

THE REQUALIFICATION OF A ROAD NET TO BE OF SERVICE TO MINOR URBAN SYSTEMS

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ABSTRACT

The strategic target of the functional requalification of a road network is the territorial realignment. Recognizing the high risk deriving from the abandonment and marginalization phenomena of huge areas, the choices of the transport system planning are considered within a programme that tends to rationalize the “strong centres” and tries to contribute to “mend” the depopulating areas.

The interventions on the road network, all by themselves, can face and solve the realignment problems, but they can and must be considered combined with adequate territorial policies not only for the location of the civil services but also for the environment and the general city planning. In this regard, the reorganization of the road network can have a strategic role in order to rationalize what already exists, enhance and incentive a form of development proper to the interested territory.

The main problem is the recover of the internal areas: the chronic backwardness of these areas is mainly due to their outer location and the limited accessibility. Therefore, a series of vast interventions on the internal road network and a strong system of connections with the main urban and productive settlements can play a fundamental role in the recover of these territories.

1. INTRODUCTION

Within a region, the existing road network is the actual fabric of the mobility and allows the connections between zones and localities. On some occasions roads represent the sole opportunity to reach the internal areas. In the current situation it's easy to expect that in the near and medium future transport by road will still be holding the absolute majority of the person and freight travel movements. It generates problems of management and adjustment of the actual network. Therefore it's becoming more and more indispensable to emphasize the need to proceed with a functional requalification of the existing network, within the context of the estate management.

In Italy the works of adjustment have been executed in the absence of a regulation which governs their implementation. It has introduced elements of non-homogeneity into the layout of the road space along the various routes, and in particular into the secondary network where there are the main interactions with the crossed territorial context. For this reason it's essential to arrange a congruous design of the network programmed on the grounds of a schedule of objective priorities which must take into consideration:

- the role assigned to each route in relation to the network and its efficiency;
- the road system safety and the environmental critical states which mark it;
- the typology of the necessary works of adjustment, managed in an organic way;
- the dynamic of the processes in progress so as to assess the functional efficiency and identify the optimal time horizon of action

Among the aims of a functional requalification plan of an existing network we reckon there might be:

- the improvement of the conditions of accessibility of a territory;
- the reorganization of itself;
- the realignment of the urban systems and of the services for the community.

The starting observation, which gave rise to the study, is that the territory is often organized in centres of productive activities and services: it enhances the phenomena of travel movements also on the long distance.

The study analyses the existing road network of Sardinia, setting itself the following targets:

- the analysis of how the transport system has influenced the territorial organization;
- the identification of where and how it is essential to intervene in order to break the conditions of deficient accessibility of the internal areas;
- the individuation of the implementation priorities of the different works.

It is presumed that the employed methodology may be an useful example of the stages to tackle in the study of those regions which have features similar to the Sardinian ones, that are:

- internal areas difficult to reach and lacking in infrastructures (roads and railways);
- demographic decrement;
- a strong opposition between poor and low populated areas and areas with higher levels of development and income.

The methodology has been worked out in order to conform itself to the goals and the characteristics of the area under examination. The starting assumption is to suppose a direct correlation between the condition of unsuitability of the road network and the socioeconomic problematics. The same correlation has been assumed between the adjustment works of the actual network and the improvement of the life condition. For this reason we haven't taken into consideration some factors which can determine the critical state of an area but the attention has been focused on the road network.

The employed methodology can be schematized in the following steps:

- a. identification of the service centres, that are the main "attraction" centres;
- b. identification of critical macroareas;
- c. territorial analysis of the macroareas and identification of the priority works to execute on the existing road network so as to improve the accessibility;
- d. calculus of the accessibility.

2. IDENTIFICATION OF THE SERVICE CENTRES AND THE MAIN "ATTRACTION" CENTRES

The starting point for the study of the minor urban system [1] has been the necessity to consider the requirements expressed by the resident population. Among these there are the need to be able to benefit from a range of basic services like education, health, etc. In particular, their presence and the possibility to reach them within a reasonable time have a strong influence on the quality of life. In the past several studies have been conducted for the purpose of identifying the causes of both the emigration and the demographic decrement of the internal areas of the Sardinian Region. Among the reasons pointed out by the interviewed citizens there was the need for them to be able to achieve some

services (secondary education and health) without being compelled to cope with excessive diseconomies (journey time, comfort, etc.). The absence of a territorial policy, in Sardinia, has determined a process of urban growth centred on the main localities and the towns characterized by the presence of productive activities.

By the terms “service centre” we have meant an urban centre in which there are placed at least the services concerning education, health, administration [2]. It can occur that all these services are situated in a single urban centre or that they are distributed among near centres. Through the analysis it appeared that in the territory there are several service centres, but not all of them are at the same level. The level of a service centre chiefly depends on the supply (quantity and quality of the available services). The individuation of the service centres has represented the first stage of our study. It has been aimed at the analysis of the main “attraction” phenomena [3].

We have taken into consideration the following services to individuate the centres:

- hospitals;
- services concerning education and university;
- courts, magistrate’s courts, and registrar’s offices;
- civil airports and ports;

The typology of the services chosen for the analysis directly depend on the above-explained considerations: it consists in basic services and services more used by the resident population.

In the following Figure there are reported the main centres identified in the territory.

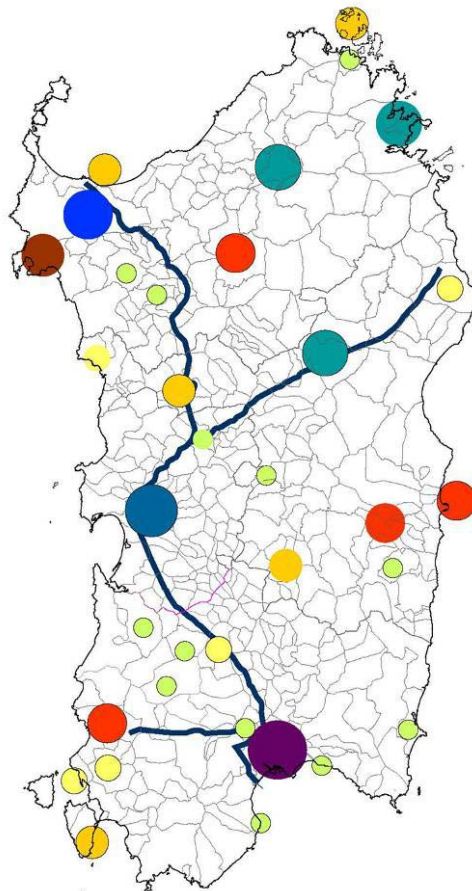


Figure 1 – Service centres in the examined area

The figure stresses the different level of the supply. In fact, the bigger circles indicate a centre that is stronger than the other municipalities which are highlighted by smaller and smaller circles.

The distribution of the centres in the territory allows us to make further reflections:

- a) many centres have developed along the main axes. This emphasizes the strong influence of the road network on the socioeconomic development;
- b) the majority of the centres having a high level of service coincides with the new provincial capitols;
- c) the centres having a regional importance (Cagliari, Sassari, Oristano) are situated along the main road axis of the Island.

Consequently the existing road network plays a crucial role [3]: where it is inadequate, because of planning and geometrical features, it can disadvantage some urban centres causing their abandonment or their depopulation. In fact, by observing the distribution of the centres and the problematics that have emerged from the analysis of the road network (state or provincial) we can notice, as it will be later explained minutely, a strong connection between the depopulation and the difficult accessibility of the primary services.

3. INDIVIDUATION OF THE AREAS HAVING LOW ACCESSIBILITY

For the subsequent stages of the study we have considered, among the centres identified in the previous point, only the ones that have at least a provincial area of influence in relation to the supply of services. They have not been taken into consideration the centres that offer a sole typology of service, or the ones whose supply has been judged unsatisfactory. So after having defined the centres, from these we have created the isochrones of the 40 minutes. This lapse of time has been reckoned bearable for the daily or frequent travels.

Because of the width of the examined territory, its various problematics and the large amount of gathered data, we have deemed necessary to resort to the employment of the GIS. This has represented not only an instrument for gathering and displaying data but also a platform of work useful for their elaboration. The implementation of a procedure to the graph of the network has allowed us to calculate for each arch the speed of itself in accordance with its geometrical and planning characteristics. In this way it has been possible to calculate for every route:

- the travelling speed of the vehicle in the condition of free flow;
- the planning characteristics of the infrastructures for every section (curvature, radii of curvature, counterblow).

The speed calculated in this way provides an index of the infrastructural quality but it does not consider the real level of service of the road. This limit has been judged negligible in relation to the small volumes of traffic pertaining to the internal areas of the Region.

Mainly it is due to the demographic features and the characteristics of the most of the Sardinian roads. In regard to the former: the Sardinian population is about 1.650.000 inhabitants with a density of 68 inhabitants/km². Let's consider that the density for the South is, on average, 168 i/km² and for Italy 194 i/km². Concerning the road network, the Sardinian one presents a widespread distribution on the territory, but at the same time it is characterised by a large presence of un-homogeneities and scarce planimetric and altimetric features [7].

The Sardinian Region is characterized not only by the lack of expressways but also by the low number of infrastructures having important roles of connection and inadequate geometrical characteristics. The road density (state and provincial) is less than the half of the national density, while, if we analyse the infrastructural estate in ratio to the resident population, for Sardinia, this indicator, is more than the double of the national one. Anyway the density of the road network in ratio to the settled population can't be reckoned much representative of the real degree of service and accessibility because of the above-cited low resident population.

After having estimated all this points, the procedure employed for the calculation of the isochrones has been judged enough representative of the real conditions of the network. Therefore the following step has consisted in building the isochrones of the 40 minutes in relation to the main provincial centres. All the zones not included in these areas have been defined as potentially critical areas: that are those parts of the territory which are not able to reach the referring service centre within a bearable time (about 30-40 minutes).

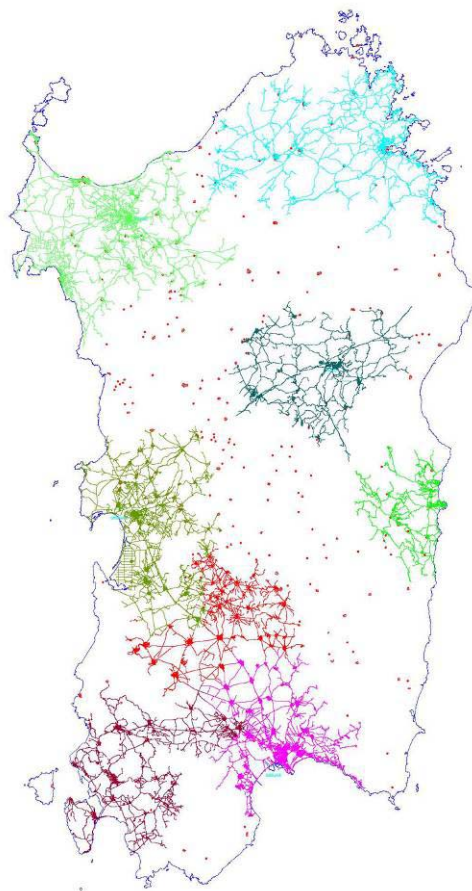


Figure 2 – Isochrones of the 40 minutes from the main provincial centres

In the Figure the isochrones have been represented as a whole of archs that can be covered within the lapse of time of 40 minutes, starting from the referring centre. The Figure lays stress on the fact that the most of the Island is outside the “40 minutes areas”. In this connection it has been necessary to verify if these zones are really critical and identify the level of the critical state of the various municipalities.

4. TERRITORIAL ANALYSIS OF THE CRITICAL MACROAREAS AND IDENTIFICATION OF THE WORKS ON THE EXISTING ROAD NETWORK WHICH ARE CONSIDERED PRIORITY TO IMPROVE THE ACCESSIBILITY

After the identification of the critical areas, we have proceeded with the study of these zones in order to verify the actual level of the critical states related to the poor accessibility. To establish this level it is necessary to use some indicators:

- indicators connected to the mobility: analysis of the distribution, in percentage, of the destination of the travel movements;
- demographic indicators connected to the depopulation.

The analysis of both indicators provides for each municipality, included in the critical areas, a pertinent level of the critical state, which allows us to:

- make a classification of the examined municipalities, based on the level of the critical state;
- consequently to evaluate the priority areas where to intervene.

For this analysis we have proceeded following these points:

1. the study of the origin/destination matrix for reasons of study and job. Study/job travels have been taken into consideration in order to obtain the percentage of those that are addressed to the outside. In fact, similar studies have pointed out, as a possible cause of isolation, the high percentage of the daily movements inside the examined municipality.

The following Figures provide an example of the conducted study for all the municipalities situated in the internal areas.

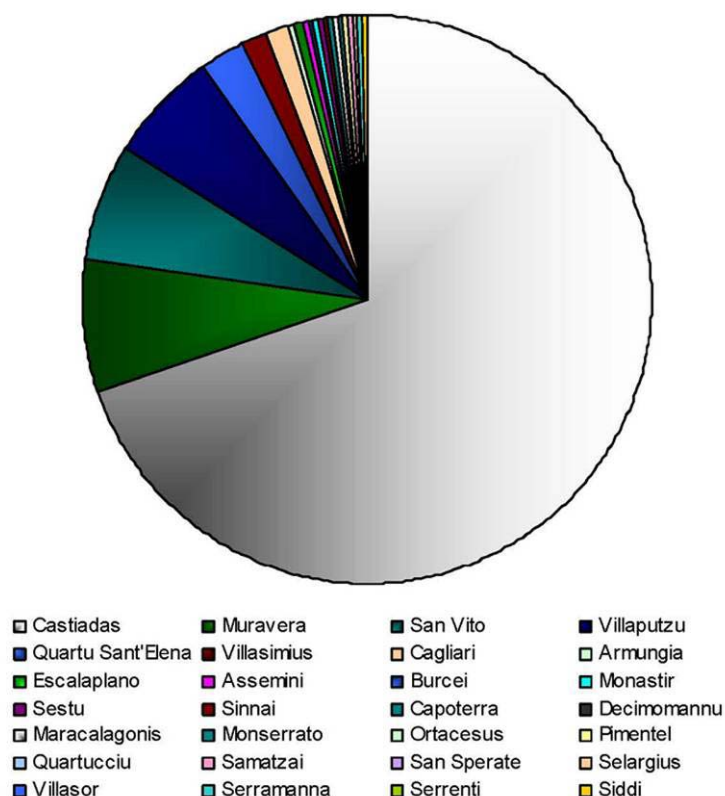


Figure 3 – Travels for study/job reasons from the urban centre of Castiadas

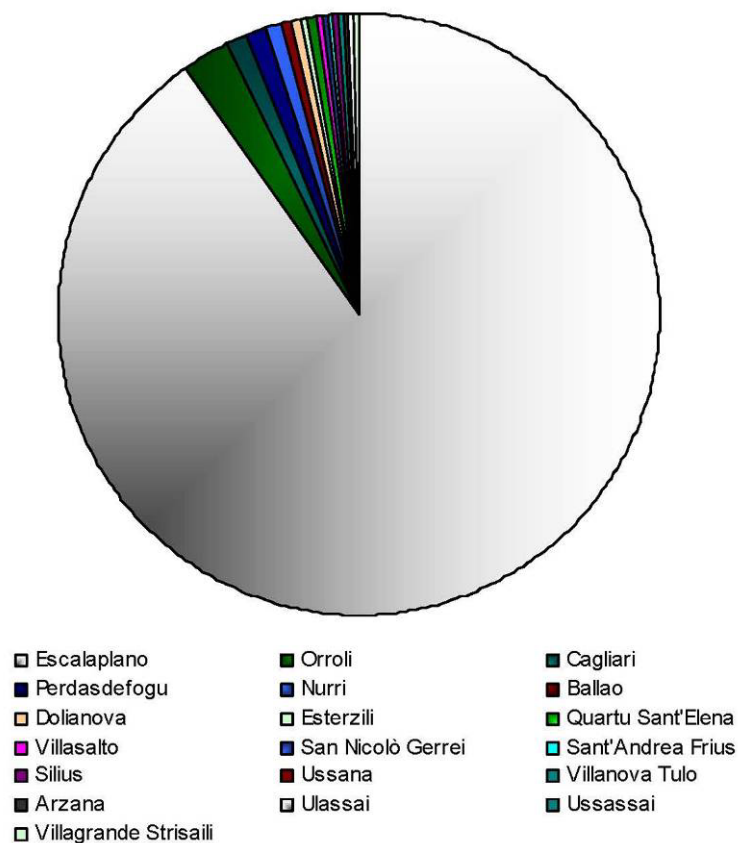


Figure 4 – Travels for study/job reasons from the urban centre of Escalaplano

Although both municipalities are included in critical areas, they have a different relation with the outside. Concerning the former it is possible to detect a fairly good percentage of movements towards other centres. In the latter, instead, it is possible to notice how the majority of the travel movements is inside itself. In the study this phenomenon has been interpreted as a further index of the deficient accessibility.

2. analysis of the demographic tendency of the various municipalities in order to highlight which municipalities are on the decrease and which is the extent of this phenomenon.

After having compared the results of the points 1 and 2, it has been possible to make a first evaluation of the level of the critical state. This is not negligible if the municipality is on a strong decrease or has a low percentage of the study/job travels towards the outside.

The subsequent stages of the study, currently in process of completion, have consisted in the following steps:

- ✓ hierarchization of the various municipalities according to the increasing critical states;
- ✓ identification of the provincial referring centre for each municipality;
- ✓ individuation of the minimum journeys which link the municipality at the provincial centre which it belongs to;
- ✓ formulating of the hypotheses of the works to implement on the minimum journey, so as to increase the speed.

5. CALCULUS OF THE ACCESSIBILITY

The demand of territorial accessibility, which appears from the analysis of the current territorial layout, under the socioeconomic point of view, is expressed by the requirements of the population, on one hand, and the needs of the production, on the other hand. We must take into the due consideration the opportunity to enhance and strengthen the economic resources, on one side, and defend the areas having a remarkable environmental value, on the other side. These different requirements express the common need of a requalification and a rebalancing of the territory in which some “strong” areas tend to influence the development of the surrounding zones and where it predominates the opposition between “strong centres” and wide portions of the territory that are deeply marginalized [9].

It is possible to find various definitions in literature regarding the territorial accessibility. Most of these chiefly refer to three concepts: the space among places, the performances of the transport system and the opportunities placed in a fixed area. Within these three concepts there are included a set of parameters whose combination allow us to obtain the measure of the accessibility.

The model employed to measure the accessibility is the one proposed by Hansen in 1959; Let “ A_j^m ” be the accessibility of the zone “j” in relation to the mean of transport “m”, we have:

$$A_j^m = \sum_{i=1}^N \frac{O_i}{C_{ij}^{2m}}$$

Where:

O_i is the value of the demand of travels from the zone “i”;

C_{ij} is the cost of the journey required for the travel from the zone “a” to the zone “j” by the mean of transport “m”.

N is the number of the zones in which the examined area is parcelled out.

In regard to the generalized cost of the transport, in our case we refer to the time.

In the final part of the study, so as to verify the assumptions, it will be calculated the current accessibility of the main provincial centres, in order to comprehend in which way the works globally improve the accessibility of the surrounding territory.

6. CONCLUSIONS

The strategic target, proposed for the road system replanning, in the above-shown study, is the territorial realignment that, recognizing the high risk that derives from phenomena of abandonment and marginalization of wide areas of the territory, lead us to consider the road choices within a programme that contributes to “mend” and “recover” the depopulated areas.

Obviously we cannot believe that the works on the road network, all by themselves, could tackle and solve the problems connected to territorial reorganization, but these interventions can and must be thought joined to adequate policies which must be directed towards the location of the services for the community, the industry and the production, on one hand, and the environment and the general territorial planning, on the other hand. By this logic, the restoration of the network system can play a strategic role and have a

remarkable importance in order to rationalize the current system and also improve and stimulate forms of development more consonant with the considered territory.

The target of the redevelopment of these areas, within a territorial realignment plan, must be pursued by actions aimed at keeping the settled population, being this a precious economic and environmental resource. But the goal cannot be achieved if we act only on the transport infrastructures. Thus it is also necessary to call our attention to the following points:

- individuation of the available territorial resources and consequently the promotion of the economic activities suitable for the territory;
- the consolidation and strengthening of the existing service centres and especially the identification of those centres that function as a barycentre for the minor urban systems;
- the implementation of an integrated system of service centres, according to a logic of complementarity, and the improvement of the connections among them and towards the centres of a territorial higher level;
- the intervention on the connections between the minor urban systems and the infrastructural network which links them, for instance, to the port and airport junctions of transport.

Considered this all, the study, briefly showed in the article, wants to furnish an application for the requalification of the road network within the critical areas.

Regarding to this we have provided to:

- individuate the critical macroareas on the base of the accessibility of these zones in relation to the service centres;
- focus the study on the above-cited areas by the purpose of achieving a level of analysis on a municipal scale;
- identify for each municipality the critical state and the priority connection so as to execute it.

The proposed methodology has provided, to the Regional Authorities that hold the management of the existing road network, an alternative point of view which is essential for:

- the definition of a better allocation of the economic resources;
- the use of the economic resources in the light of the existing territorial problematics;
- the identification of the priority routes on which further in-depth studies must carry out;
- the construction of an instrument which might be integrative and alternative to the Regional Transport Planning.

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