SECOND UNIVERSITY OF NAPLES

FACULTY OF CIVIL ENGINEERING

SPEED MANAGEMENT STARS PROJECT

S.P. 341 - SAN TAMMARO (CE) – ITALY

FINAL REPORT

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ABSTRACT

ETSC is a Brussels-based independent non-profit making organization dedicated to reduce the numbers of deaths and injuries in transport in Europe.

ETSC seeks to identify and promote effective measure on the basis of international scientific research and best practice in areas which offer the greatest potential for a reduction in transport crashes and casualties.

A European project on speed by the European Transport Safety Council is STARS project.

STARS is an 18 month project which aims at mobilizing transport research into speed management to demonstrate how excessive and inappropriate speed can be reduced through existing measures. The main purpose of STARS is to run concrete actions that can reduce speed through the work of students. STARS relies on the work of committed young university students who will be encouraged to run a local speed management action to reduce speeding through infrastructure projects or communication projects in road transport with the support of ETSC and its partners. During these months, some possible solutions have been identified.

This report tries to outline all solutions studied during the project as from the first solution presented during the camp in Brussels to the final solution presented to the municipal technicians.

***You can see the final project at the end of this report**.*

As a result of our proposals and studies completed during the past few months, has been drawn up by the municipal technicians final project that will be implemented, it will be in accordance with the regulations, the collective needs and budget.

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1. INTRODUCTION

We are Alfonso and Alfonso, two students from the Second University of Naples, faculty of civil engineering. We are attending the second year of Italian post graduate degree. We live both in Caserta, a province near Naples in the south of Italy.

Figure 1: Caserta - The Royal Palace

As roads users, we have noticed that the number of dead in the street is linked to high speed. We dealt the topic, during the course called “safety and functionality roads”, thanks to the exam, we also deepened the subject, and both we have passed it with an excellent mark.

We considered the possibility to take part of this project offered by ETSC like an important opportunity to cultural growth and a formative experience. Thanks to this experience we compared our knowledge to other people, with which we tried to find solutions to become aware road users on high-speed. Besides, this project gave us a possibility to get something concrete for our city.

In this regard, we have focused our attention on a stretch of road that runs through the City of San Tammaro.

2. SITE TO BE TREATED

We have identified a stretch of “via Nazionale Appia”(S.P.341 ex S.S.7 BIS), a road located in the heart of San Tammaro where users travel on high-speed respect to road signs.

San Tammaro is an urban district in the Province of Caserta in the Italian region Campania, located about 30 km north of Naples and about 9 km west of Caserta.

Figure 2: Location of San Tammaro in the Province of Caserta

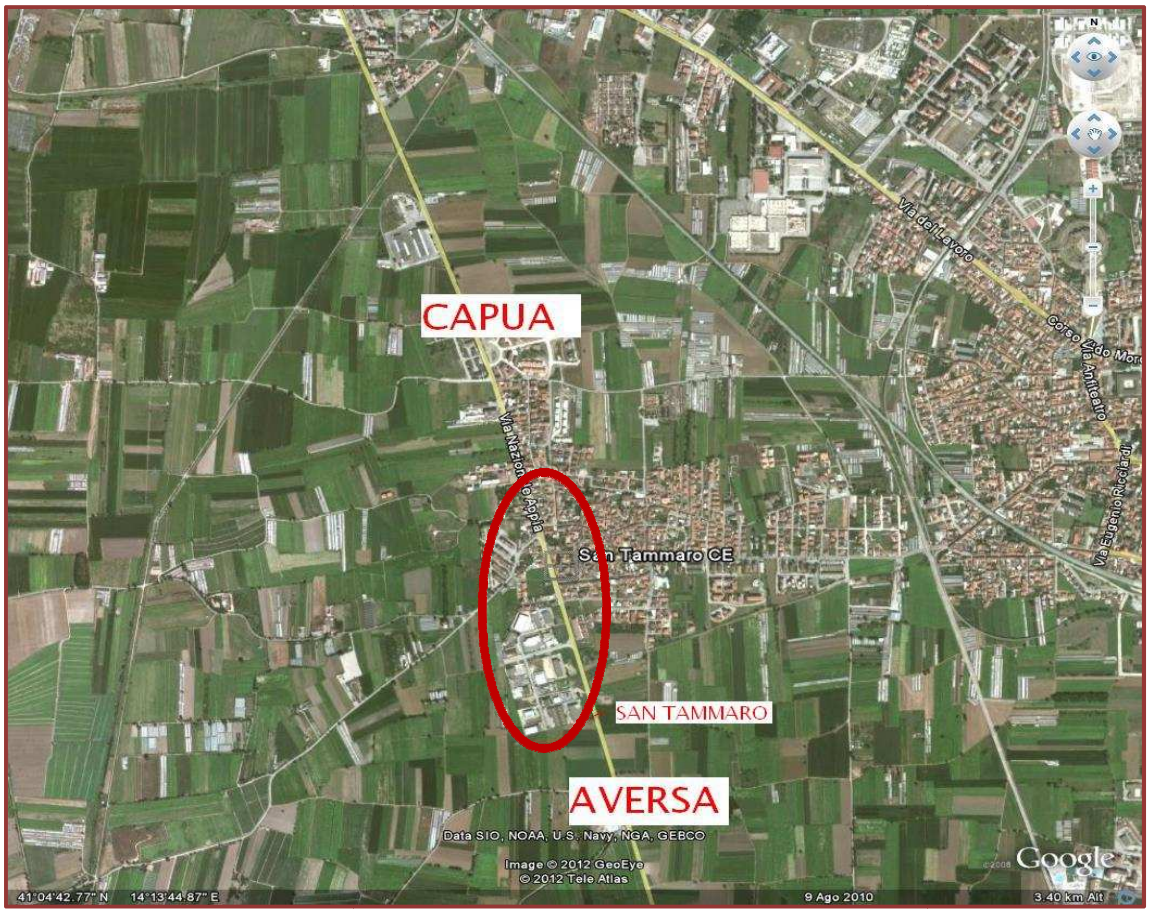


Figure 3: Location of the site

Drivers come from an extra urban to an urban road. They don't perceive the entrance in the town and they can overtake.

Figure 4: Aversa direction

Figure 5: Capua direction

We have made an investigation on the spot, we have taken some pictures of the site. We have also analyzed the traffic and measured the main distance of the road.

- It is a provincial road: S.P.341;
- Speed limit is 50 Km/h;
- There are very large sidewalks and no visible pedestrian crossings;
- There aren't cycle lanes;
- It is a road with large tertiary activities (supermarkets, shops, bars);
- It has great movements during rush hours.

2.1. PICTURES OF THE SITE

Figure 6: Entrance in the built-up area - Aversa direction

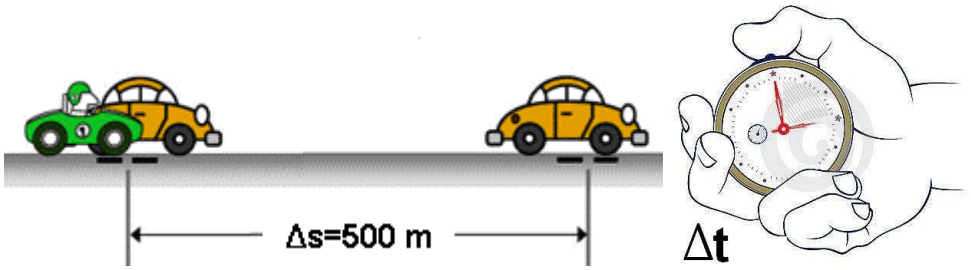
Figure 7: Picture along the stretch

Figure 8: Entrance in the built-up area - Capua direction

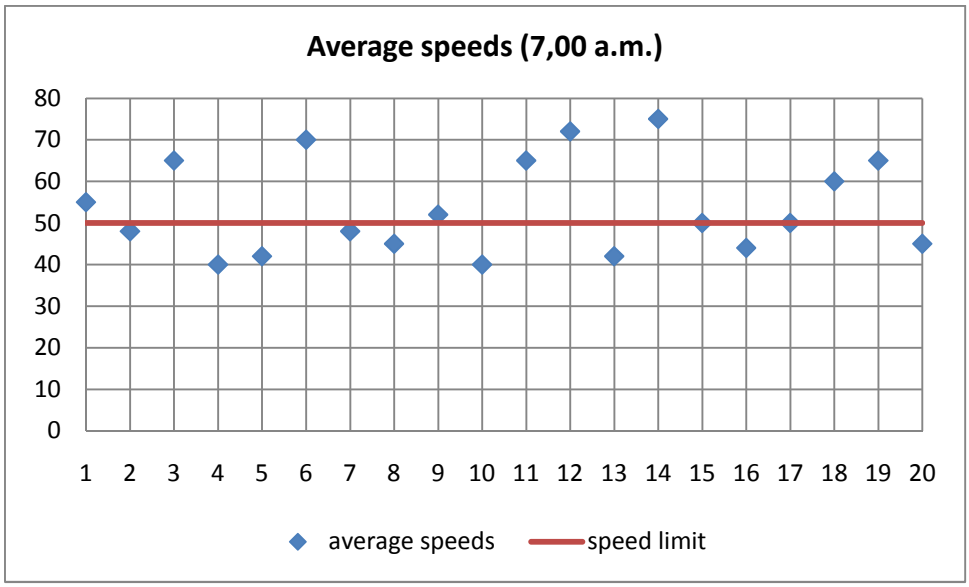
2.2. SPEED MEASUREMENTS

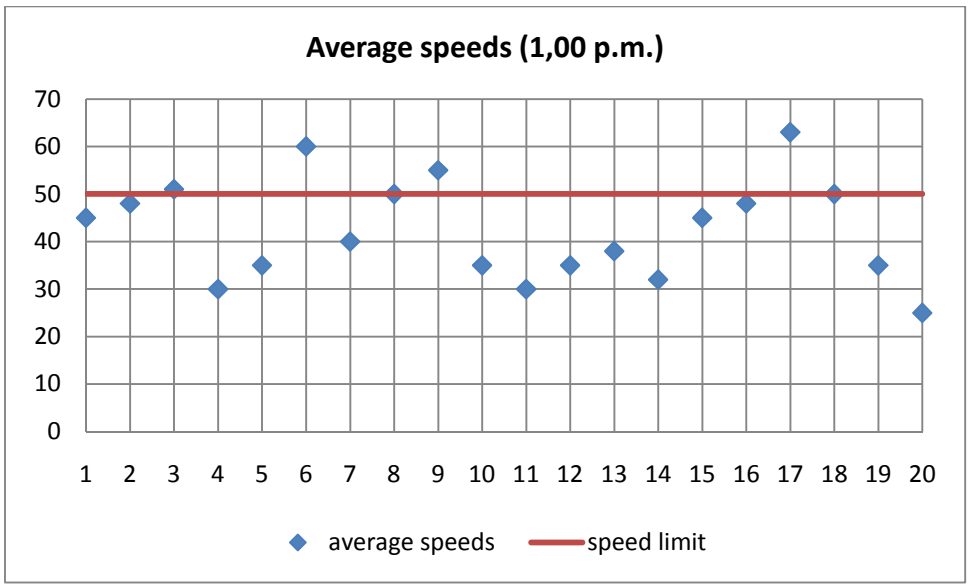
We didn't have speed measuring instrument available. Therefore, we decided to calculate the average speed for 20 users knowing the time that each of them has taken to run along a certain length of road.

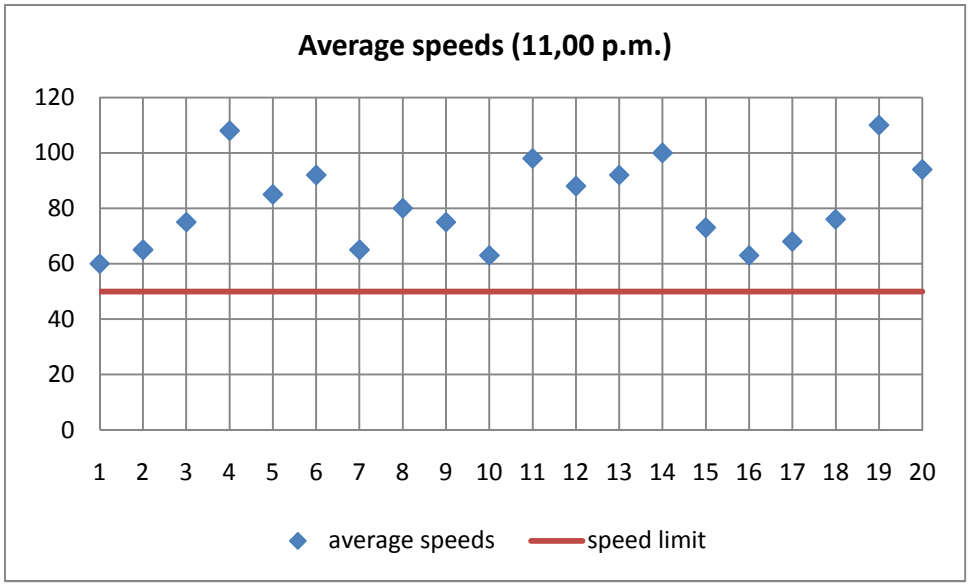
Average speeds were calculated three times during a day (7,00 a.m.; 1,00 p.m.; 11,00 p.m.).



$$V = \frac{\Delta s}{\Delta t}$$




Average speeds (1,00 p.m.)
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
average speeds
speed limit


Average speeds (11,00 p.m.)
120
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
average speeds
speed limit

2.3. COLLISIONS COLLECTION

The commander of town police doct. Giuseppe Vastante confirmed us that this is an unsafe road and users don't respect speed limit. He also said that there aren't many strong collisions, so he granted us this document in which he has collected the incidents from 2004 to 2006.

COMUNE DI SAN TAMMARO
(Provincia di Caserta)

UFFICIO DI POLIZIA MUNICIPALE

Prot. 218 PR

S.Tammaro, 05/04/2012

ATTESTATO

IL COMANDANTE

Vista la richiesta di Iuliano Alfonso, studente presso la facoltà di Ingegneria della SUN concernente la richiesta dei dati incidentali avvenuti in San Tammaro negli anni che vanno dal 2004 al 2006 nel tratto urbano della strada SS 7bis; ;
visti gli atti d'ufficio;

ATTESTA

I dati incidentali avvenuti in San Tammaro negli anni che vanno dal 2004 al 2006 e rilevati dal presente comando, nel tratto urbano della strada Statale 7 bis tra il km 1.100 e 3,600 sono i seguenti:
anno 2004 - 2
anno 2005 - 7
anno 2006 – 4
relativamente alla velocità media rilevata non vi sono dati.
Tanto per quanto richiesto.

Il comandante
(cap. dr Giuseppe Vastante)

Figure 9: Collisions collection

3. PARTNERS INVOLVED

We haven't found partners willing to subsidize our ideas but a few months ago we received three letters of moral support by the major, by A.C.I. (Automobile Club Italia) and by Lambretta Club Caserta.

COMUNE DI SAN TAMMARO
Prov. di Caserta
(Tel. 0823/793449 - fax 0823/793707)
comunesantammaro@tin.it

Prot. n. 4319 del 15 MAG. 2012

Spett. le E T S C
Sig. Alfonso Iuliano
Sig. Alfonso Pascarella

Oggetto: Riduzione della velocità sulla S.P. 341

La presente per comunicarVi che ho riscontrato con enorme compiacimento la Vs. nota riguardo al progetto STARS che mira a ridurre il numero di morti e feriti nel settore dei trasporti in Europa.

Questo progetto mi trova particolarmente sensibile anche in considerazione del fatto che la Vs. attenzione in seno al suddetto progetto si concentra sull'eccessiva velocità sulla S.P. 341 (ex SS 7Bis) che molte volte ha causato vittime per i numerosi incidenti automobilistici.

Io e tutta l'Amministrazione che rappresento siamo ben felici di sostenere la Vs. iniziativa e di collaborare affinchè possano essere studiate soluzioni per garantire la sicurezza stradale alla nostra collettività.

Cordiali saluti.

Il Sindaco
(Dott. Emiddio Cimmino)

Figure 10: Support letter by the major

alfonso iuliano

Da: Aci Napoli [aci.napoli@tin.it]
Inviato: martedì 15 maggio 2012 14.12
A: iuliano.alfonso2006@libero.it
Oggetto: R: SECONDA UNIVERSITA' DEGLI STUDI DI NAPOLI-PROGETTO STARS

Automobile Club Napoli

Egregi studenti Alfonso Iuliano ed Alfonso Pascarella,
ci congratuliamo per la Vostra iniziativa che ci auguriamo possa essere realizzata con positive ricadute per la sicurezza stradale.
Siamo sempre disponibili ad aiutare i giovani impegnati attivamente in questa materia che, purtroppo, non riesce ancora a trovare sufficiente spazio nei percorsi formativi universitari, non solo di tipo ingegneristico.
Saremmo, pertanto, lieti quando il Vostro progetto sarà pronto di prenderlo in esame per una eventuale pubblicazione, nella ferma convinzione che qualsiasi attività messa in campo per salvare anche una sola vita umana vale la pena di essere incoraggiata e sostenuta.
Ogni anno nella nostra regione perdono la vita più di 300 persone a causa degli incidenti stradali che, fra l'altro, pesano sulla collettività campana per un costo sociale di 2 miliardi di euro. Ben vengano, dunque, iniziative, come la Vostra, che mirano a contrastare un fenomeno che rappresenta la principale causa di mortalità per i giovanissimi.
Nell'incoraggiarVi a proseguire il cammino intrapreso ed augurandoVi un brillante avvenire, Vi porgo cordiali saluti.

Il Presidente
Antonio Coppola

1

Figure 11: Support letter by "A.C.I. NAPOLI"

Lambretta club
Vestigia Tifatine

Sig. Iuliano Alfonso
Sig. Pascarella Alfonso

Egregi studenti,

In qualità di presidente del Lambretta Club "*Vestigia Tifatine*" delegazione di Caserta posso asserire che lo stesso si mostra particolarmente sensibile alle problematiche presenti sulle strade della nostra Regione , che purtroppo continuano a mostrarsi inadeguate a ragionevoli standard di sicurezza.

È questo il motivo per il quale, con la presente, Vi esprimo l'enorme compiacimento ottenuto nell'esaminare la Vostra iniziativa che senza dubbio ritengo possa avere effetti più che benevoli nell'ambito della sicurezza stradale.

Mi sento quindi in dovere di offrirVi il mio sincero sostegno per un'eventuale futura collaborazione mirata a contrastare gli spiacevoli fenomeni che troppo spesso degenerano tragicamente.

Caserta,18/07/2012

Il Presidente
(arch. Giuseppe Casulla)

Lambretta Club
"Vestigia Tifatine"
Delegazione di Caserta

Lambretta Club "Vestigia Tifatine" delegazione Caserta c/o arch. Giuseppe Casella
cell. 338 8935020 – 33[illegible] 6686086 tel/fax 0823 387289 e-mail: gcasella54@virgilio.it

Figure 12: Support letter by "Lambretta Club Caserta"

Besides, we have sent a lot of email unsuccessfully.

Caserta, 13 Aprile 2012

Gentile Signore/Signora,

siamo due studenti della "Seconda Università degli Studi di Napoli" e facciamo parte entrambi dei 22 studenti di ingegneria selezionati in 11 paesi europei che partecipano al progetto STARS (Students Acting to Reduce Speed) condotto da ETSC (European Transport Safety Council).
ETSC ha sede indipendente a Bruxelles e senza scopo di lucro mira a ridurre il numero di morti e feriti nel settore dei trasporti in Europa dimostrando che la velocità eccessiva sulle strade può essere ridotta da misure esistenti e / o innovative.
Il progetto STARS, in particolare, si concentra sulla gestione della velocità e della sicurezza stradale attraverso azioni specifiche in materia di infrastrutture e comunicazioni.
Siamo gli unici due studenti selezionati in Italia; abbiamo seguito un seminario completo a Bruxelles della durata di una settimana sulla gestione della velocità e della sicurezza stradale tenuto da molti esperti, associazioni, istituzioni e aziende che lavorano su questi temi.
A tal proposito abbiamo concentrato la nostra attenzione su un tratto di strada della **S.P. 341** (ex SS 7 Bis) all' ingresso del centro abitato di San Tammaro, provincia di Caserta, particolarmente rilevante per sostenere le idee e le misure che desideriamo presentare.
Stiamo preparando una soluzione a basso costo affinché gli utenti che transitano per il centro abitato di San Tammaro possano percepire l'ingresso in una zona abitata e adeguare di conseguenza il loro comportamento alla guida.
La contattiamo siccome stiamo cercando di coinvolgere la maggior parte degli enti ed associazioni dedite in ambito della sicurezza stradale a fornire il loro sostegno anche attraverso una semplice lettera in cui si chiarisca l'importanza del tema e l'eventuale supporto che ognuno di essi possa fornirci.
Le lettere raccolte saranno successivamente presentate alle amministrazioni locali e ai possibili partner che vorranno finanziare il progetto in modo tale da sensibilizzarli al tema e rendere più agevole il nostro lavoro.
Siamo inoltre alla ricerca di finanziamenti o sponsor per cui le saremo grati se ce ne riuscisse ad indicare qualcuno da contattare.

In attesa di una sua risposta la ringraziamo anticipatamente.

Distinti saluti,

Alfonso Iuliano	iuliano.alfonso2006@libero.it	3280682950
Alfonso Pascarella	pascarella.alfonso@gmail.it	3395257712

Figure 13: Example of a mail sent to companies and associations

These are only some of associations and companies that we have contacted.

Figure 14: Associations and companies contacted

We have also point out this blackpoint to "ANIA" by this website.

Figure 15: Signalling of the black point to Ania Foundation

4. PROPOSALS TO REDUCE SPEED

During these months, some possible solutions have been identified.

It will try to outline all the solutions studied during the project as from the first solution presented during the camp in Brussels to the final solution presented to the municipal technicians.

<u>You can see the final project at the end of this report</u>.

The main problem is the excessive width of the roadway which involves dangerous overtaking and stop outside the spaces allowed. Therefore, several actions were proposed to reduce the width of the road and slow down vehicles automatically.

4.1. FIRST PROPOSAL

The first solution, also presented on the last day of the camp, included a row of trees in the middle of the road.

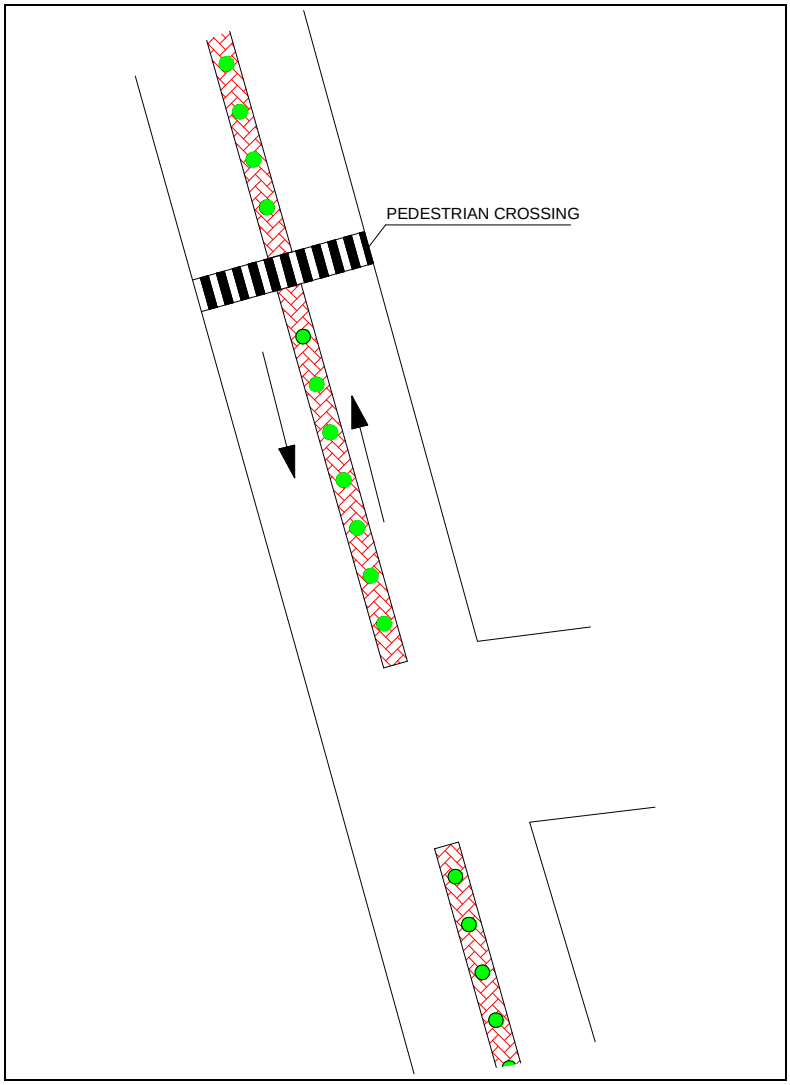


Figure 16: First solution - Row of trees in the middle of the road

This solution was discarded by the experts because it could be dangerous in case of leakage.

4.2. SECOND PROPOSAL

A second solution involved the widening of sidewalks. In this way it is also possible to increase pedestrian safety because the section crossing is less.

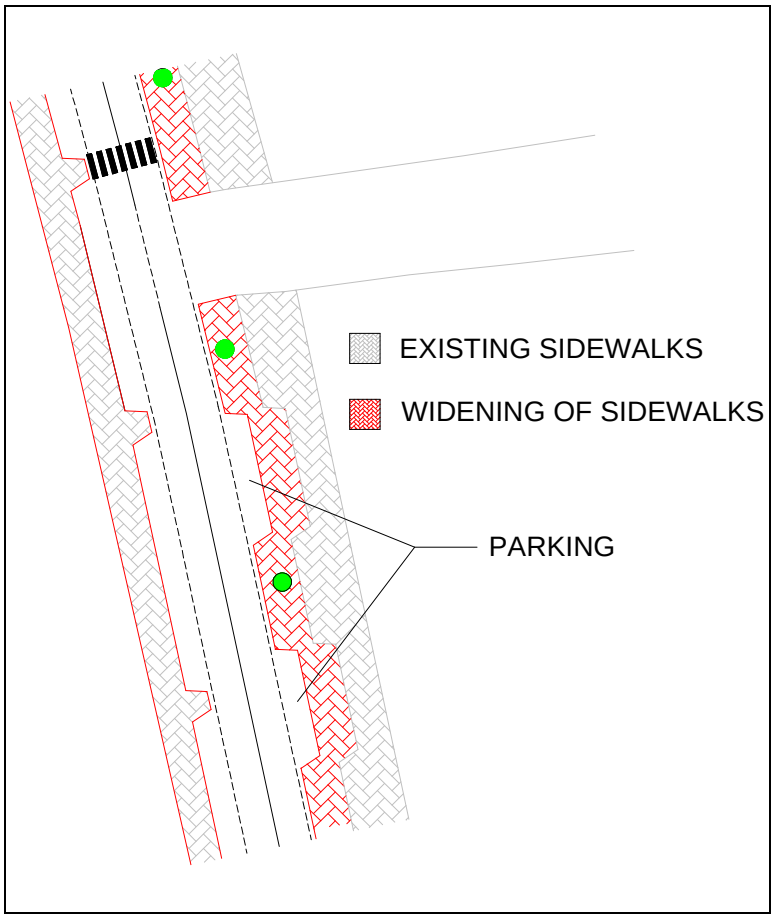


Figure 17: Second solution - Widening of sidewalks

The latest idea was too expensive and difficult to implement.

4.3. THIRD PROPOSAL

We have also proposed the realization of a middle lane to be used for the left turn in two different variants: the first made in porphyry and the second made of colored conglomerate. This last solution was really cheap.

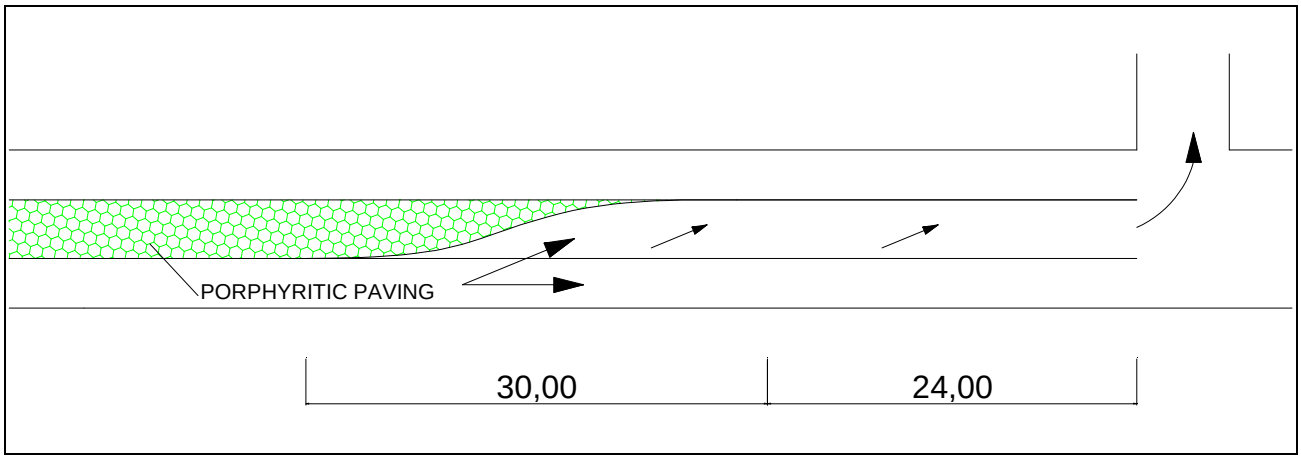


Figure 18: Third solution (A) - Porphyritic middle lane

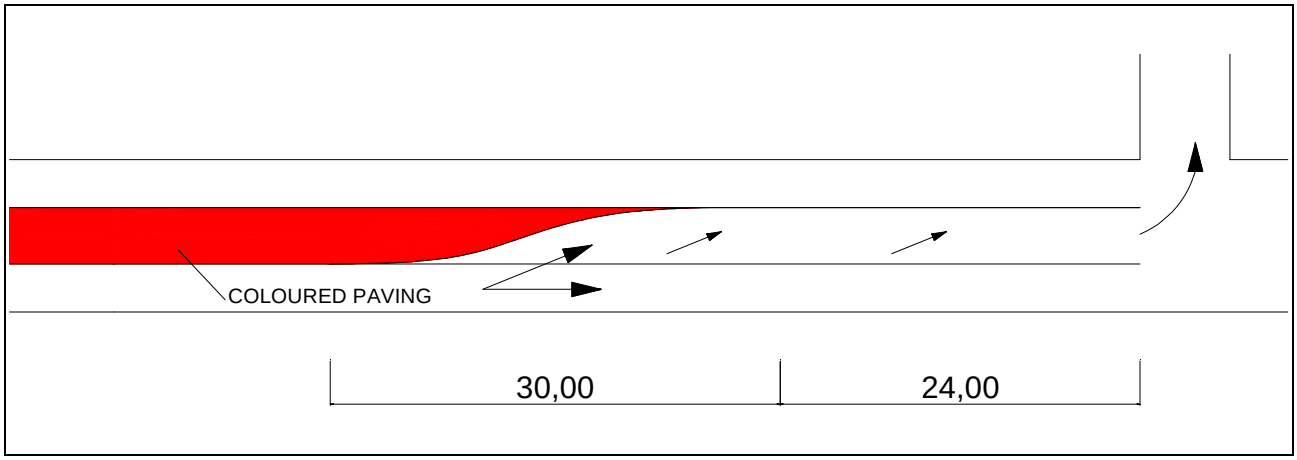


Figure 19: Third solution (B) - Coloured middle lane

These solutions, however, were not very effective for usual users.

4.4. FINAL PROPOSALS

At the end it was decided to take action at the beginning of the urban stretch in both directions. The width of the road has not been changed.

The final solutions are:

- some measures at the entrance of the town;
- two mini- roundabouts (mini-circles);
- three raised pedestrian crossings (speed tables) so as to further decelerate the vehicle .

Figure 20: Final proposals - (1-3 mini roundabouts; 2 A-B-C speed tables; 4 A-B measures at the entrance of the town)

4.4.1. MEASURES AT THE ENTRANCE OF THE TOWN

A series of measures have been provided to inform the users that they are coming from a provincial road and they are going to cross a stretch of urban road.

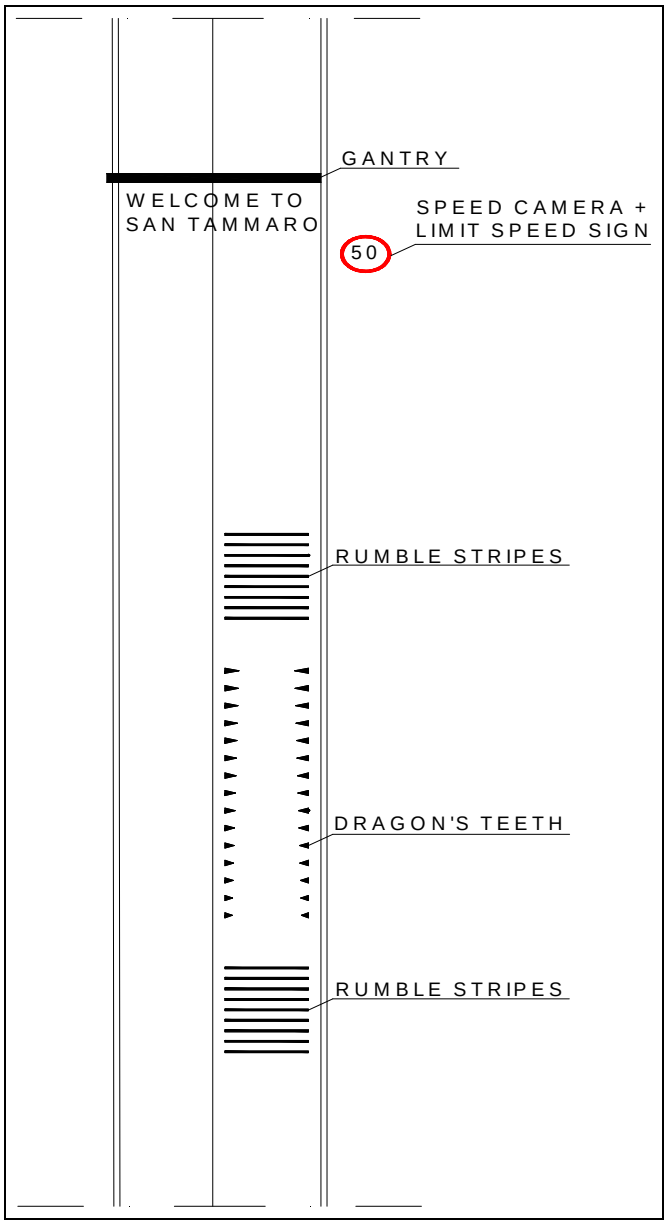


Figure 21: Solution 4 A-B

- **RUMBLE STRIPES**

Rumble stripes, also known as sleeper lines or audible lines, are a road safety feature that alert inattentive drivers to potential danger by causing a tactile vibration and audible rumbling, transmitted through the wheels into the car body. A rumble strip is usually either applied in the direction of travel along an edge- or centreline, to alert drivers when they drift from their lane, or in a series across the direction of travel, to warn drivers of a stop ahead or nearby danger spot. In favourable circumstances, rumble strips are efficient (and cost-effective) to reduce accidents due to inattention.

Figure 22: Rumble stripes

- **"DRAGON'S TEETH"**

It is proposed that 'Dragon's Teeth' (a series of triangular road markings placed in pairs on each side of the lane or road) be provided at the entrances to the town to highlight to the drivers that they are entering in a built up zone.

This is a measure which causes an optical reduction of the road. Users are automatically pushed to decelerate.

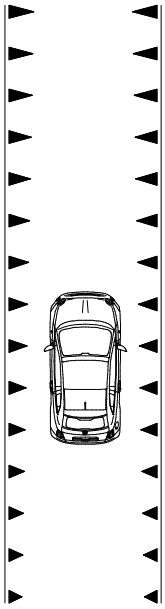


Figure 23: Dragon's teeth with growing height

- **SPEED CAMERA**

A speed camera records the speeds at the entrance to the town and shows to users their speed through a display. Its purpose is to inform and not to punish drivers. This tool is always installed with a speed limit sign.

We have tought to add a simple electronic message like: “SLOW DOWN” ; “-2 POINTS” by driving licence (if the excess of the speed is less than 40 Kilometers per hour)or “-10 POINTS” by driving licence (if the excess of the speed is more than 40 Kilometers per hour).

Figure 24: Speed camera

- **GANTRY**

Gantry is a portal installed at the entrance of the town to alert users which are going to cross over a built-up area; so they must reduce speed.

Figure 25: Gantry

4.4.2. MINI-ROUNDABOUTS

Mini-roundabouts is constituted by a ring which allows the movement of vehicles from more roads. It is distinct from other roundabouts by the small sizes both of the central island (which is often partially or totally surmountable) and the ring, which is always to a single lane. It has in common with the larger roundabouts for the purpose of increasing the levels of safety and traffic flow.

In urban areas must ensure the safety of vulnerable users, consisting of pedestrians and cyclists.

Figure 26: Example of a partially surmountable mini circle

Figure 27: Example of a totally surmountable mini circle

The rules establish its sizes and criterions of use. Mini-roundabouts can be introduced on roads with speed limit less than or equal to 50 km / h. The diameter of the central island is very small, less than 4 m, and with an outer diameter of the ring comprised between 14 and 20 m. This kind of roundabout is passable by large vehicles, to facilitate the passage the central island often is simply painted on the pavement; in other cases is realized with slightly raised materials.

The benefits obtained with the mini circles can be enhanced if they are placed in subsequent intersections. They may be combined with other measures, because the results are not dependent on a single element, but by the overall system.

Some researchers from Seattle have performed studies on the effects of these roundabouts, which revealed that the advantages are the safety of intersections and reducing average speeds. The results can be obtained for about 60 m before and after the intersection. Collisions between vehicles, however, can be reduced by 95% at intersections where mini circles have been realized.

Two mini roundabouts have been proposed, one for each direction.

You can see several solutions: from the most expensive to the cheapest. The cheapest replaces the roundabout with simple colored paving.

- **CAPUA DIRECTION**

Figure 28: Location of our mini-roundabout - Capua direction

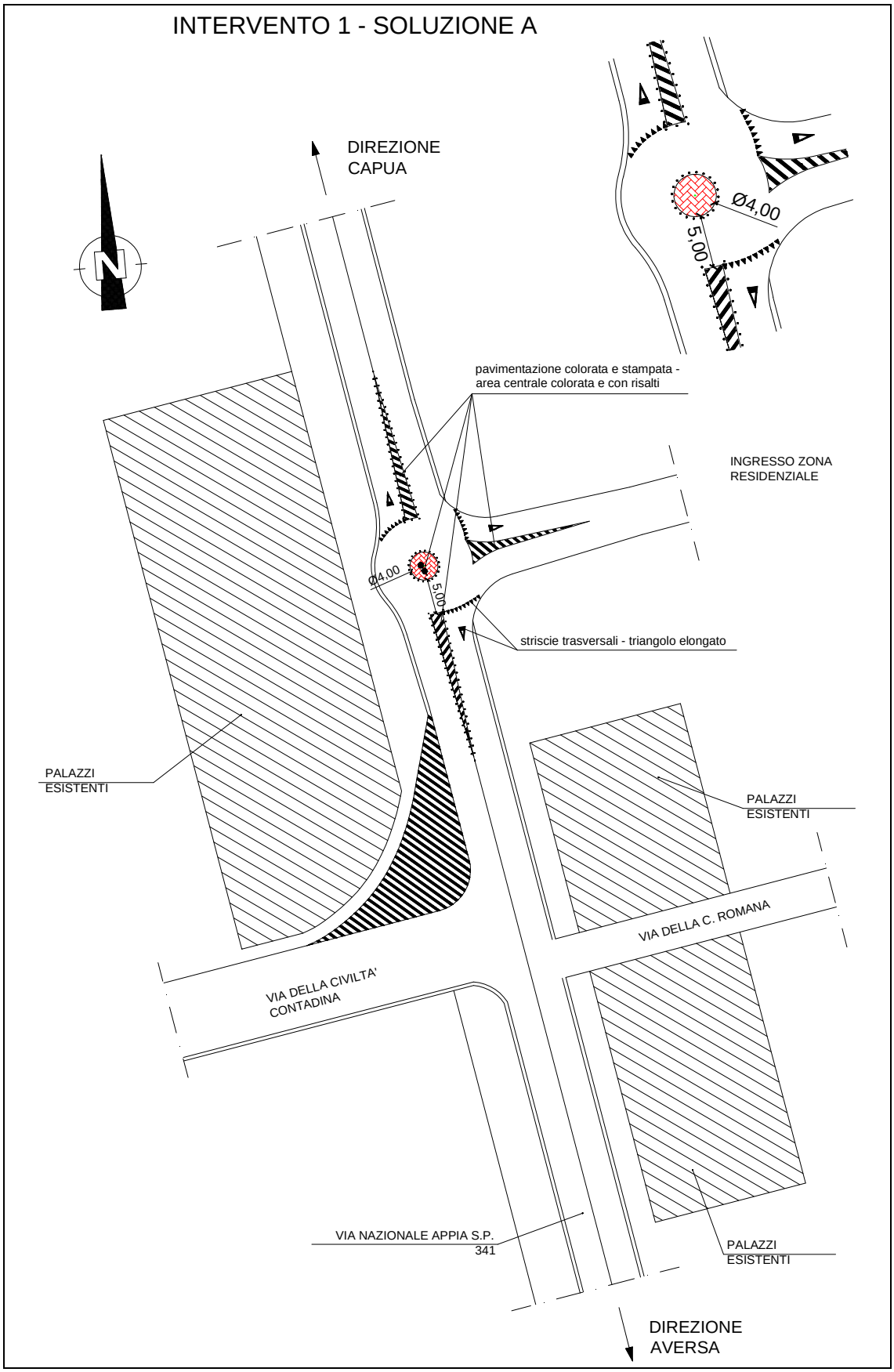


Figure 29: Solution 1 - plan A

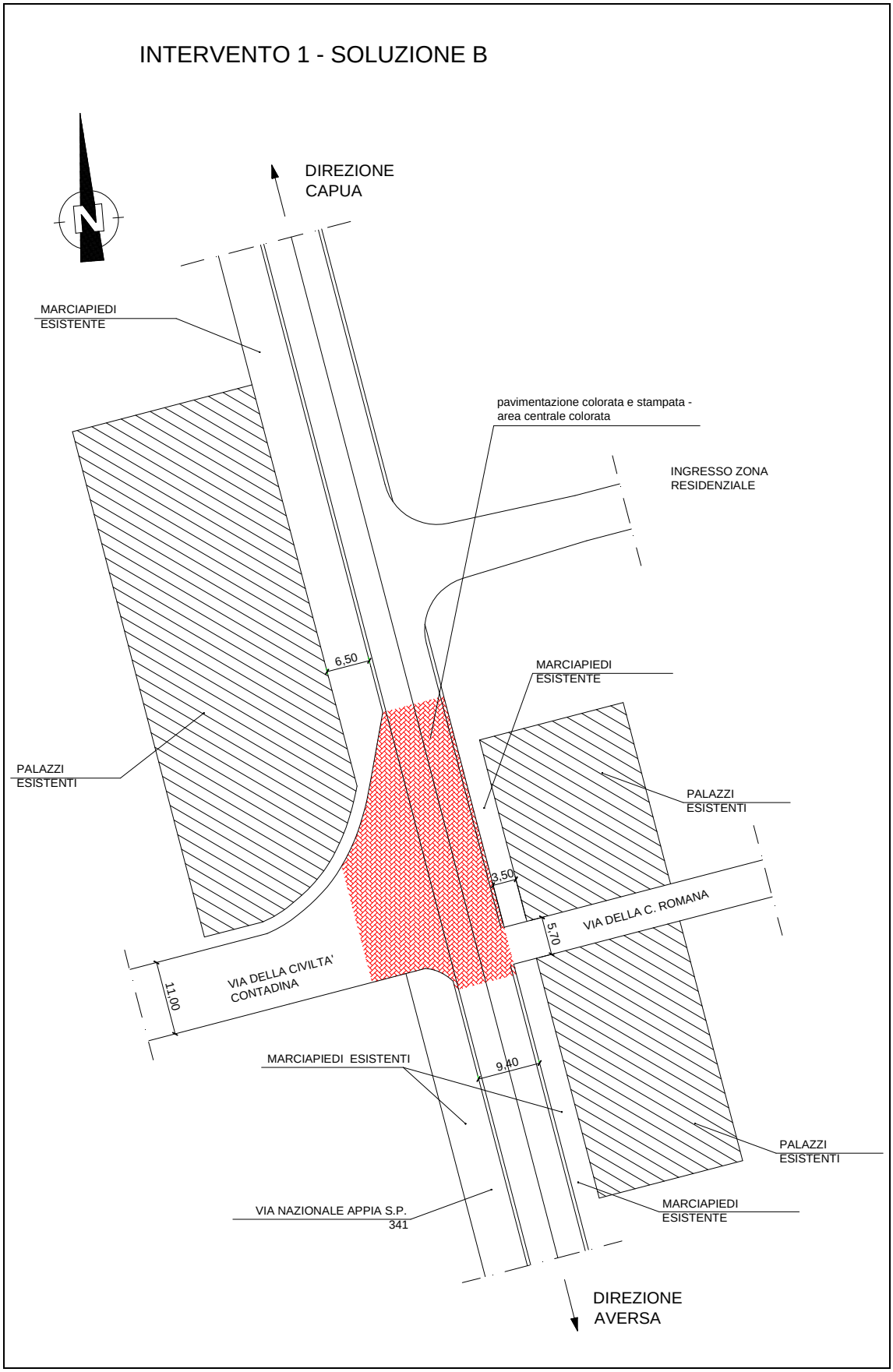


Figure 30: Solution 1 - Plan B

- **AVERSA DIRECTION**

Figure 31: Location of our mini-roundabout - Aversa direction

Figure 32: Picture of the location of the mini-roundabout - Aversa direction

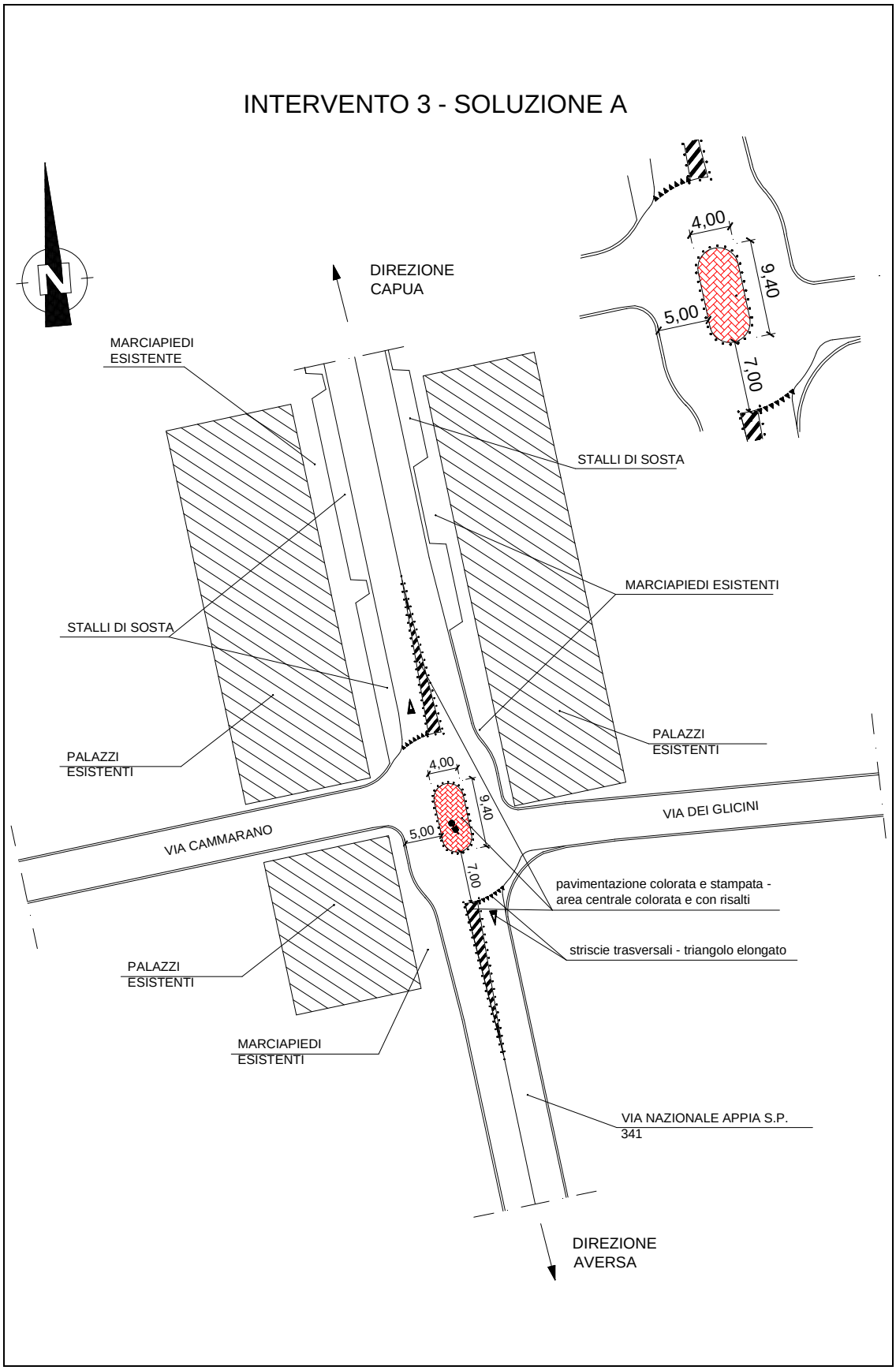


Figure 33: Solution 3 - plan A

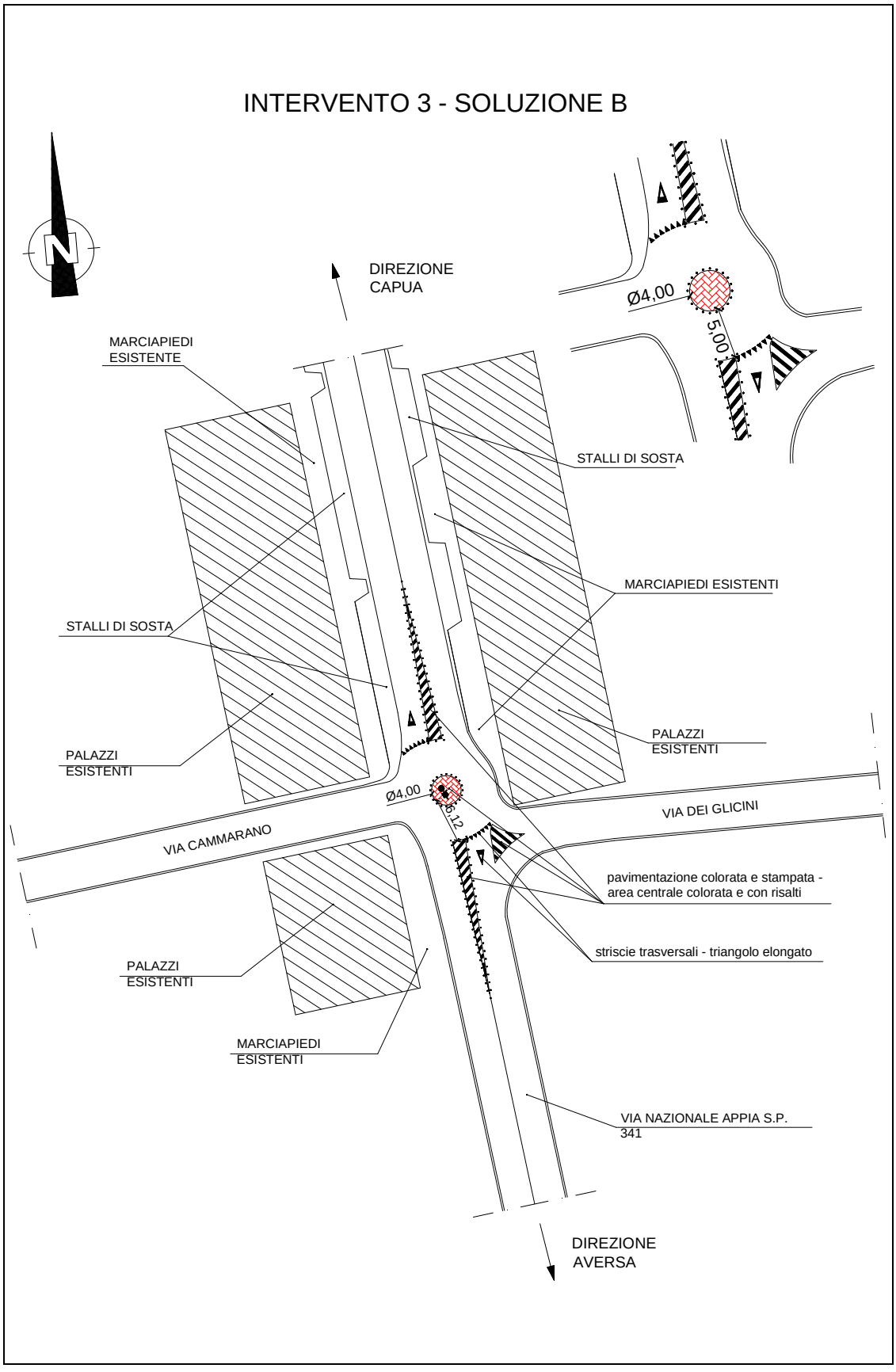


Figure 34: Solution 3 - plan B

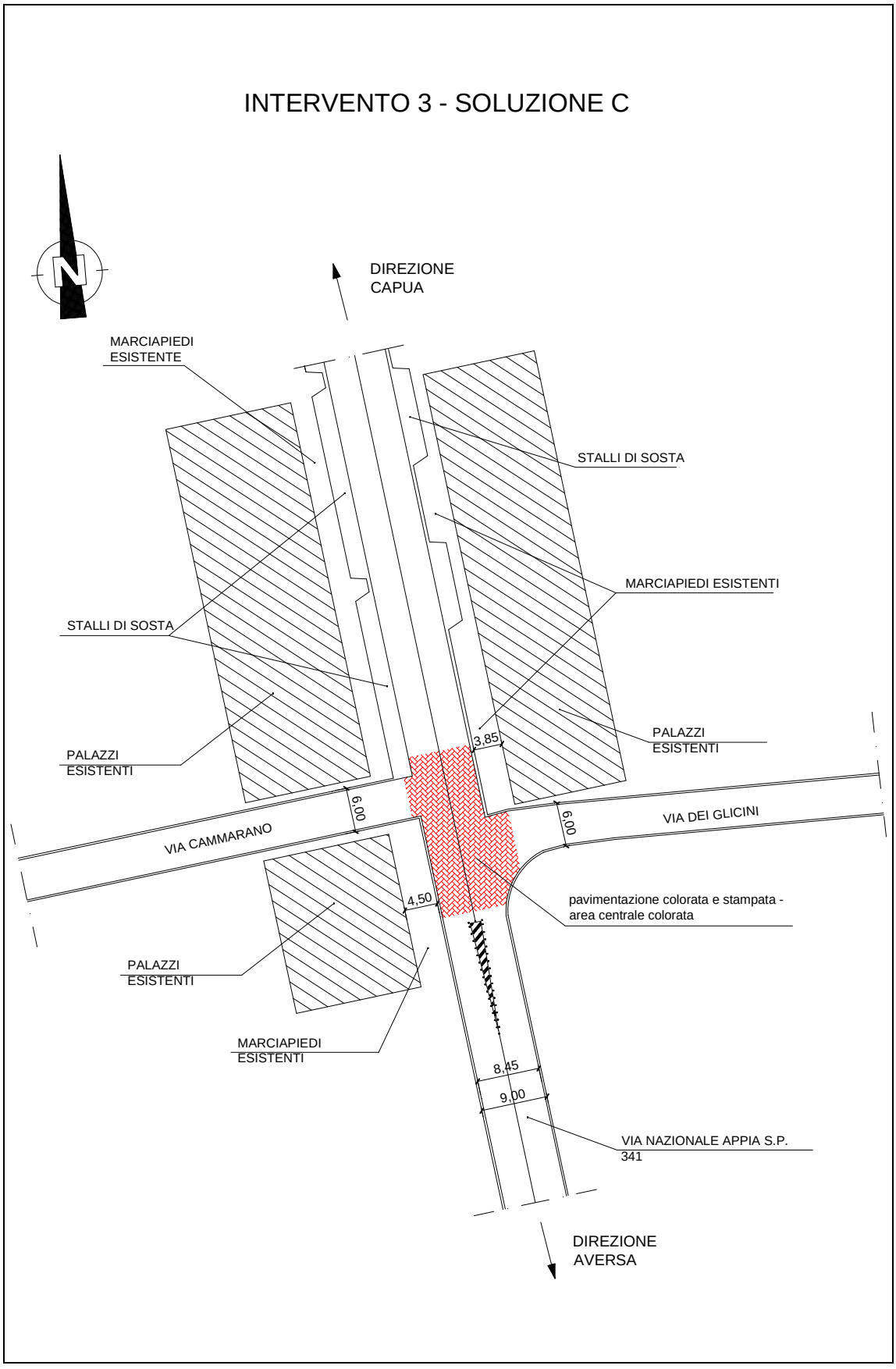


Figure 35: Solution 3 - plan C

4.4.3.SPEED TABLES

A speed table is a traffic calming device designed as a long speed hump with a flat section in the middle. Speed tables are generally long enough for the entire wheelbase of a passenger car to rest on top. The long, flat design allows cars to pass without slowing as significantly as with speed humps or cushions. Because they slow cars less than similar devices, speed tables are often used on roads with typical residential speed limits.

They are made to give continuity to the sidewalks in a part of the road between two intersections, and to interrupting the continuity of long straight, so as to moderate vehicles' speed. When it is realized near very frequented buildings like schools and hospitals it can be constituted by a platform having a considerable extension.

Speed tables can also be signed as pedestrian crossings.

Figure 36: Example of a speed table

Speed tables can be constructed of asphalt, concrete, or rubber. While traditionally most humps were constructed of asphalt or concrete, rubber is becoming increasingly popular due to several

factors. Asphalt and concrete can be difficult to construct precisely while rubber products are pre-shaped to standardized sizes and thus consistently meet industry standards. An additional advantage is ease of installation, which is particularly beneficial when a city wants to test streets before deciding where to keep the devices. The simple installation process also allows for removal during the winter when snow is a concern (preventing damage to the humps by snow plows). In addition, unlike concrete and asphalt, which necessitate frequent and high cost replacement, rubber products are longer lasting and thus more cost-efficient.

Speed tables are effective in calming traffic on streets where the speed limit needs to be maintained rather than slowing cars more significantly. Traffic speed, volumes, and accidents have been shown to decrease with the use of tables. Although not as responsive to emergency vehicles as speed cushions, speed tables cause less of a delay than humps and are typically preferred by fire departments over speed humps.

Because there aren't Italian technical regulations for their design, often refers to some European guidelines. To achieve average speeds of less than 25.6 km / h, at the crossing the slope must be at least 7%. The Department for Transport in the UK recommended not to exceed 10%. CERTU (Centre D'études Sur Les Réseaux, Les Transports, L'urbanisme Et Les Constructions Publiques) states that if the length of the flat part is less than 10 m, the maximum height should be 10 cm. If instead the length of the platform exceeds 10 m, the height may be between 10 and 20 cm.

In Britain and the United States it is customary to draw some triangles on the ramps in order to make visible the height difference of the floor even from afar.

Figure 37: Speed tables in the U.S.

According to the guidelines, three speed tables were designed.

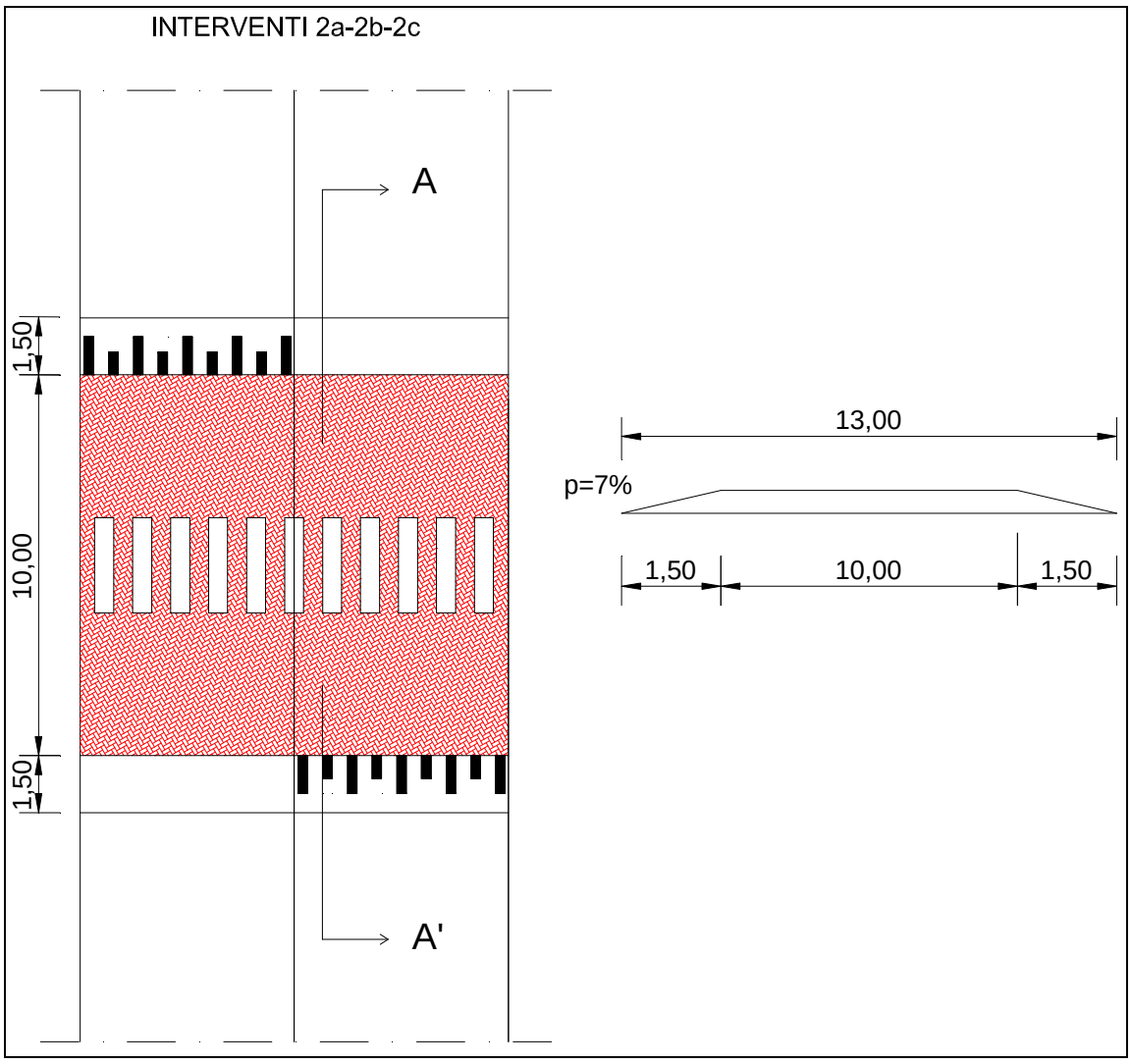


Figure 38: Solution 2 A-B-C

5. EXPEXTED RESULTS

The aim of speed management treatments is to lower the speed profile along the street so that speed objectives are met. The speed profile reflects the physical nature of the street and driving "culture" of the road users, and thus responds to the characteristics and attitudes of the community. Intermittent points of conflict, lower-speed geometry or poor pavement conditions, for example, will cause fluctuations in the profile but, in general, the speed profile will normally reflect an approximately constant speed in streets with reasonably uniform physical conditions.

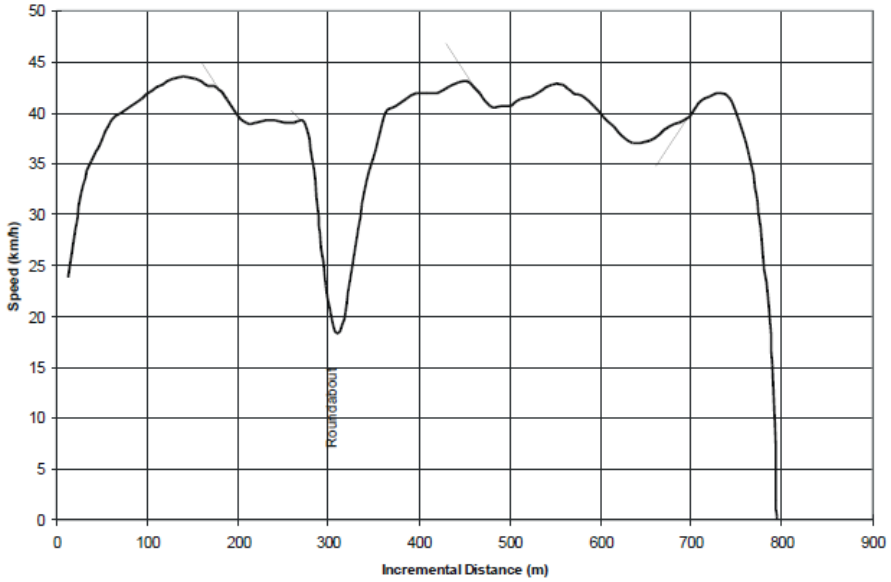


Figure 39: Typical free speed profile in a residential street and the effect of a single roundabout

This characteristic of the normal speed profile contrasts with the speed profiles that are created by speed management devices, giving rise to one of the issues that have to be dealt with implement neighbourhood traffic management. Each device has a "zone of influence" over which it exerts a speed-reducing effect. Consequently, a series of treatments along a street will create an oscillating speed profile. Figure 39 shows the speed profiles in a street showing the effect of humps at about 120 m spacing on the speed profile, and confirming both the limited zone of influence of these treatments and the ability of vehicles to return to speeds above 40 km/h if the spacing is much above 70 m or so.

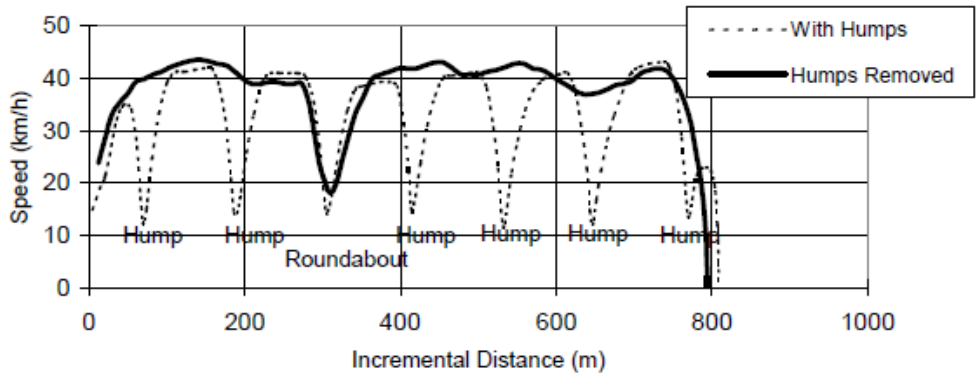


Figure 40: Speed profiles before and after the removal of humps on a street

Traffic calming is a speed management technique that relies on the concept of using physical and visual devices to persuade motorists to slow down. The devices used for traffic calming can be divided into two broad categories: vertical deflections and horizontal deflections. Vertical deflections are raised segments that force drivers to slow down in order to minimise unpleasant bumping or vibrating sensations. Horizontal deflections are either lateral shifts in the roadway that create non-linear driving paths, or constrictions of the roadway that cause drivers to lower their speeds in order to manoeuvre safely through the deflection.

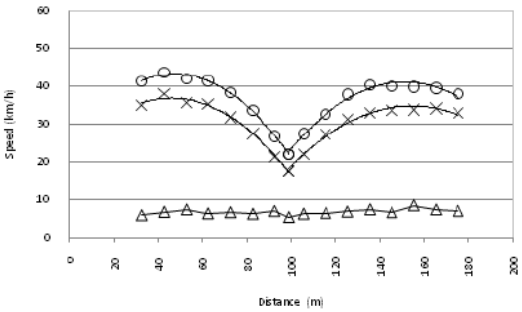
Researchers from University of Canterbury have shown that speed reduction on residential streets can be attained through traffic calming. Their research examines the speed profiles of individual vehicles on traffic-calmed streets, in order to provide a better understanding of how drivers react to calming devices over an extended street length and to find ways of estimating speeds along traffic-calmed streets.

Results indicate that traffic-calmed streets do not necessarily promote low speed environments. It was found that 85th percentile speeds at long distances from calming devices were 45-55 km/h for horizontally deflected streets and 40-45 km/h for vertically deflected streets. The speed hump and the angled slow point produced the biggest speed reductions, with the 2-way mid-block narrowings causing no significant speed changes.

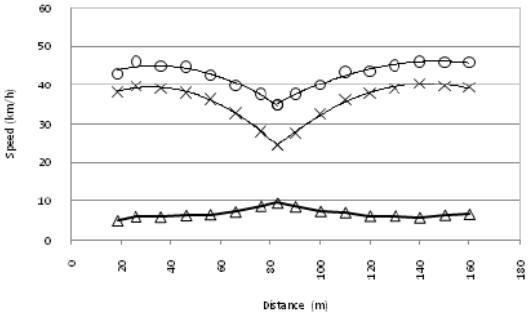
Smaller variations in speeds were recorded on the speed hump and the raised angled slow point, while the speed table registered a higher variation. This suggests that drivers have different perceptions of appropriate operating speeds. For multiple devices, larger spacing produced higher speeds between devices.

These findings, along with speed difference curves and speed-spacing models developed from this research, can aid in the selection of device type and spacing between devices in order to improve the effectiveness of traffic calming.

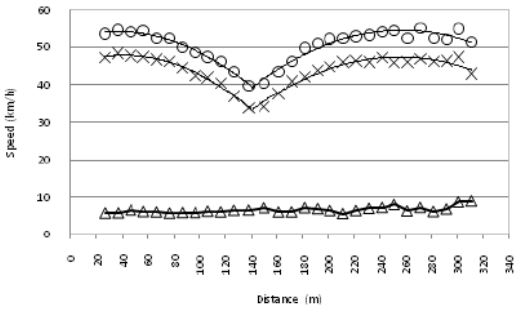
Speed profile for street with speed hump



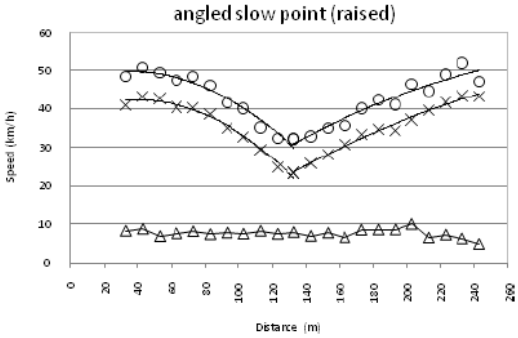
Speed profile for street with speed table



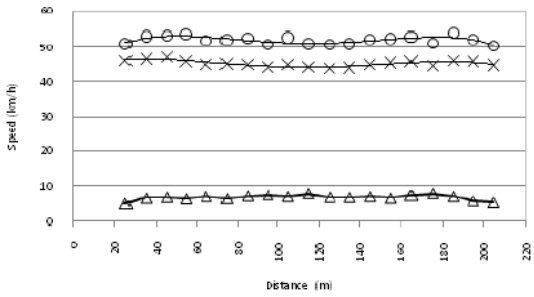
Speed profile for street with one-lane angled slow point (flush)



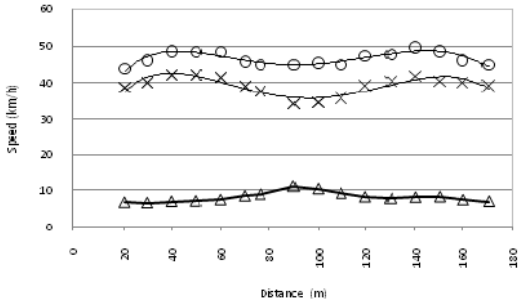
Speed profile for street with one-lane angled slow point (raised)



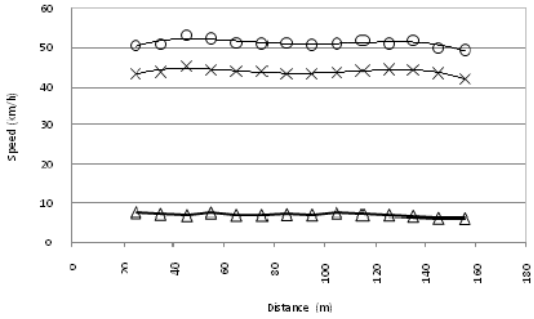
Speed profile for street with one-lane midblock narrowing (flush)



Speed profile for street with one-lane midblock narrowing (raised)



Speed profile for street with two-lane midblock narrowing (flush)



Legend:

- 85th Percentile Speed
- Mean Speed
- Standard Deviation

The following conclusions were drawn from this study:

- Speed humps produce the lowest operating speed and one is closed to the target speed of 20 km/h. These devices are also most influential in reducing street speed, as proven by the sizeable speed change and small dispersion of speeds.
- Speed tables do not perform as well as speed humps. Though street speeds are kept below the limit, operating speeds are approximately 13 km/h higher than speed humps. The gentler design of the observed speed tables enables drivers to perform their vehicles at higher speeds, leading to a higher standard deviation in speed at the device than at speed humps.
- One-lane raised angled slow points produce a greater speed-reducing effect than speed tables and just like the speed hump, the deviations in speed are smaller than on other sections of the street. However, street speeds are still fairly high.
- Mid-block narrowings are not effective in reducing speeds. The differences between operating speeds and street speeds are slight.
- Angled slow points exert the most extensive zones of influence, it means that drivers begin reducing speeds at a further distance from the device. By contrast, drivers choose to slow down at a closer distance to mid-block narrowings.
- Spacings between speed humps of 170 m or more will likely result in 85th percentile speeds exceeding 50 km/h. For speed tables, the equivalent spacing is 145 m and above.
- Spacings of 85 m or less is recommended for speed humps if a speed environment of 40 km/h is desired. Spacings between speed tables of 70 m or less will likely result in speed environments of not more than 45 km/h.

This study has provided some insight into the effects of traffic calming devices on driver behaviour via their choice of speed not only when traversing the devices but also as they move towards and away from the devices. While speeds may be lowered at some of the devices, street speeds may still be high. This suggests that low speed environments may not be achieved throughout a street unless devices that produce an optimal speed-reducing effect are selected and located at appropriate spacings.

However, engineering solutions alone are often not enough to control speeds in neighbourhoods.

There is a better chance of achieving low speed environments on neighbourhood streets if a 30 km/h or 40 km/h speed limit is imposed on local streets and supported by the use of traffic calming devices.

It is therefore recommended that before-after studies on 30 km/h and 40 km/h speed zones on residential streets with and without traffic calming be conducted to gauge the level of effectiveness of these speed management options.

On the basis of the abovementioned studies and technical italian regulations have been adopted appropriate devices. Therefore, we expect a reduction of speeds as shown by the UK research.

6. PROJECT DRAWN UP BY THE MUNICIPAL TECHNICIANS

As a result of our proposals and studies completed during the past few months, has been drawn up by the municipal technicians final project that will be implemented, it will be in accordance with the regulations, the collective needs and budget.

Has been carried out a **cost–benefit analysis** (CBA); it is a systematic process for calculating and comparing benefits and costs of a project.

CBA has two purposes:

- to determine if it is a sound investment;
- to provide a basis for comparing projects. It involves comparing the total expected cost of each option against the total expected benefits, to see whether the benefits outweigh the costs, and by how much.

So, this project involves the insertion of a single roundabout in only one direction (Capua direction). As you can see it is very similar to ours but with a larger diameter.

The roundabout will be advanced a few meters from our to take advantage of wider spaces and because the municipal technicians are able to expropriate land to private individuals.

Therefore, the roundabout will be realized only at the end of the ***compulsory acquisition process.***

Figure 41: Comparison between our and technicians' roundabout

Figure 42: Location of technicians' roundabout

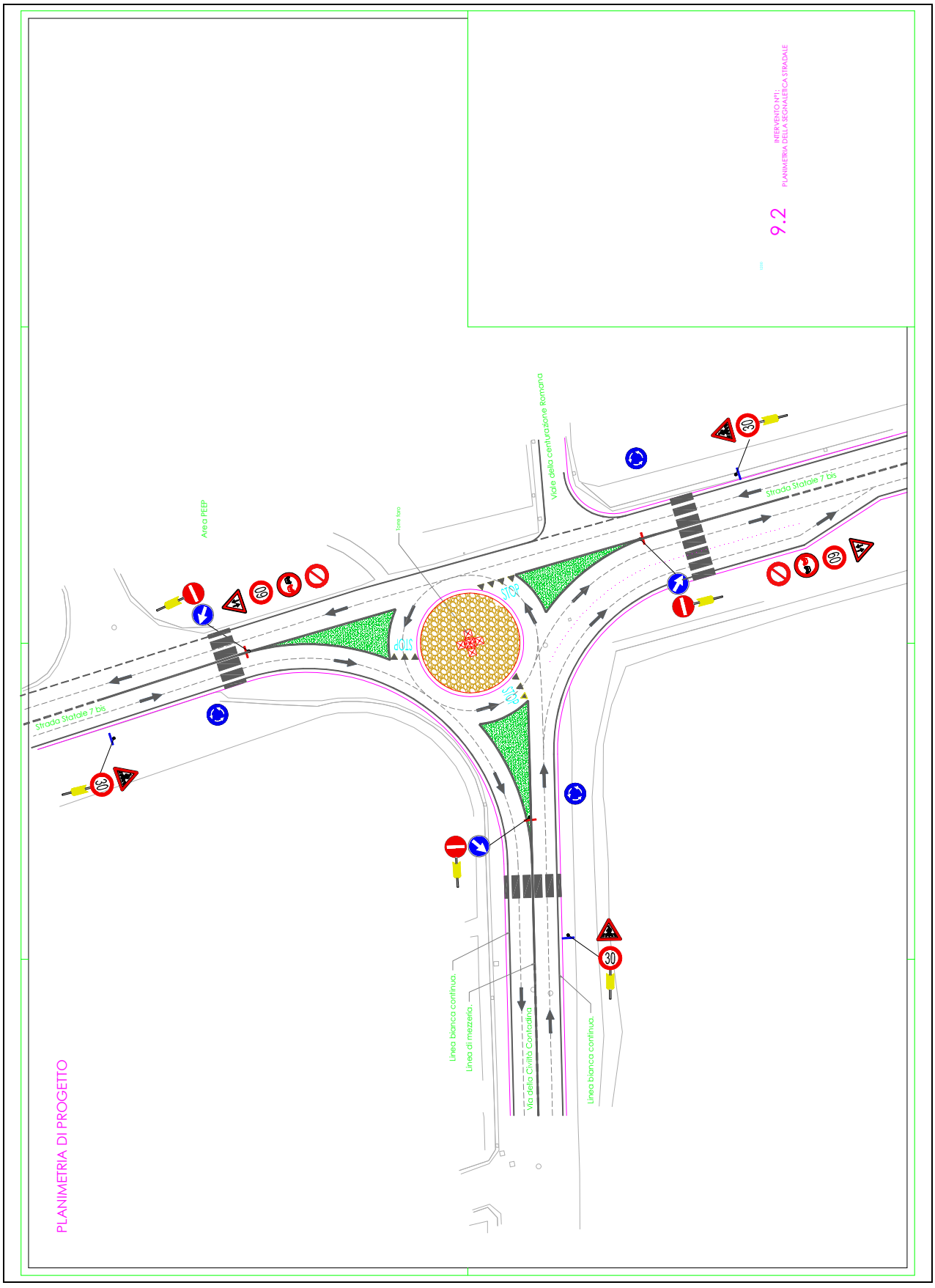


Figure 43: Technicians' project - Road signs

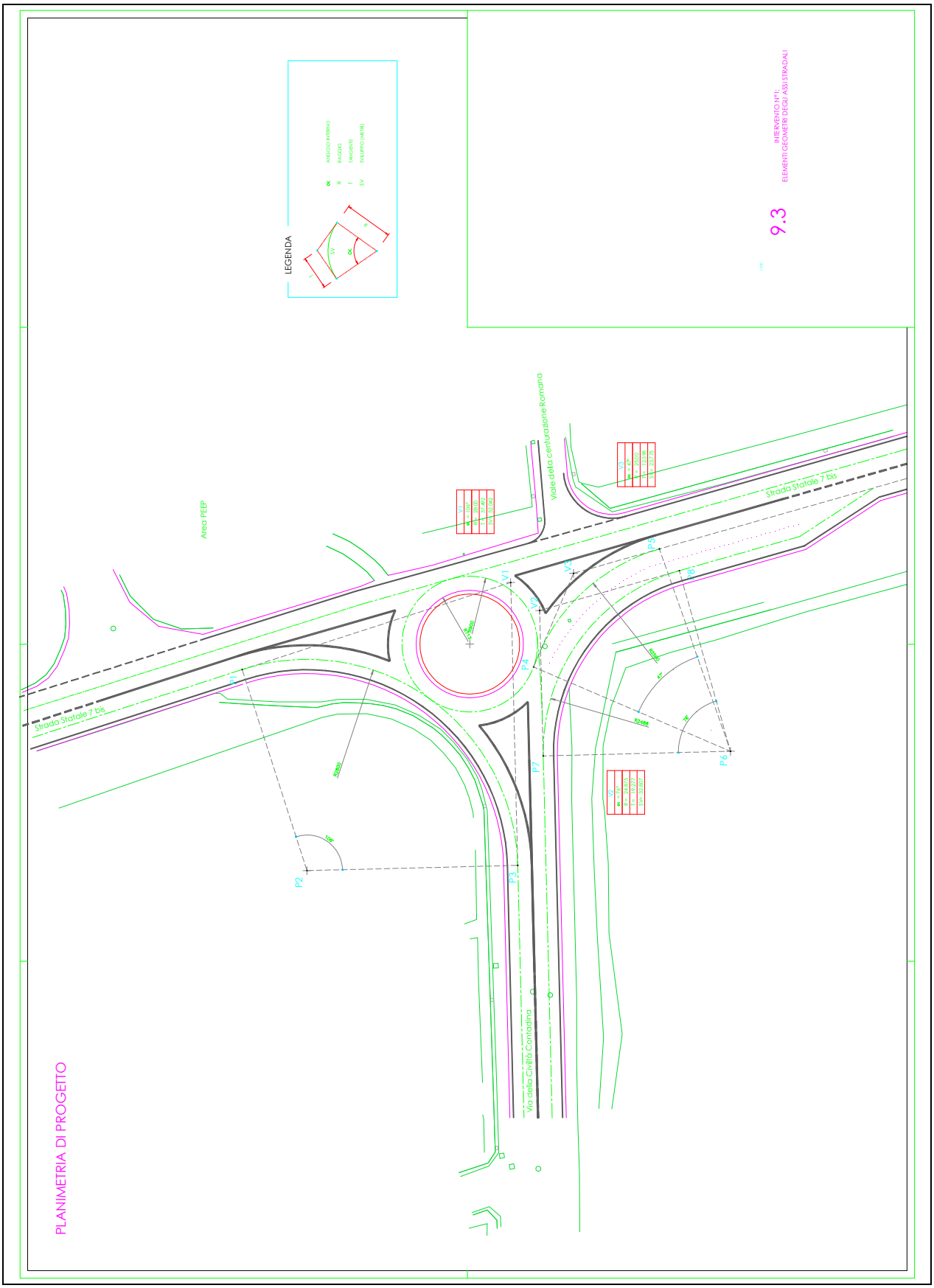


Figure 44: Technicians' project - Geometric elements

7. CONCLUSIONS

At the end of the project we presented our ideas to the administration. We were not able to implement them within the deadline but we managed to sensitize local authorities. We do not know when the roundabout will be built because the Italian bureaucracy is really very complex.

When the roundabout will be built, we will have a great achievement in terms of reduction of accidents and vehicles speed.

THANKS FOR THE OPPORTUNITY !!!

T.C.

SECONDA UNIVERSITA' DEGLI STUDI DI NAPOLI

FACOLTA' DI INGEGNERIA

ETSC European Transport Safety Council

STRADA PROVINCIALE 341 - CASERTA

Riduzione della velocità nel tratto urbano
Comune di San Tammaro (CE)

PROGETTO PRELIMINARE

Elaborato: Rilievi e Soluzioni

PROGETTISTI	IL RESPONSABILE STUDI E PROGETTI
Ing. Alfonso Iuliano Ing. Alfonso Pascarella	Prof. Ing. Mariano Pernetti

SCALA:
vedi grafici

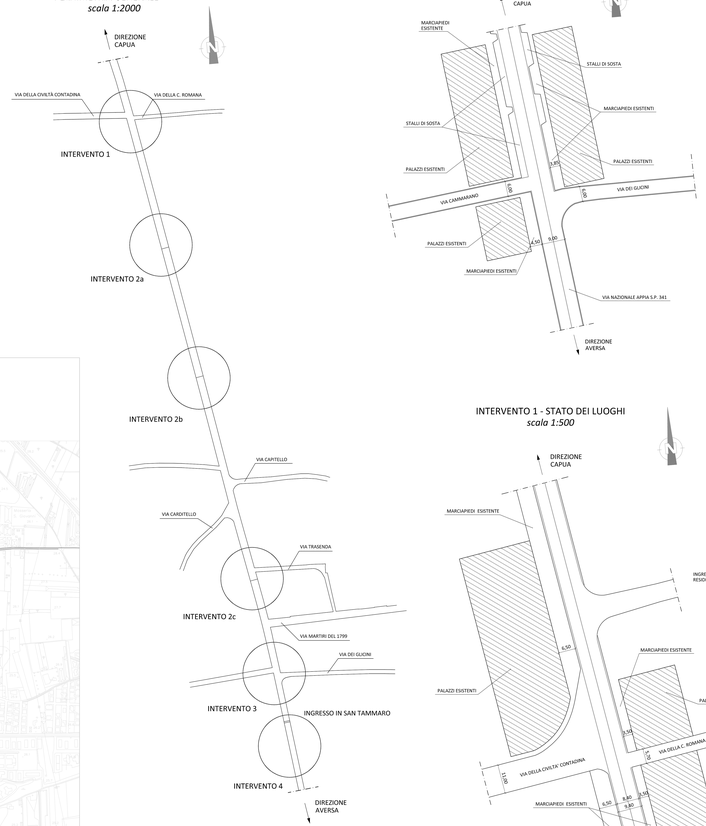
REVISIONE	ELABORAZIONE:	VERIFICA:	APPROVAZIONE:	DATA:

COMUNE DI
SAN TAMMARO
PROVINCIA DI CASERTA

CARTOGRAFIA NUMERICA
DA RILIEVI AEROFOTOGRAMMETRICI

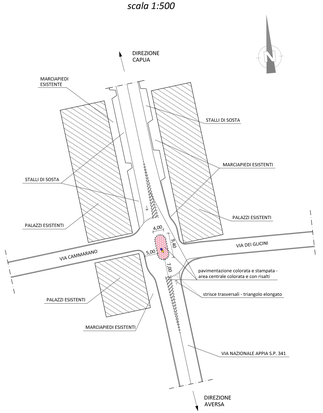
SCALA 1:5000

PLANIMETRIA GENERALE
scala 1:2000

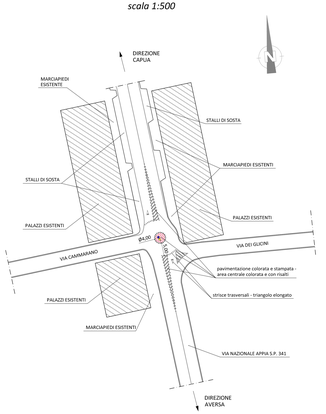


INTERVENTO 3 - STATO DEI LUOGHI
scala 1:500

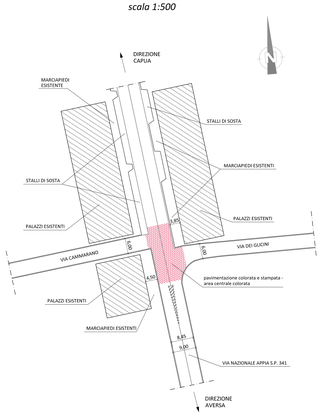
INTERVENTO 3 - SOLUZIONE A
scala 1:500



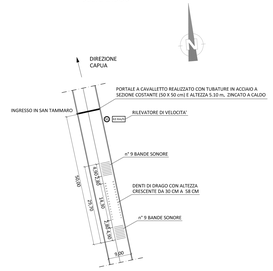
INTERVENTO 3 - SOLUZIONE B
scala 1:500



INTERVENTO 3 - SOLUZIONE C
scala 1:500



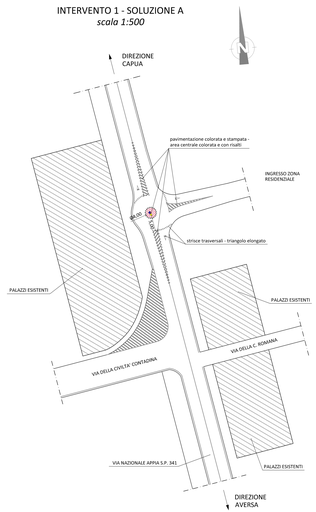
INTERVENTO 4
scala 1:500



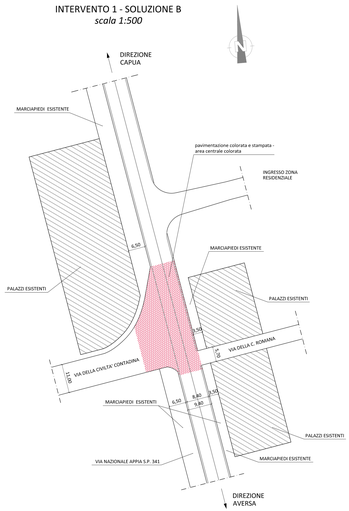
N.B.
L' intervento 4 è stato previsto a prescindere dalla soluzione adottata.

INTERVENTO 1 - STATO DEI LUOGHI
scala 1:500

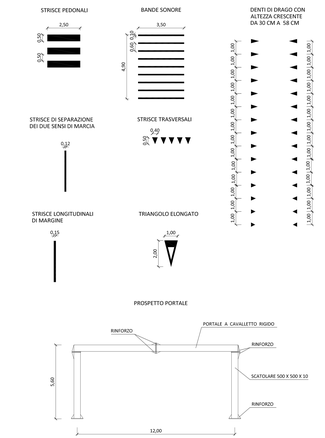
INTERVENTO 1 - SOLUZIONE A
scala 1:500



INTERVENTO 1 - SOLUZIONE B
scala 1:500

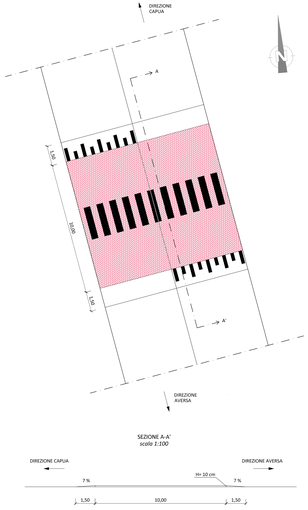


PARTICOLARI INTERVENTI
scala 1:100



INTERVENTI 2a-2b-2c
INSERIMENTO ATTRAVERSAMENTI PEDONALI RIALZATI

PIANTA
scala 1:100



SEZIONE A-A'
scala 1:100

Figure 45: Our final project