"MULTI-USE" HIGHWAYS: THE POGGIO MOIANO CASE STUDY

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ABSTRACT

This paper relates to a design proposal answering the call for tender issued by the Italian Ministry of Public Works about "pilot projects", i.e. test innovative interventions and projects aimed at improving road safety and at reducing the number of fatalities. In a national contest, the municipalities that will propose and implement innovative solutions will be awarded, on the basis of different parameters (as innovation level, local severity index, economical status, and so on). This initiative is envisaged in the National Plan for Road Safety; in its guidelines many are the classes of actions that are foreseen and that could be selected to improve road safety. The proposal, here presented, is referred to the class concerning “Urban areas and land structures”, at the point “Change from extra urban to urban road system”. It represents a typical case of a National road (with its heavy traffic and its safety problems) that enters an urban area without appropriate devices for alerting drivers of the change of context.

Highways and streets should be designed to meet the requirements of their specific class of users; problems arise when the users’ needs are in conflict. In this sense, the crossings of small towns by national highways are very critical spots, since the perception and the use of the same space is completely different for highway’s drivers and local users.

Extra urban roads are characterized by constant geometrical conditions and by a behaviour of the drivers that is similar in all them; this situation allows both high speed driving and a good safety level. In this case, the highway drivers find very difficult to adjust their behaviour to a completely unexpected situation such as the presence on “their” road of very "slow” users, who move following “unpredictable” paths; on the other side, urban users, particularly pedestrians, cannot walk freely in “their” town streets without having to compete with cars driving at incomparable speed.

In the considered case study this situation is very evident; the National Highway “Salaria”, a consular road, passes through the small centre “Osteria Nuova”, part of the little town of Poggio Moiano, without significant changes of the road’s geometrical characteristics; as result, the 50 km/h speed limit, signalised at the urban area entrance, is not considered by most of the drivers, who, according to the police measurements, cross the area at speed often faster than 100 km/h. Right on the highway there are bus stops (very used to and from Rome), shops and, nearby, a school and public facilities; the actual drivers behaviour makes the use of these facilities often very dangerous and, moreover, very uncomfortable.
for dwellers. The accidents rate is very high and the severity index is 100 times higher than the national one.

The aim of the intervention is to improve the safety level of the highway, both for drivers and pedestrians, by the implementation of a system of measures targeted to induce users (mainly car drivers) to behave in a more respectful way, according to the rules in force and to the road functional features.

This is obtained enhancing the urban “meaning” of the passing-through highway: discontinuities and other typical urban elements are introduced to underline the different way drivers should behave, and to make pedestrians feel that the space is available for them. The road is completely reshaped to enhance its legibility; “gates” at the urban area entrance help drivers in perceiving the unexpected change of conditions; the following variation of alignment, designed by narrowing the carriageway and adding a central island, induces a natural slow down, prevents drivers from overtaking and, above all, brings them to respect the 50 km/h speed limit; this contributes to reduce the noise level, to improve comfort for dwellers, and to limit the difference between the various classes of users. Traffic signs, public lighting, vegetation, materials are designed to meet both drivers and pedestrians requirements, and to continuously remind drivers they are in a different environment; this kind of message is important especially at some conflict points, where crossing facilities provide a safe access to schools and bus stops; their suitable design allows the right boarding operation without affecting car traffic.

**BACKGROUND**

Road infrastructures are designed according to the expected uses and users, different geometrical and environmental characteristics are provided to allow a safe and comfortable use for all the users. Users needs are often very different, and problems arise when different users’ classes need to share the same space.

**USERS BEHAVIOUR AND ROAD SAFETY**

Using the street (driving, walking, cycling etc.) is based on interaction, interaction with the infrastructure and with other users; users constantly evaluate many variables, according to which they modify their behaviour. Needed information flows from the “environment” subsystem to the “driver” subsystem. This process is influenced by many factors, some of them, such as weather conditions, lighting, geometry and landscape belong to the environment, some others such as health, tiredness and experience, belong to the users. Users’ experience may influence the perception process in some non obvious way. Actually users tend to discard every piece of information they have learned as not relevant. As a consequence, during their life, they reduce the number of signals coming from the environment, and replace them with information coming from experienced situations. An accident is overall an unlikely event in users’ life, then they tend to follow behavioural patterns suggested by experience, considering them as the more logical and functional, even when they are illegal and clearly more dangerous. The understanding and then the taking into account of this process is essential to design what keeps on stimulating users to the right level of attention and what is able to effectively induce the correct behaviours, providing, at the same time, an high degree of safety, capacity and comfort.

**THE CASE STUDY**

Very often National Highways, with high traffic volumes and high cars’ speed, pass through small and little towns, this creates different problems, the interruption of the urban fabric,
the loss of safety and the increase of air and noise pollution, that may lead to the loss of pedestrians’ mobility and the discredit of the local activities.

The presented design proposal, developed answering the call for tender issued by the Italian Ministry of Public Works about "pilot projects", i.e. test innovative interventions and projects aimed at improving road safety and at reducing the number of fatalities, tries to solve the problems of small town crossed by national highways. Osteria Nuova is a small fraction of the little town of Poggio Moiano, a few kilometres north from Rome, with some public services (school, health centre, commercial points, bus stops) divided in two parts by the National Highway “Salaria”. The passing-trough road is an important inter-zone highway with high traffic volumes, mainly used for commuting and goods’ transport; the speed limit is normally 80 km/h and it is reduced to 50 km/h inside the neighbourhood, nevertheless the monitored speeds are, by far, higher. Public services around the highway need to be used by many pedestrians in particular the bus stops are used by hundreds of people every day, still no particular pedestrian facilities have been provided but zebra crossings.

The selected case study clearly highlights a conflict between two classes of users, which live the same space in two completely different ways. Local users, mainly pedestrians, which use, or would like to use, the highway just like any other local street of their town, and non-local drivers which consider the crossing of the Osteria Nuova neighbourhood as a spot in a much longer and monotonous trip. By now conflicts between users are ruled only by traffic signs which indicates the speed limit and the pedestrian crossing spots. Observations show how traffic signs are completely ignored, it is then important to understand how users relate themselves with the infrastructures and how to induce correct behaviours.

A view of Osteria Nuova, on the left the National Highway “Salaria”

Mobility

The road infrastructure system is based on the National Highway Via Salaria, a consular road connecting Rome to the Adriatic Sea (Ascoli Piceno), which is characterised by one lane for direction and a very large cross-section. Less important is the local street Via Salaria Vecchia and the network of bendy provincial roads which connect Poggio Moiano to the other towns of the “Alta Sabina”. The majority of the traffic flow on the “Salaria” Highway is passing trough, the number of passages is about 18.000/day of which about 1.000 are lorries. The bus system is also very used and the Osteria Nuova bus stops are used by an average of 800 persons/day. Commuting to both Rome and Rieti is very frequent.
Safety Conditions

The analysis of the accident data of the last six years shows a very critical situation. In the 1999 the severity index (number of fatalities/100 accidents) was 152 time higher than the national one.

**Accidents Osteria Nuova (1999)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidents</td>
<td>24</td>
</tr>
<tr>
<td>Accidents with injured people</td>
<td>14</td>
</tr>
<tr>
<td>Injured</td>
<td>20</td>
</tr>
<tr>
<td>Fatal accidents</td>
<td>4</td>
</tr>
<tr>
<td>Fatality</td>
<td>5</td>
</tr>
<tr>
<td>Injured people/100 accidents</td>
<td>83.33</td>
</tr>
<tr>
<td>Fatalities/100 accidents (severity index)</td>
<td>20.83</td>
</tr>
</tbody>
</table>

**Poggio Moiano/ National data ratio (1999)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injured people/100 accidents</td>
<td>33.71</td>
</tr>
<tr>
<td>Fatalities/100 accidents (severity index)</td>
<td>152.36</td>
</tr>
</tbody>
</table>

The historical data of last years show a negative trend for the number of accident, but the number of fatalities is slowly increasing, the consequence is a dramatic increase of the severity index.
The main risk factor is the inconsistence between how the road has been designed and the actual way of use; this situation has different consequences:

- Both drivers and pedestrians tend to use the infrastructure in a wrong way, the combination of these mistaken behaviours leads to situations of great danger. Drivers come from a long and monotonous trip in an extra-urban context and a speed limit of 80 km/h, at Osteria Nuova the scenario suddenly changes, with pedestrian crossings, bus stops and a speed limit of 50 Km/h, but at the same time the cross section remains exactly the same as in the extra-urban stretch. The lack, in the background, of architectural elements presenting the discontinuities typical of the urban context, doesn’t “invite” drivers to modify their behaviour according to the new situation which includes the necessity to deal with local, slow and vulnerable users. At the same time pedestrians are invited to use “via Salaria” as any other urban street, with zebra crossings, bus stops on the side of the street without any particular warning or protection.

- The cross section, that is absolutely the same as in the extra-urban stretch, easily allows speeds over 50 km/h, (in the years 1999/2000 over 1800 spot fines for speeding have been charged, with average speeds of 90 km/h and peaks over 130 km/h). Pedestrian crossings have been “added” without any particular device to enhance the visibility to drivers. In addition the particular road’s altimetry prevents drivers coming from Rieti from seeing in advance the urban area.
The many vehicular accesses to commercial zones, public services and private houses, located directly on the highway, create dangerous conflicts between entering/exiting and passing through vehicles.

Houses and services are on both sides of the road, it is then necessary for pedestrians to cross the highway; the provided zebra crossing is completely inadequate given the high speed of the incoming cars. (Traffic light has been installed, but after 5 days of working and 5 accidents provoked, it has been stopped)

Bus stops, used by more than 800 people a day are directly on the street, without “bay” or any particular device aimed at improving safety and accessibility for passengers, and conflicts between the stopped buses and the passing through vehicles. No safe pedestrian path to bus stops, exchange parking, or town centre has been provided.

The project

The design proposal is based on the use of a “system” of traffic calming measures which try to recreate the different characteristics of the urban spaces, strongly suggesting to the driver behavioural patterns consistent with the presence of pedestrians and in general with urban areas.

The main task, due to the current situation, is reducing vehicular speed, at the same time interventions are needed to allow pedestrians to safely and comfortably reach facilities, especially the bus stops and the school. The reshaping not only of the road space but of the entire environment tries to create the best conditions in terms of safety and comfort; this can be made using various innovative measures widely used in many European countries. In this case “gates” at the beginning of the urban part of the highway are very important. Gates are combinations of traffic signs, lights and architectural elements, that should suggest the change of context from extra-urban to urban, these combinations must be completely different from every other element that can be seen on highways and are the prelude of a sudden change of the geometry of the road. Inside the urban area the cross section of the road must be adapted to the actual needs of a “urban street” with speed limited to 50 km/h, lanes’ width are generally reduced to the 3.50m limit, and a central island is provided to prevent overtaking (which is already forbidden but still very common). To enforce the “urban” feeling, discontinuity are created in the alignment, the pavement and the background.
Narrowed Carriageways

Short description:
Narrowed carriageways are obtained reducing the space available to cars to the minimum allowed by prescriptions. The reduction can be punctual, for instance matching a pedestrian crossing, or linear for general speed reduction. Narrowed carriageways are suitable in both urban and extra-urban contexts.

Benefits:
It's demonstrated that this is one of the most effective ways to reduce speed in extra-urban roads.
Punctual reshaping combined with pedestrian crossings reduces the crossing distance, helps reducing speed, and enhances visibility between pedestrians and drivers.

Problems:
Minor accidents may be caused especially by the punctual ones.

Changes of the alignment are obtained varying from time to time the width of the sidewalks and/or the central islands. Pavements may be realised using different colours and textures matching with particular spots such as gates, bus stops or pedestrian crossing. The background must recover an urban quality which has been lost also due to the inhospitality of the current environment, vegetable elements, of different heights and species, can be used in the central islands and in the surrounding areas, built elements, such as waiting facilities at the bus stops, may also be useful in this context. General improvement of the whole environment may also be obtained with the right use of lights, not only to generically brighten but also to communicate and “furnish”, it is then very important to use the right light for each function and context, for instance a counter-flow lighting of a pedestrian crossing may greatly increase pedestrians visibility by the projection of the silhouette on the asphalt, while low lamps may create a comfortable atmosphere if installed along a pedestrians path.
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The speed reduction and the overall betterment of the road safety conditions need to be completed increasing the road usability for pedestrians. In particular bus stops and pedestrian crossings, which represent the interface between the different modes, need to be arranged in order to satisfy the requirements of all the users. Bus stops are organized with “bays” which allow buses to stop without interfering with other vehicles and at the same time provide a safe place for the bus to get in/out. Waiting facilities such as shelters provide a safe and comfortable place to wait for buses away from the road. Pedestrians crossings are surely one of the most critical spots, since conflicts between drivers and pedestrians cannot be avoided; many researches showed how different solutions such as under/over passes are generally refused by pedestrians, mainly for security related problems. The main problem to solve is the visibility between drivers and pedestrians, it’s then very useful to widen the sidewalks in correspondence of the crossing point, this allow pedestrians to safely wait for a suitable gap “inside” the road, having the chance of both evaluating the arriving vehicles and, at the same time, influencing drivers’ behaviour with their presence. The reduction of the crossing distance is another important result that is obtained widening the sidewalks and providing a central island, it has the double effect of reducing the crossing time, which may be critical for elderly and disable people, and of slowing down vehicles, that need to drive in an exceptionally narrow section. Different pavement colours are used to improve the visibility
of the crossing point. The most critical element in designing a pedestrian crossing is probably the crossing point location; it is then essential to integrate all the facilities in a pedestrian network which connects all the notable spots of the area allowing pedestrians to move wherever they want as freely as possible.

CONCLUSIONS

The main task of the project is the enhancing of the readability of the road space, to improve safety, accessibility and comfort; to gain this goal it is essential to understand how users perceive the space. The construction of “roads” instead of “streets”, inside villages cannot give anything but very poor performances. Experiences suggest that it is essential to move information from traffic signs to the environment itself, that should “tell” to the users the best behavioural pattern using as many ways as possible, from the geometry of the street to the lighting and the surrounding landscape.

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