavior. Adopted from the incentive system that was included in the flexible mechanism of the Kyoto protocol for pollutant emissions based on "green certificates", the Mobility Credit system in Bologna rewards people for sustainable travel behavior. Going by bike, public transport or using car sharing/pooling instead of taking the private car will be rewarded with a complementary amount of mobility eco savings (mobility credits). These credits can be used to get environmental/energy benefits such as a free bus ticket. This incentive system should help to convince people to consider alternatives to the private car and start to develop their mind set towards more multimodal thinking.

The measure so-called "MobiMart" is conducted as a pilot test within CIVITAS MIMOSA, a European project co-funded by EC. It aims at designing, prototyping and demonstrating a model for measure mobility eco-savings coming from different instruments, both at citizen and community level. The challenge is to implement a widely acceptable certification method for mileage savings, resource use, emissions reduction, etc. Conversion criteria and trading rules, validated protocols and guidelines about mobility credits issuing and voluntary agreements between key stakeholders for mutual recognition of transport related mobility credits will be implemented. The results will contribute to the understanding of successful promotion of multimodal travel behavior.

This paper presents the concept of the Mobility Credit system approach, results from the pilot test implementations in Bologna and an outline of the evaluation framework.

Keywords: CIVITAS; travel behavior change; incentive system; evaluation.

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1. Introduction

To encourage people to change their travel behavior towards more sustainable modes is one of the biggest challenges in times of climate change. Changes of available travel options is one alternative and changing of people's behavior without changes in travel options is the other alternative. However, a combination would be most effective and to achieve a multimodal mind set (Dziekan, 2011) which means that people are informed about and know how to use different modes. This could be seen as a cornerstone on the way to a sustainable transport system. Measures that aim at changing travel behavior are often described as push and pull measures. Pull measures make a specific mode more attractive and push measures make it less attractive or even prohibited. There are several theoretical approaches to describe travel behavior modification as reviewed by Gärling & Fujii (2009): choice theories, attitude theories, self-regulation theories and habit formation theories. The most popular is the theory of planned behavior and the norm activation model. Much scientific literature is available on travel behavior modifications.

Policy measures that focus on changing or reducing demand for private car use are implemented under the term travel demand management or mobility management.

The practice and the literature show that good designed incentives systems work very well to change behavior. Incentives are widely used and researched measures (Laffont & Martimort, 2002). Incentives are effective but the question remain whether they can also help to change travel behavior and how the incentive system must be designed. What do we know about how to influence travel behavior?

From psychology we know that behavior changes only temporary with monetary pay off – feedback on the behavior is very important to build up intrinsic motivation. Thus, in the MobiMart project special consideration should be given to design the right level of incentives. From psychological research we also know that small incentives are often more effective in developing intrinsic motivations in the individual. While a large incentive only strengthens the external motivation which disappear when the incentives is not longer given.

The challenge and the research question is, how to measure the mobility credits / virtuous km. And what are good incentives that convince people to change their travel behavior? To elaborate on this questions pilot test with MobiMart were designed.

The original idea to achieve more sustainable transport behavior in Bologna was to use the flexible mechanism from the pollution trading included in the flexible mechanism of the Kyoto protocol. Whilst the European Union´s Emission Trading Scheme (EUETS) in 2005 is based on the idea of a defined level of allowed pollution and if a company does not comply with this limit then should "buy" credits, the flexible mechanism is based on VER (voluntary emissions reductions) than can be traded and exchanged on a dedicated platform and bought by subject willing to compensate their emissions. The virtuous behavior of citizens, which imply change of transport modal choices towards more sustainable ones, will be measured, evaluated, certified and traded in order to obtain credits, to be reinvested in mobility.

2. Elements Definition

2.1. MobiMart

MobiMart is one of the 69 measures of the CIVITAS MIMOSA project. The specific objective of the measure is to shift some systematic movements from motorized private transport to public or sustainable transport modalities, such as flexible transport service, car pooling, car sharing or cycling.

The research activity as well as the related tests are based on a mobility credit mechanism i.e. a system of rewarding positive behaviours related to transport and to convert the CO2 saved into **"mobility credits"** that can be traded for the benefit of the proposer. This rewarding system is implemented through:

- The development of four pilot tests on specific transport modalities;
- An appropriate methodology for calculating the amount of CO2 saved;
- A conversion of these reductions in so-called "mobility credits" which can be attributed to public administrations or private companies.

MobiMart aims to evaluate whether the creation of this system can encourage private individuals and companies to adopt more sustainable practices from an environmental perspective or not.

A rewarding system is established, identifying right conversion factors in order to incentive habitual users and to attract new ones multiplying the positive effects and changing the way of thinking on mobility issues. A conversion methodology and the completion of the trade circle can be considered the main outputs of the measure. They are drafted and tested based on the *Guidelines for the definition and implementation of local authorities' GHG emission reduction strategies* edited by the Cartesio network (2010).

2.2. Description of CARTESIO network

Italy ratified Kyoto Protocol and assumed as a national objective the reduction of green house gases emissions of 6,5% referred to 1990 level. To respect this commitment, in 2008-2012 period, the Italian emissions could not exceed the 485,7 Mt CO2 eq. On an yearly basis, this objective correspond to 95 Mt CO2 eq. The reduction of 30 millions of tons of GHG emissions will be achieved by industrial sector, through the European Emission Trading Scheme (Directive ETS CE/87/2003). For the remaining 60 millions of tons, could be implemented some kinds of cooperation among government, regional authorities and local bodies. For this reduction, main involved sectors are: transports, buildings and the promotion of eco-efficiency in industrial and civil consumptions.

Regional authorities and local bodies have important competences related to these sectors. Some local authorities have acted in advance through the adoption of voluntary tools aimed to: quantification, planning, communication and valorization of reduction and compensation actions.

Cartesio Network is committed to survey and analyze the possible contribution of regional authorities and local bodies to accomplish Kyoto target and to identify common methods to report and quantify the results. It is promoted by six Italian regional authorities: Emilia-Romagna, Lazio, Liguria, Lombardy, Tuscany and Sardinia and is open to public and private actors. Cartesio network currently involves more than 150 organizations from 16 Italian regions.

The network is aimed to reach and promote collective solutions in cluster sustainable management in both industrial and urban areas in order to improve existing synergies.

Cartesio topics are: cluster approach to EMAS (Eco-Management and Audit Scheme), Eco-industrial parks, product supply chain policies, governance and climate change.

The strategy outlined in the proposed guidelines by Cartesio Network answers to the most recent policy acts issued by European Commission about fighting Climate Change, primarily the *White Paper on adapting to Climate Change* [COM(2009) 147 final].

3. The research phase

MobiMart includes four different projects of GHG reduction, which are developed according to the methodological requirements relevant to the validation of the reduction quotas. The testing phase is followed by a monitoring one aimed at assessing the state of the pilot projects, both in relation to the objectives set, both the operating and the benefits accounting methods.

Supervision and authentication activities are conducted by the methodological point of view during the testing phase by an external academic auditor, that can confirm the consistency of MobiMart with the

Cartesio guidelines and identify the experimental tests as "GHG reduction projects" as defined by the same guidelines, assuming the possible validation of the corresponding "reduction quotas" which may be entered in a hypothetical register.

The supervision and authentication activities are especially focused on: objectives of emissions reductions, general eligibility requirements (additionality[†]), baseline reference and monitoring.

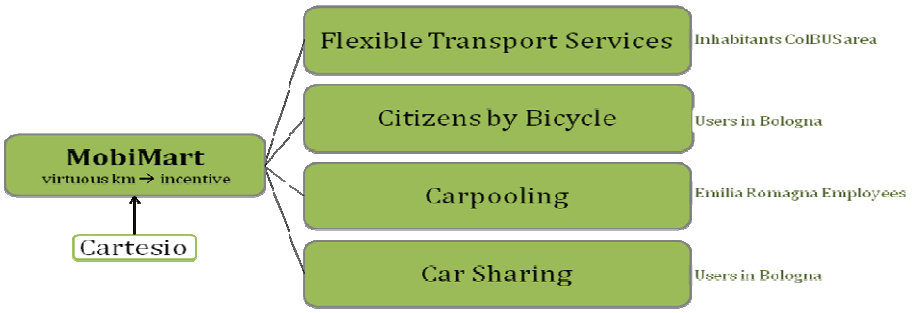

Fig. 1. Overview MobiMart 4 pilot actions

3.1. Flexible Transport Services: a pilot test on colBUS – La Navetta del Borgo

colBUS – La Navetta del Borgo is an experimental service of urban public transport line delivered since June 2009 in a neighborhood district in Bologna, previously not served by urban buses. colBUS can be booked by phone, and allows workers, students and residents to move inside the district or to be linked with the main lines of public transport and the main services of the district. It is therefore a Flexible Transport Service, operated according to itineraries and schedules which are agreed at the time of booking by phone between the users and the telephone operators. Trips can only be booked among bus stops of different colors referring to two different areas (e.g. from blue to red or vice versa). This restriction was implemented with the aim to avoid short trips that can be easily made by walking.

Fig. 2. (a) colBUS area of service with details of bus stops divided into red ones (centrals) and blue ones (peripherals); (b) image of the bus.

[†] The criterion of additionality, one of the fundamental requirements of the reduction projects under the Kyoto Protocol, provides that actual emissions associated with a reduction action should be lower than those which would have had without the intervention itself, or in a situation of business-as-usual.

The pilot action was launched by SRM with the initiative named "Fall in love with colBUS – La navetta del Borgo". During the Valentine's week, from 14th to 19th of February 2011, colBUS was available for free to all the citizens that wanted to use it for their daily trips. Furthermore, as additional incentive to gratuitousness, users could have been rewarded with a monthly ticket by simply having booked and used colBUS during Valentine's week.

The aim of the initiative was to raise awareness on colBUS service inviting citizens to a free trial in order to increase the use of public transport. The pilot week was preceded by a two week bulk advertising campaign.

The pilot test was advertised since the end of January2010 by:

- Direct mailing towards the 199 people that provided personal data during the 2010 survey;
- A3 sized flyers posted on the public bulletin boards of the Borgo Panigale district;
- A4 sized plastic flyers posted on the most used colBUS stops;
- News on the Borgo Panigale district's website.

First significant results of the initiative were already obtained after the dissemination campaign of the initiative "Fall in love with colBUS – La navetta del Borgo" started at the end of January and good results in terms of participation were registered during the initiative and after it. The average number of passengers in 2010 per month was 204; a similar number of passengers was registered in January 2011 when the number of passengers was 212. In February, with the help of the pilot week and above all of the related promotional campaign, 326 passengers used colBUS, increasing the average number of passengers per day from 9 to 14.

The pilot week registered a good result in term of number of passengers if compared with an average number and with the first week of service (June 09).

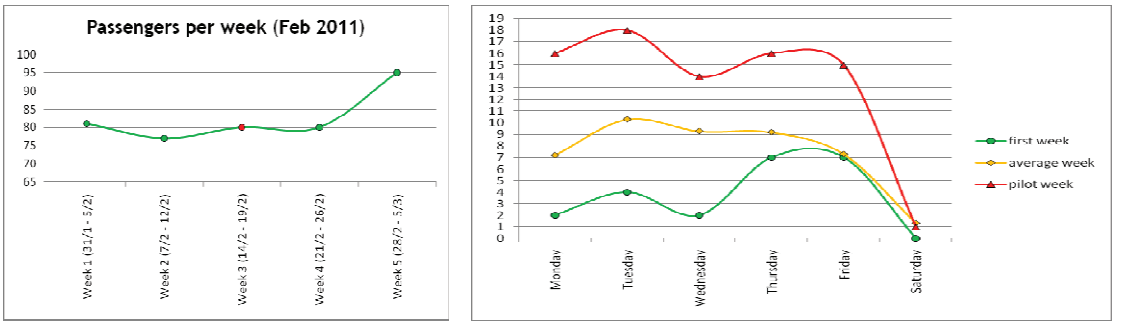

Fig. 3. (a) average number of passengers per week on colBUS in February (31 Jan – 5 Mar) – Tot. 413 pax; (b) comparison among colBUS passengers during first week of service, average week and pilot week.

In order to quantify the reduced CO2 and the additionality required by Cartesio guidelines, we compared the impact of the travel behavior before (habit) and after (pilot week). Results were **positive** in terms of CO2 reduction.

The key to promote the shift from individual mobility to collective one is communication. We acknowledged in fact that the number of passengers per day already started to increase during the advertising campaign. The increased awareness about objectives (less pollution, less traffic, cost optimization) encouraged the use of the service. The data collected by survey allowed a deep analysis of costs/benefits and an informed decision about the future of the service itself. Thanks to data analysis we discovered that only few people abandoned the car to use the service while most users had no alternatives (students, elderly, disabled) to FTS. As a side effect, this also confirms the FTS as an important tool to

fight against social exclusion, especially useful in low density area and to act as a feeder for the main bus service or to train stations.

3.2. Citizens by Bicycle

Citizens by Bicycle is an initiative organized by SRM with the aim of encouraging the use of bicycles and raise awareness of citizens to the theme of sustainable mobility.

The pilot initiative was started with a questionnaire during the European Mobility Week 2010 and events linked to it. On this occasion, 746 people were interviewed of which 362 have shown interest in participating in the pilot. Respondents were asked to indicate on an appropriate average weekly chart the movements, the motive and the means of transport used.

On May 23, 2011 the campaign itself kicked off, preceded by a series of awareness campaigns through press releases and social networks. Participants were asked to record the movements carried out for two weeks on a special diary over a period of 4 weeks.

Parallel steps were taken to activate a profile on Endomondo.com, site specialized in GPS tracking for sports activities. Following a special agreement, Endomondo has provided SRM a site specifically created for the campaign “Bologna citizens by bicycle” (www.endomondo.com/campaign/mimosa); through the website is still available to download for free a mobile application for GPS tracking of workouts and trips, including the "cycling transportation", the only relevant activity within that campaign.

Incentives and prizes strictly related to cycling were foreseen as well as a lottery among participants.

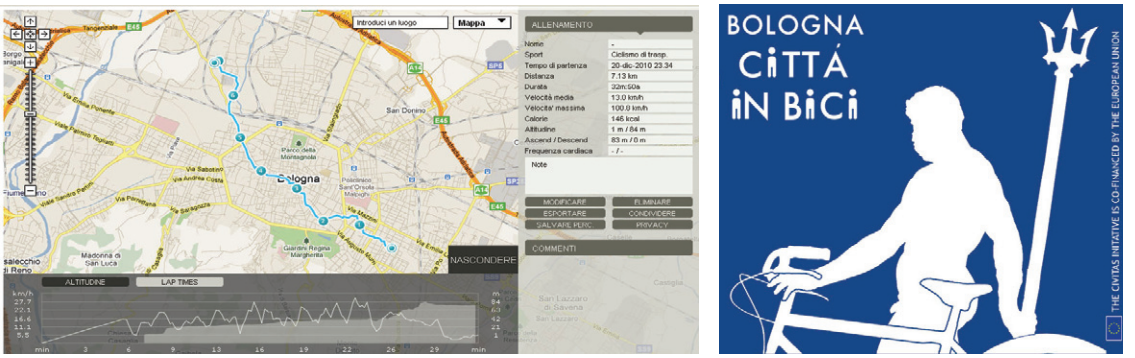

Fig.. 4. (a) screenshot of Endomondo.com website; (b) campaign logo

The pilot results in terms of emission reduction were based on a restricted group of participants to the pilot that were interviewed twice, since they participated in the pilot final stage.

N. 138 participants were asked to record the movements carried out for 2 weeks on a special diary over a period of 4 weeks. Aim of incentives was to stimulate cycling instead of using private motorized means of transport. We discovered that apparently the use of bicycle decreased.

Reasons to explain this can be find in several fields. One of the reason is probably due to the fact that in June 2011 (the pilot started on 23rd of May and ended on 19th of June) the amount of precipitation was well above the average for the period: 146,5 mm of rain versus the average of 57,3. This huge amount of rain probably affected somehow modal choice in favor of car use.

Another important element is for sure the difference among the two methodologies of data collecting: estimating (before survey) and reporting (pilot survey). This unwilled assessment error led firstly to a negative result in terms of CO2 emissions before and during the pilot. During the single diary analysis

also the habitual home-office mileage were underestimated: a common deformed perception about car use was identified. Thus, an adjustment to a 20% of maximum difference among estimated and reported data has been assumed.

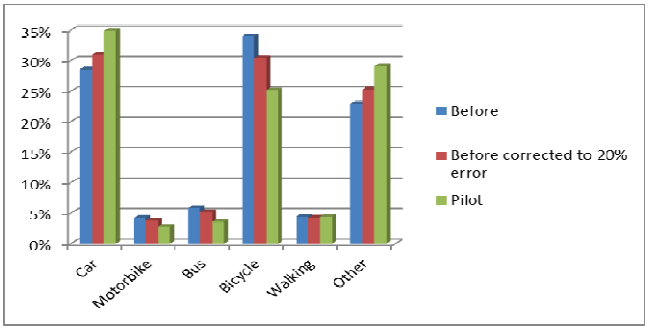

Fig.. 5. Graphic representation of data collected before and during the pilot

Assessing individual behavior of participants, a small group of them reduced motorized mileage and increased cycling (modal shifting that creates additionality). In terms of CO2 equivalent emissions saved, using the values determined by "calculette" -www.ademe.fr- and adapted to local needs, a combined transport footprint per km has been calculated for each the participant based on 0,302 kg of CO2 issued per km by car, and 0,19 kg of CO2 issued by motorbike.

Based on this footprint and on virtuous mileage a calculation on CO2 equivalent savings is **positive.**

The main reason for behavioural change was not economical: the motivation and the shared objective of CO2 reduction were very important to all involved users. Also the “challenge mechanism” launched via Endomondo website worked very well. 11 teams representing the different areas of the city were created and the mileage done were updated in real-time allowing the challenge monitoring. A final event in the main square of Bologna allowed a meeting among all the participants. 2 bicycles were assigned to most virtuous while another one and a set of minor prizes were raffled.

A specific issue is related to the measurement system: after the pilot it is now clear that punctual measurement foreseen for big industrial plants cannot be applied *tout court* to mobility sector: such specific measurement requires a relevant amount of resources in term of time and money. A new methodology has to be applied, based upon local (detailed) statistics and models on car use and average pollution per km per inhabitants; a urban cyclist saves CO2 itself without the need to demonstrate additionality. By this way, even small groups or individuals can measure GHG emission reduction thus applying the MobiMart conversion methodology.

3.3. Car pooling among employees of Emilia-Romagna region

In MobiMart **car-pooling groups** were arranged within a big public body: Emilia-Romagna Region.

In order to identify available volunteers, SRM and the Emilia-Romagna Region Mobility Manager conducted an information campaign among the employees using the intranet, a road show and the website already activated that promotes the creation of crews for car-pooling company.

A specific on board device (AZregolo) and a microchip card allow highly accurate detection of trips made in sharing and, consequently, an exact accounting of CO2 saved.

For each crew, AZregolo is able to collect all the needed data for MobiMart car-pooling purpose thanks to smart card use. First passenger that make check-in is considered the driver thus the car operating is that

associated to the driver in its profile. The others that check-in are automatically passengers. At the end of the trip each passenger has to check out, so to allow a punctual registration of km done onboard for each passenger.

At the end of each month the server calculates the amount of virtuous mileage for each crew and for each subscriber. The system is also able to calculate the amount of money that each passenger should charge and to make the costs clearing. Incentives are foreseen in order to invite Emilia-Romagna Region employees to participate, such as free parking and leisure packages.

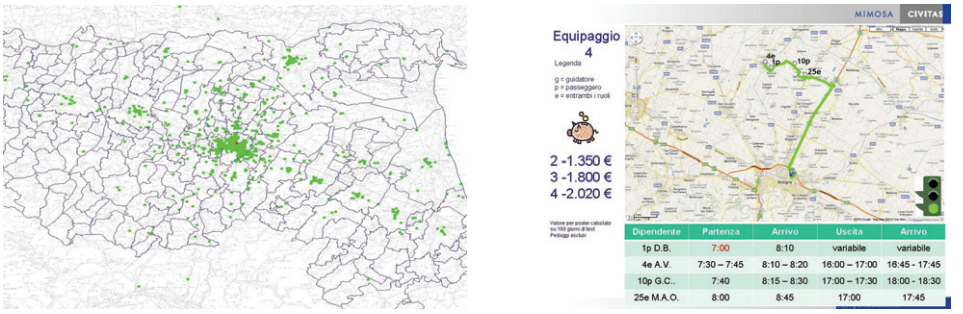

Fig.. 6. (a) Regione Emilia-Romagna employees' home (origin); (b) Example of one potential crew among volunteers with information on work shifts, possible route, yearly money saving according to the average occupancy of the car.

Here is a short description of the pilot phases:

- Recruiting the car-pooling volunteers : during the European mobility week 2010 the Region employees were contacted (desk in front of the headquarters of the Regione Emilia-Romagna/via intranet with the support of the Mobility Manager);
- 35 volunteers of which 7 willing to participate as passengers, 4 as drivers and 24 for both roles;
- Analysis of potential paths/crews: 21 potential users in 7 crews – 14 in waiting list;
- Pilot starting and data collection;
- Volunteer awarding.

A first direct incentive is the money saving that components of the crew can achieve by implementing the car pooling system itself and a second incentive is a free reserved parking for each crew of car poolers close to the office venue. Due to the fact that many of the potential car poolers were commuters travelling from other municipalities or counties, mobility-related rewards were considered improper and difficult to be exploited. The prizes were therefore identified in "leisure packages" to be attributed to the three most virtuous car poolers; another additional one is assigned by lottery among all the participants.

In order to assign the prizes, the virtuous mileage was calculated as follows:

	Trip 1	section 1	section 2	section 3	section 4	section 5	G: actual mileage run	H: virt mileage per user	I: user coefficient: I=H/G
A	Mileage per section	1	3	7	2	1			
B	User Alfa	1	1	1	1	1	14	33	2,36
C	User Beta		1	1	1		12	31	2,58
D	User Gamma			1			7	21	3,00
F= A*(B+C+D) Virtuous mileage per crew		**1**	**6**	**21**	**4**	**1**	**33**		

Table 1. Example of calculation of virtuous mileage in order to calculate the user coefficient

The first lessons leant in order to start up a successful experience is to involve a big company - better if a local governmental body- with an huge number of employees, who do not work in shifts. Work shifts have to be considered as barriers in matching the transport needs. MobiMart Car Pooling first attempt was failed because it involved the local Health Service company but work shifts have hindered to start the pilot. Another key factor is the availability of parking space in the office proximity: the impossibility to park or at least very expensive car park are strong encouragement for car poolers, especially if linked to the offer of reserved stalls for them, in the proximity of the building.

Useless to say that the distance of the employee from the office should be meaningful to produce an economic spare, which is the real force to involve the poolers, as they will bind their movement freedom in order to arrange the trips with other people. Other important factors are: the availability of a recovery plan in case the driver can not confirm the return trip (such as the possibility to use the company fleet or have at disposal a rented car).

3.4. Car-sharing managed by ATC in Bologna area

Bologna is one of the first cities offering car sharing service in Italy: since August 2002, after some pilot trials and a brief running-in period, car sharing is now a fully operational reality. The service is currently performed by ATC (local public transport company in Bologna), and takes part in the ICS group ("**Car Sharing Initiative**", involving several Italian cities where car sharing service has been carried out). At the moment, the car rental fleet is composed of about 30 vehicles available in the urban area and 10 in the province. The system now has about 1.050 members. Even though car sharing is implemented in several Italian cities the basic concept of the system "use a car without owning it" is extremely innovative in Italy. The car is in fact a status symbol and it's extremely hard for people to consider it only as a transport mean.

The recruiting for the car sharing pilot was done on public events dedicated to car sharing held in June and September 2011. A total number of 24 questionnaires were filled in. On the total of 24, 17 private users and 1 company expressed the willing to participate to pilot test.

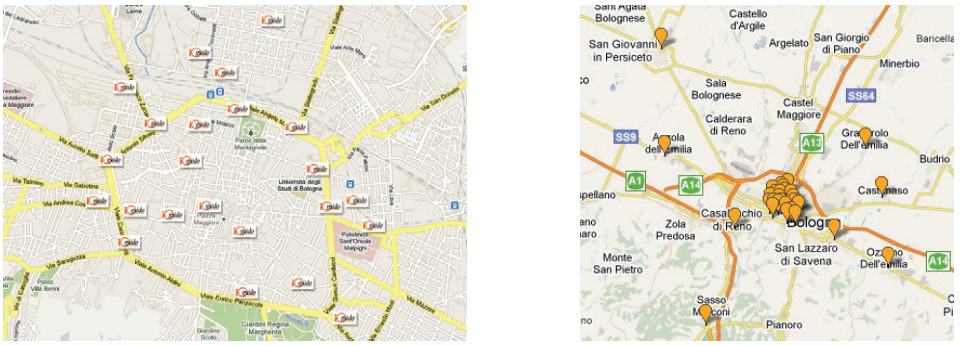

Fig. 7. (a) Car Sharing reserved parking places in the urban and (b) in the provincial area

The pilot action on car sharing is based on a "Bring a friend" methodology. Several studies on car sharing service demonstrate that it allows a considerable reduction of emission for the following reasons:

- The car sharing fleet is comprised of vehicles that meet the lowest possible emission in their respective vehicle class. Car sharing vehicles often run on natural gas;
- Customers of car sharing services reduce their kilometers travelled by car significantly as they make more rational travel choices, including more ration use of parking space;

- Reductions also derive from the expected gap in technology and maintenance between shared cars and private cars, as stated by the EU Federation for Transport and Environment.

For these reasons the higher is the number of subscribers, the bigger is the potential impact of emission reduction produced by the service. Incentives are foreseen both for the new subscribers and for the presenters. Rewards linked to sustainable mobility are provided to the subscribers to the service that will bring new members within 3 months from the start of the pilot test.

Pilot final data will be available in December 2011. As the pilot is still ongoing we cannot draft final conclusions yet. Anyway we discovered that the punctual methodology of comparison before and after mileage could not work for car sharing, since the aim of the whole system is to reduce mileage instead of increasing it. From here the need to identify a new methodology to be discussed in depth with the certification body as the issue of detailed before-after measurement cannot be applied properly.

Conclusions

Of the four pilots only two of them are finished and evaluated. The other two are still ongoing but we can already draft some conclusions about the original question if some kind of incentive could influence the travel behavior of citizens of Bologna, moving them to more sustainable modes. Our answer is YES, but the incentives have to be accompanied by a good promotional and advertising campaign in order to share a "vision" with pilot volunteers. Also the "challenge" mechanism we launched was very stimulating and allowed the volunteers to feel part of a community in action that was doing something good for sustainable mobility.

The analysis of the different steps done in the pilot led us to the idea that incentives are goods, but not alone. Many citizens declared their interest and availability to be involved in a first phase but only few decided then to take the challenge to try to change their behavior. We suspect it is due to the fact we left unchanged the mobility options they had at disposal. If some traffic restricting measures would be undertaken by local decision-makers or mobility managers (such as parking places reduction/parking costs increase, road pricing measures, increase of pedestrian areas, etc) even in further steps, the results could be of much bigger impact.

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