

ON-DEMAND-TRANSPORT AS ALTERNATIVE MOBILITY SYSTEM IN LOW DENSITY AREAS: THE CASE OF CASTILLA AND LEON

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I. INTRODUCTION

Intra-urban displacement demand has increased rapidly due to the spatial concentration of service activities and the new consumption habits. The rural depopulation reduced profitability to the business in nuclei with decreasing population, which is forcing public administrations to modify their equipment location. The use of private car is widespread, although not all the inhabitants can use it, which causes new problems both in the cities (traffic jam, road investment, construction of car parks or pollution, among others) and in the rural world (maintenance of a wide road network, increasing of distances, accident rate). The public transportation is therefore essential to satisfy the demand, detailing public-private arrangements to cost saving and service recovering economically and socially, avoiding a lower quality of life and emigration (Farrington and Farrington, 2005). To achieve this, alternative systems of mobility were developed (collective taxi, *carpooling*, *car sharing*), but they are not available to all for economic reasons or high age of claimants. In the eighties, the *Demand Responsive Transport* systems offered new options and at the beginning of XXI century they were promoted with the project ARTS (*Actions on the Integration of Rural Transport Services*) of the Mobility and Transport European Commission. At that time, similar actions were done in several Spanish northwestern regions, characterized by a more dispersed and ageing rural population. The aim of this article is to analyse these problems in one of them, Castilla and Leon, which suffers them mainly because of its surface area and settlement model. Together with the use of statistical and documentary sources at regional and municipal level, the surveys and interviews have been fundamental for knowing the real needs of rural population. After presenting the initial situation and challenges it is studied the functioning and starting up of on-demand transport in the Autonomous Community and more specifically in the province of Segovia, with results that show how this system meets

the requirements set by the settlement model and according to users, it satisfies greatly the current needs, being an appropriate model for other territories of similar characteristics.

II. SETTLEMENT, SERVICES AND PASSENGER TRANSPORT PROBLEMS IN RURAL AREAS

Castilla and León has a large surface (94,226 km², the 18.6% of the Spanish one) and a low population (2,494,790 inhabitants in 2014, the 5.3%) so its density is extremely low, the minor second of all the Autonomous Communities. The 26.5 inh/km² average in 2014 hides strong contrasts between urban and periurban areas, which concentrate the 59.0% of their residents in 42 municipalities (454 inh/km²) against a fragmented rural area in 2,206 (11.3 inh/km²), it also has outstanding territorial imbalances. There are 6,151 population nuclei, 5,586 with less than one thousand inhabitants and 3,704 do not reach a hundred. A settlement model so scattered implies the need of a well-provided network of business centre services, but this is threatened by the demand fall hardly stopped during the first decade of this century by the foreign immigration. Only the nuclei nearer to cities, those localized along the major transport axes and the touristic ones can scape that situation. In the low-density-population areas, the demographic losses are constant and both the number of centres and economic activities tend to decrease. The depopulation is as well cause and consequence of the dotacional decline and the less accessibility to services, a common problem to European rural areas of low population density (Noguera and Ferrandis, 2014). The passenger transport is therefore essential, although the scheduled lines are insufficient, forcing to use private vehicles. In order to explain this situation, two essential aspects are addressed: the availability and adaptation of existing appropriations and the supply of passenger transport services in the rural area.

Most of the villages in the region lack frequent use services, forcing population to move to the service centres and cities. In 2003, before the start-up of the on-demand-transport, 1,599 municipalities did not have bank branches in spite of their importance in the functioning of other activities and the figure increased to 1,647 in 2011 (the 74%), adding 356,453 inhabitants. The index of barely 267 residents per office predicts a reduction even faster of those offices because they do not have a minimum demand. As in the case of other activities, the growth of residential development in the peri-urban areas meant the opening of new business premises and between 2001 and 2009 the foreign immigration stopped the depopulation in the service centres, allowing temporarily the maintenance of services, although the equipment shortcomings continued to deepen in the strictly rural areas. At the beginning of this century, for instance, the 45% of finance offices were located in service centres but even all the centres did not count on those offices. The mobility motivated by its reduced presence was extended to other more frequent consumption services, such as the supply. According to the 2002 survey, the journeys for going shopping were common for the majority of population, something that is understandable because in the 31% of the municipalities did not exist retail trade and in other 27% it was insufficient, being limited to the most basic goods (feeding). The specialized trade was only present in the 24% of the cases and scarcely the 4% had got an adequate offer. A second survey in 2004 showed the same tendency: though in the 79.5% of them the basic needs were covered, it was only possible thanks to ambulant commerce, trade fairs and mobile markets and a 86% of the

residents needed moving to centres or nearer cities to make up that deficit. The deficiencies affected all kind of equipment, like those designed to cover the needs of the most ageing population (retirement homes, day-care centres or home help), which were insufficient in the 55% of municipalities with less than three thousand inhabitants.

If the equipment deficiencies imposed the need of the displacements, the low density of population prevented from supporting the bus services for lack of profitability. Neither the high state subsidies nor the annual half million of passenger transport logistics were enough to mitigate the demand. About 25% of the municipalities, which did not exceed 3,000 inhabitants in 2002, lacked public transport and the available one was insufficient in half of the rest. Only a 17% of the rural municipalities had got taxi ranks and the 22% of them had more than two thousand inhabitants. The mobility depended on private cars, which rate of 30 per one hundred inhabitants was very close to the urban one (40), but trending to decrease due to the demographic ageing. In 2004, the percentage of municipalities, where public transport was considered adequate, had fallen about a third in spite of born-local initiatives; all of them were unsuccessful due to the clash of interests between neighbours and town councils with the taxi owners or because the scarcity of users made it impossible to cover the investments. These problems boosted Junta Castilla and Leon, since 1988, to grant aids to the operation of unprofitable transport services with the objective of maintaining the small rural nuclei interconnected with the service centres, where the demand did not cover the cost of the service provided. The aids were destined to companies with rural routes, in particular to the requested itineraries by provincial and local administrations, considering the social interest, transport needs, population served, assistance to people with reduced mobility, environmental management programmes; all them will lead to a more specific post-project, proposals aimed at improving the managing transport depending on the demand. In 2001, the *Co-ordination Plan for Rural Transport*, which is addressed to specific counties, was another step forward incorporating optimization of routes and adapting timetables to each type of requested service (education, health, fairs and markets, culture and leisure). The amounts of aids rose quickly since 1998 from 931,000 to 13.5 millions of euros in 2008, an investment effort which is difficult to maintain. Before the start of the on-demand-transport, there were 156 concessions of scheduled services with itineraries and fixed schedules and another 100 special transports, with more flexible timetables. The itineraries were too long, because they tried to link as many entities as possible and there were many unoccupied seats. Neither the economic profitability was reached nor passenger demands were satisfied, since each displacement was a high economic cost and an inordinate amount of time. There was a need to find another alternative.

III. FUNCTIONING AND EXPANSION OF ON-DEMAND-TRANSPORT

On-demand-transport in Castilla and León was based on *on-line* technologies of AVM (*Advanced Vehicle Monitoring*) applied in the United Kingdom (Brake *et al.*, 2004). Attention and coordination tasks follow the *Mobility Centres* or *Travel Dispatch Centres* model, where the reservations are made by free calls. The price of the service is social –EUR 1 return ticket until 2012 and two euros since that year- and independent from the kilometres travelled, with the intention of being accessible for the whole population. Routes, schedules and frequencies

are established depending on health needs –visits to health centres–, supply needs – weekly markets–, access to administrative and financial services or for linking with other means of transportation. The testing phase began in May 2004 in peripheral areas, raising quickly the municipalities benefited and the number of passengers, thanks to the loss-leader effect. This system has benefited firstly to the users who may have access where scheduled lines do not arrive, granting the speed and provision of service by removing unnecessary stops and reporting in real time by terminals; secondly to the operator due to route optimization, cost saving, the increase in the number of passengers, the easiness to adapt the type of vehicle to specific requirements; finally to the Administration, which is able to control the service quality. This has enabled the reduction of displacements by private cars, the family spending, the accidents and the CO₂ emissions, coinciding with other similar European initiatives (Laws *et al.*, 2009).

The layout of the routes responds to the rural settlement model and, specially, to the distribution of the less inhabited population nuclei. Each route includes a service centre with enough facilities to satisfy the demand, which coincides with the most developed service centre, conforming around it a *Zona de Transporte a la Demanda* –ZTD–. The service centres in small population areas fall to villages of merged entity, hardly a thousand of inhabitants, but with minimum services guaranteed. In order to define the ZTD and the routes, the existing health and social action areas were considered, which were greatly overlaid, pivoting each of them over a Social Action Centre, which organises the services and is point of reference for the population. This produced or took advantage of areas of influence with a potential demand around ten thousand inhabitants or even lower in regions of low demographic density, in order to not increase the distances excessively. Once each area was configured, the Administration contacted with the transport companies that operated in them in order to propose new routes, modifying the scheduled lines or replacing them in their entirety. The creation of ZTD maintained a very rapid evolution in the first years and at the end of 2007 the 59 operative routes had succeed in reducing by 67% the number of kilometres travelled every year by the scheduled lines. Although this process slowed down after the economic crisis and brought to a halt in 2012, when the last of them was inaugurated. The resulting territorial coverage is very uneven because the budget cuts prevented the project from completing, even though the areas that were the most disadvantaged areas traditionally were serviced. Neither new ZTD haven't been created nor none of the 105 existing ones haven't been eliminated, although the routes have been reconfigured, schedules and frequencies of journeys have been modified in order to optimize routes and to reduce costs. The number of expeditions between 2011 and 2013 decreased by 40%, prioritising the accessibility to the most basic services in order to ensure the same villages attended.

In 2014 and after ten years of operation, the system served to 3,551 villages and 395,464 inhabitants, being excluded the residents in the service centres (1,007,269 with them), the total amount of passengers that had used it was 2.7 millions. Despite the crisis, the surveys show that the on-demand- transport service continues to be praised by the users. The global level of satisfaction in 2009 obtained 9.5 out of the 10 points, without showing appreciable differences between the ZTD and those caused by the user characteristics (sex and age). That level of satisfaction had decreased slightly in 2012 (9.0), without any doubt, this downward

trend has been maintained due to the recent cutbacks. New surveys have not been carried out in the region, except in the province of Segovia, showing that the 54% of rural population considers public transport is insufficient despite the 77% of the villages belong to a ZTD (Martínez and Moreno, 2014). It must be taken into account that the typical users are ageing people (the 64% are over 65 years old), (generally women 67%), who have not got own car and need to travel at least once per week due to the reduction of services in their place of residence, therefore the low frequency of travels reduces their satisfaction level.

IV. ON-DEMAND-TRANSPORT IN THE PROVINCE OF SEGOVIA

The province of Segovia has been chosen as example to examine in detail the system of on-demand-transport in Castilla and León, due to its variety of settlement models, with regions where this settlement is more concentrated and the density of population is relatively high –countryside and around the capital- and others with a more scattered distribution and minimum densities, which are even lower than 5 inhabitants per km² (north-eastern mountain ranges). The entity of the route centres varies between very large limits for those inequalities with maximum levels of nearly ten thousand inhabitants and minimum levels below five hundred. The choice of so small nuclei is justified by even the smaller size of the remaining in the eastern ZTD, almost all are inferior to two hundred inhabitants. In such extreme cases, the reason prevailed to the administrative limits, tracing routes that include villages of neighbouring provinces according to a demographic and economic logic in accordance with the location of the route centres. Including the interprovincial ones, eight areas operated with 61 different routes in 2014, giving service to 43,639 people –the 54% of the rural population- in 272 villages, 90 of them without previous access to public transport or without direct connections to the centres. The routes through the countryside are primarily used, while the demand is reduced in the eastern mountain ranges due to the small resident population, but even in areas with similar population the use of the service varies depending on the availability of private vehicles, the travelling time to the service centres or the presence of basic equipment in other nearer villages. In general, the traffic intensity is considerably higher in the central plains (26 passengers per a thousand inhabitants) that in the northeast (14 per a thousand), where the octogenarian population is above the 20 or even the 25% of the total.

As a consequence of the economic crisis, as well as in the whole Community, the journeys were reduced to a 36% since 2011, affecting to the reorganization of routes, frequencies and schedules to the 43% of the expeditions, and three of the ZTD already programmed have not been implemented. The economic cutbacks forced to find other complementary options in order to ensure the sustainability of the service, such as sharing the school transport with the adult one, taking advantage of free seats in the buses. Three pilot projects began in 2013, which extended to 12 routes in Segovia and 21 in other provinces of the Community, which caused suspicions despite of respecting schedules and bus stops. This method implies defining new basic rural and urban units, as well as solving conflicts of competences between different public administrations that did not exist before. There are numerous unknowns about the result of this initiative, while the maintenance of the present ZTD predicts the coexistence of their routes with others of mixed transport and scheduled lines.

V. CONCLUSIONS

On- demand- transport, based on a suitable selection of route centres and itineraries, has proved to be an appropriate initiative to facilitate the population mobility in the rural areas, achieving a high level of satisfaction among the resident users in the small villages of the rural area and together with its social value, from an economic point of view it allows to reduce the investment in aids to the scheduled lines, because the routes are optimized according to the demand and therefore the operating costs are minimized. The model developed in Castilla and León in response to the problems of passenger transport in territories affected by intense processes of depopulation is not unique, because there are several precedents in the UE. Therefore, this model may be applied to other Spanish Communities (some of them already have put into operation pilot projects) and countries. Nevertheless, the reduction of costs imposed by saving policies slowed its expansion and forced to reorganise it, boosting also the search for alternatives. After demonstrating to be necessary and successful, there is a risk of suffering the same problems of other public services, when it may continue compensating those growing deficiencies as much as possible.