



## SAFETY IMPROVEMENT

OF A DANGEROUS FOUR-LEG, STOP CONTROLLED INTERSECTION IN AFRAGOLA, ITALY



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## BACKGROUND

On May 6, 2016 Francesca Podda presented the project **Young Europeans Acting for Road Safety** at the Department of Civil, Architectural and Environmental Engineering of the University of Naples Federico II

The seminar was attended by **50 students of the course Highway Design** taught at the Master Programme in Hydraulic and Transportation Systems Engineering

The **University of Naples Federico II was established in 1224** through an Imperial Charter of Frederick II Hohenstaufen, King of Sicily and Holy Roman Emperor. It was the **first publicly funded university in Europe**

Nowadays the university offers courses in essentially all academic disciplines, leading to 155 graduate level degrees. Current **student enrollment nears 86,000** and the academic personnel is 2532

The university is made up of **3 Schools** - the Polytechnical and Basic Sciences School, the School of Medicine and the School of Human and Social Sciences - and **26 Departments**

## BACKGROUND

**The students** of the course Highway Design participated to the YEARS project presenting **6 projects**

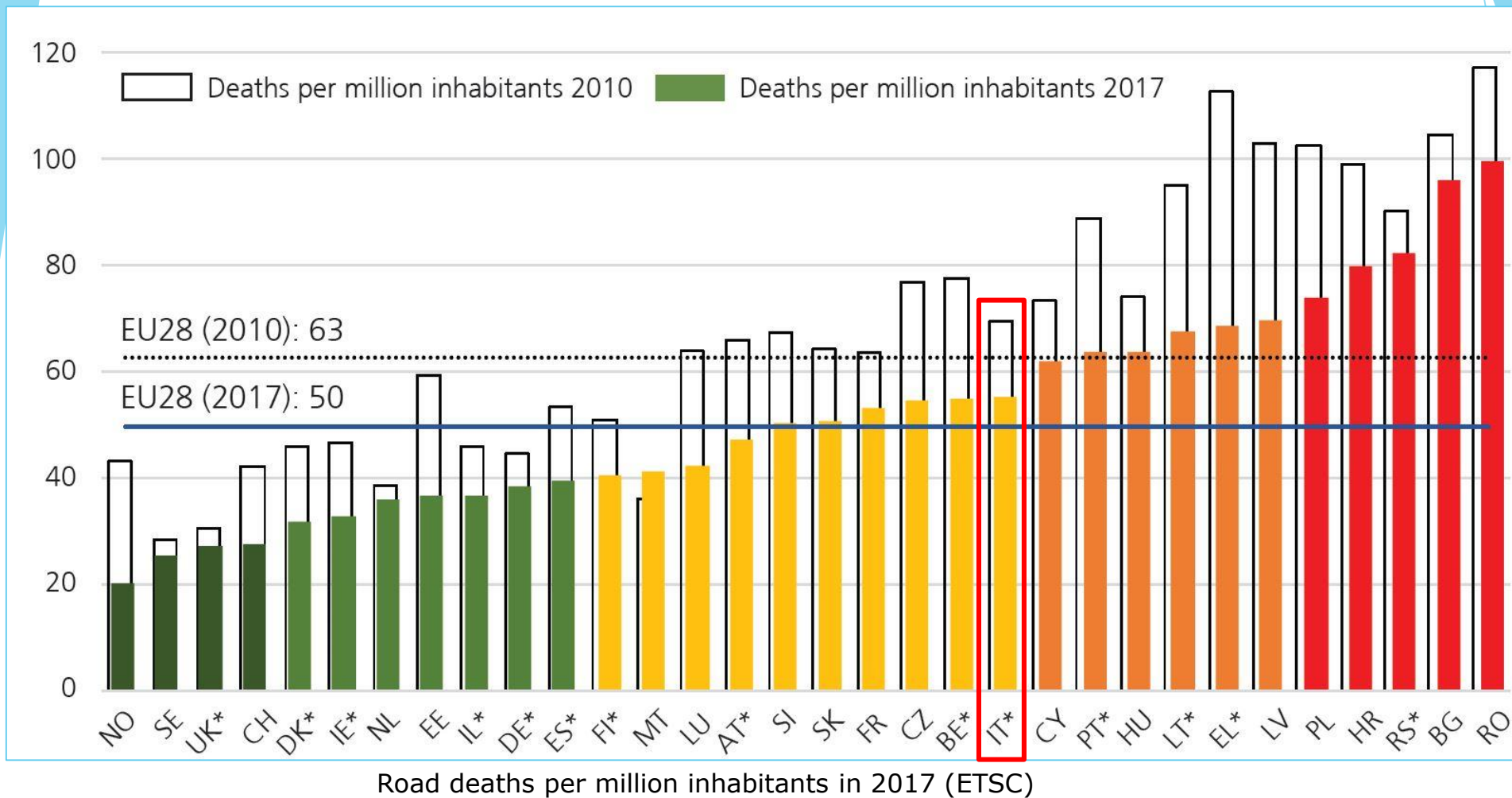
Among these projects, the project of **Giuseppe Silvestro** and **Vincenzo Viro** (who later attended also the Highway Safety course at the University of Naples) was selected to participate to the **YEARS camp** in Brussels from 24 to 28 October 2016

Due to budget constraints, the project was revised and a new project with a very low cost (3.000,00 €) was presented to the Municipality of Afragola

In the meeting held on June 13, 2017 at the Municipality of Afragola, attended also by **Antonio Avenoso, Francesca Podda** and **Michael Woodford, Safer Roads Foundation** has decided to finance the project

After a technical meeting, the **project was improved** and the cost was increased to 22.000,00 € (plus VAT)

# CRASH DATA - ITALY



Road deaths in 2017 = **3,378** (Source ISTAT)

Road deaths per million inhabitants in 2017 = **55** (Source ETSC)

Road injuries in 2017 = **246'750** (Source ISTAT)



# LOCATION AND SITE OVERVIEW

The Corso Meridionale / Via Ugo Foscolo four-leg intersection is located in the residential area of the Afragola Municipality.

Corso Meridionale (the main road) is a two-lane urban collector that connects the residential area with the rural highway SS 162 NC. Via Ugo Foscolo is a two lane urban local road that provides access to residences and commercial activities.



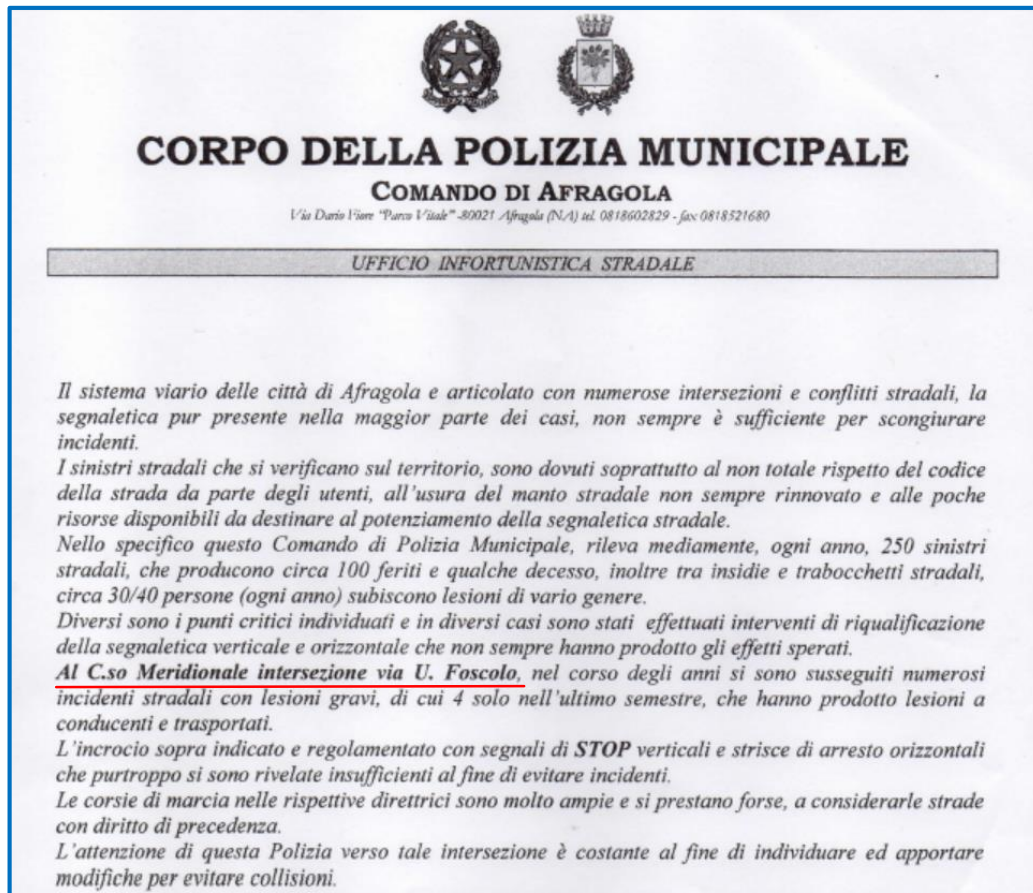
# CHOICE OF THE HIGH RISK SITE

Crash data for the Corso Meridionale/Via Foscolo intersection

PERIOD 2011 – 2017

**Number of crashes = 34**

**Number of injuries = 23**



According to the report provided by Local Police, Corso Meridionale/Via Ugo Foscolo intersection was the most dangerous of the city



# ROAD SAFETY ISSUES

## Cross-Sections

Two-lane roads.

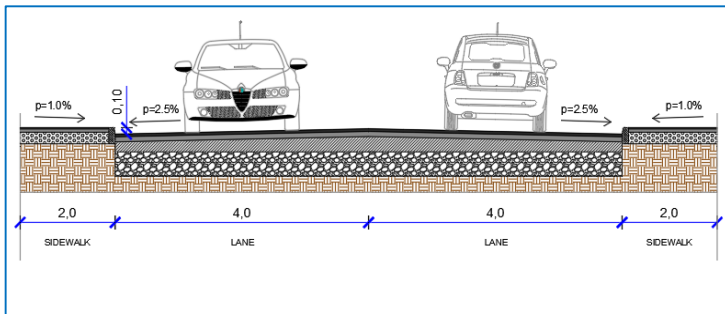
The carriageway of the minor road is wider than the carriageway of the major road.

The minor road dimensions give rise to a misperception of the priority rules.

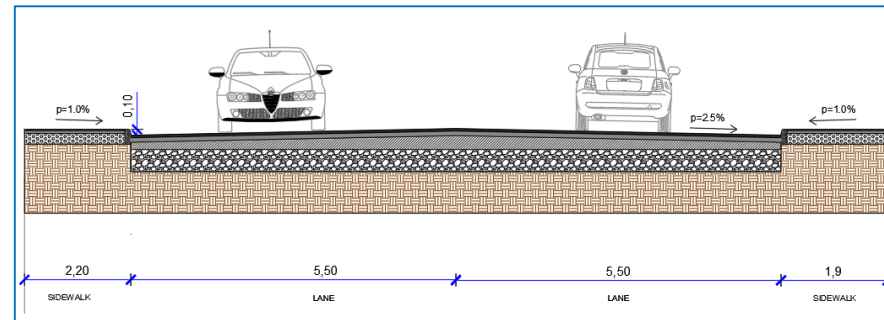
Several road users on the minor road do not give way to vehicles on the major road, causing right-angle, rear-end and sideswipe crashes.



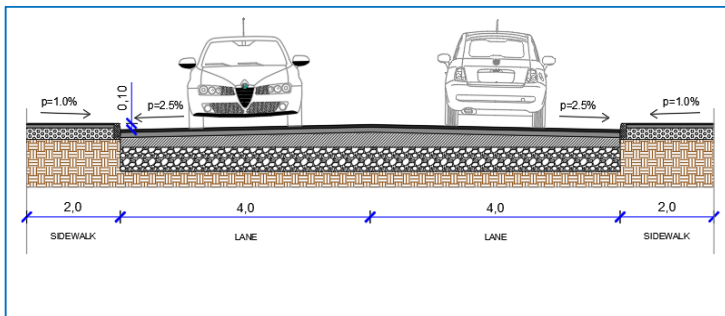
Leg 1 - Major Road, Corso Meridionale



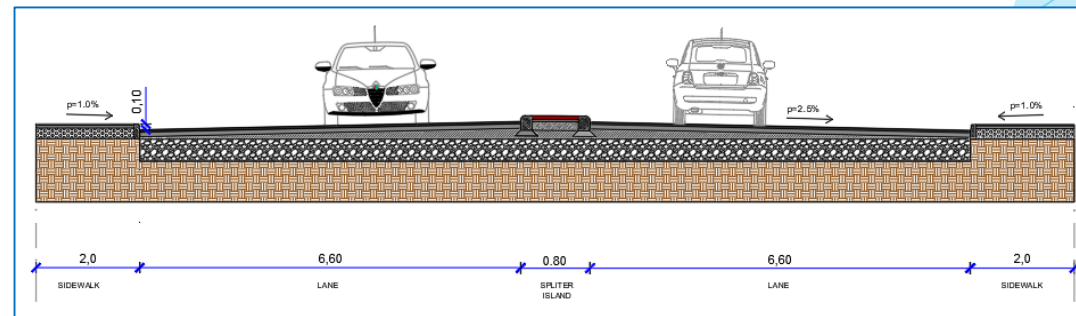
Leg 3 - Minor Road, via Ugo Foscolo



Leg 2 - Major Road, Corso Meridionale

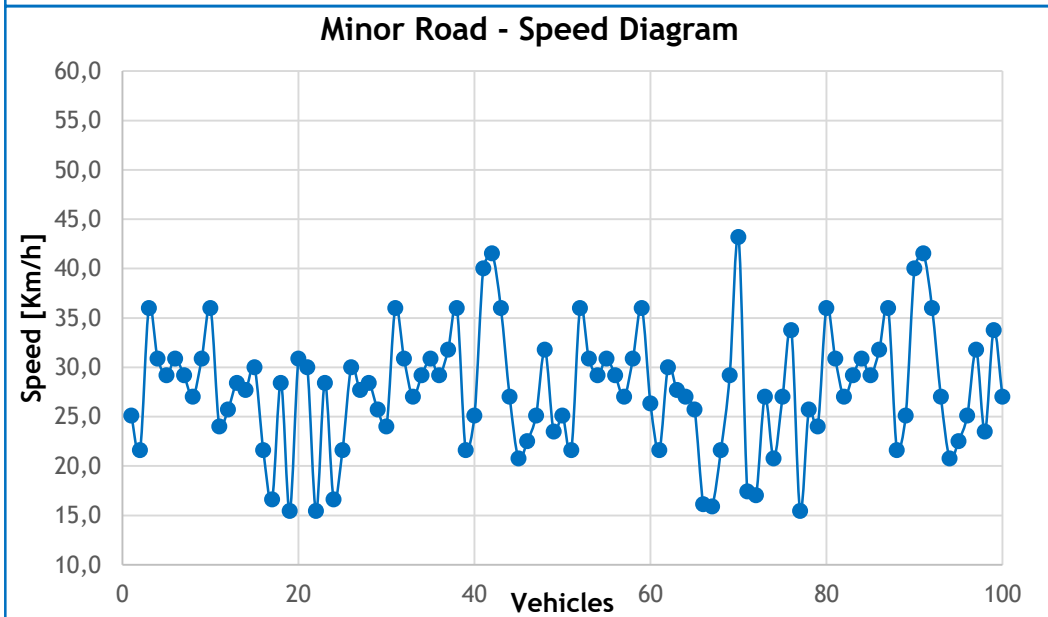
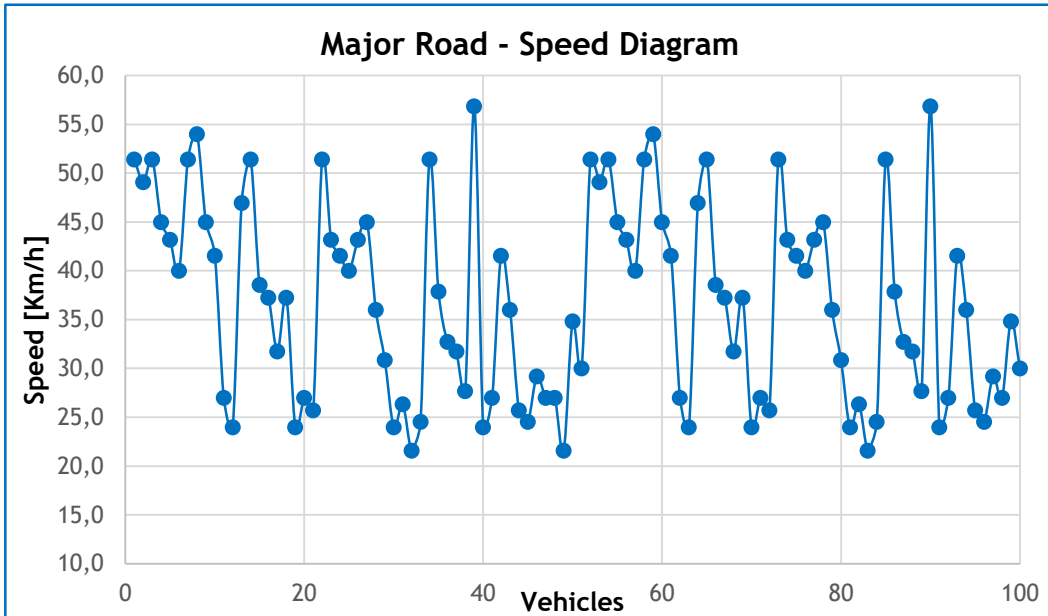


Leg 4 - Minor Road, via Ugo Foscolo



# ROAD SAFETY ISSUES

## Speeding



Measured speeds on the major and minor road are showed in the diagrams on the left.

Speeds were inconsistent with an urban setting.

SPEED (km/h)	Major Road	Minor Road
Average	36.7	27.7
85th Percentile	51.4	34.1

# ROAD SAFETY ISSUES

## Inadequate Splitter Island

A splitter island was present on via Ugo Foscolo (Leg 4), but there was evidence of several crashes.

Due to the vertical curbs and irregular stones, the splitter island was a significant risk factor for pedestrians, cyclists and motorcyclists.





# ROAD SAFETY ISSUES

## Inadequate Pavement Condition

Inadequate wearing course condition has been identified during a visual inspection of pavement.

The present issue compromises drainage with a negative effect on friction.

Inadequate pavement condition may cause various crash types, such as run-off-the-road and rear-end.



# ROAD SAFETY ISSUES

## Poor Markings

Poor markings conditions were observed.

The following markings were totally absent:

- Stop lines;
- Stop pavement symbols;
- Zebra Crossings.



Poor markings is one of the reasons of road users do not observing the priority rules.  
The present issue can be considered a contributory factor of head-on and angle crashes.



# ROAD SAFETY ISSUES

## Poor Signs

Signs are covered by the vegetation.

The inadequate signs can be considered a contributory factor of rear-end, sideswipe and angle crashes.



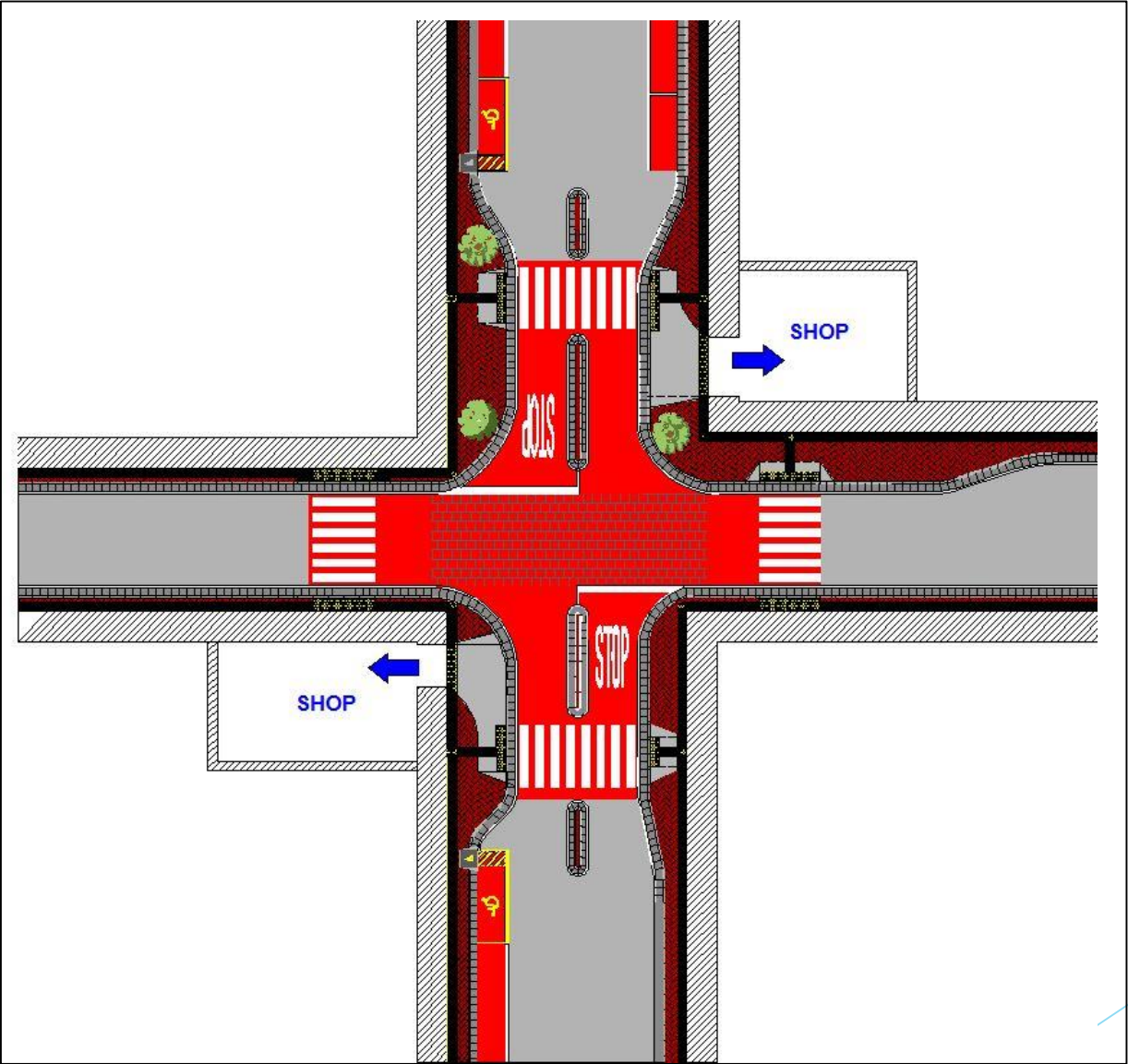
# ROAD SAFETY ISSUES

	Pedestrian	Head-on	Sideswipe	Rear-end
Inadequate Cross Sections		X	X	X
Speeding	X	X	X	X
Inadequate Splitter Island	X	X	X	X
Poor Markings	X	X	X	X
Poor Signs	X	X	X	
Inadequate Pavement Condition		X	X	X

# PROPOSAL LAYOUT

## General Plan View

### First Proposal





# PROJECT EVOLUTION

## Main difficulties

- No budget availability from Afragola Municipality

## Sponsors



### **University of Naples Federico II**

Prof. Alfonso Montella



European Transport Safety Council

### **European Transport Safety Council**

Antonio Avenoso (Executive Director)

Francesca Podda (Project manager)



### **The Safer Roads Foundation**

Michael Woodford

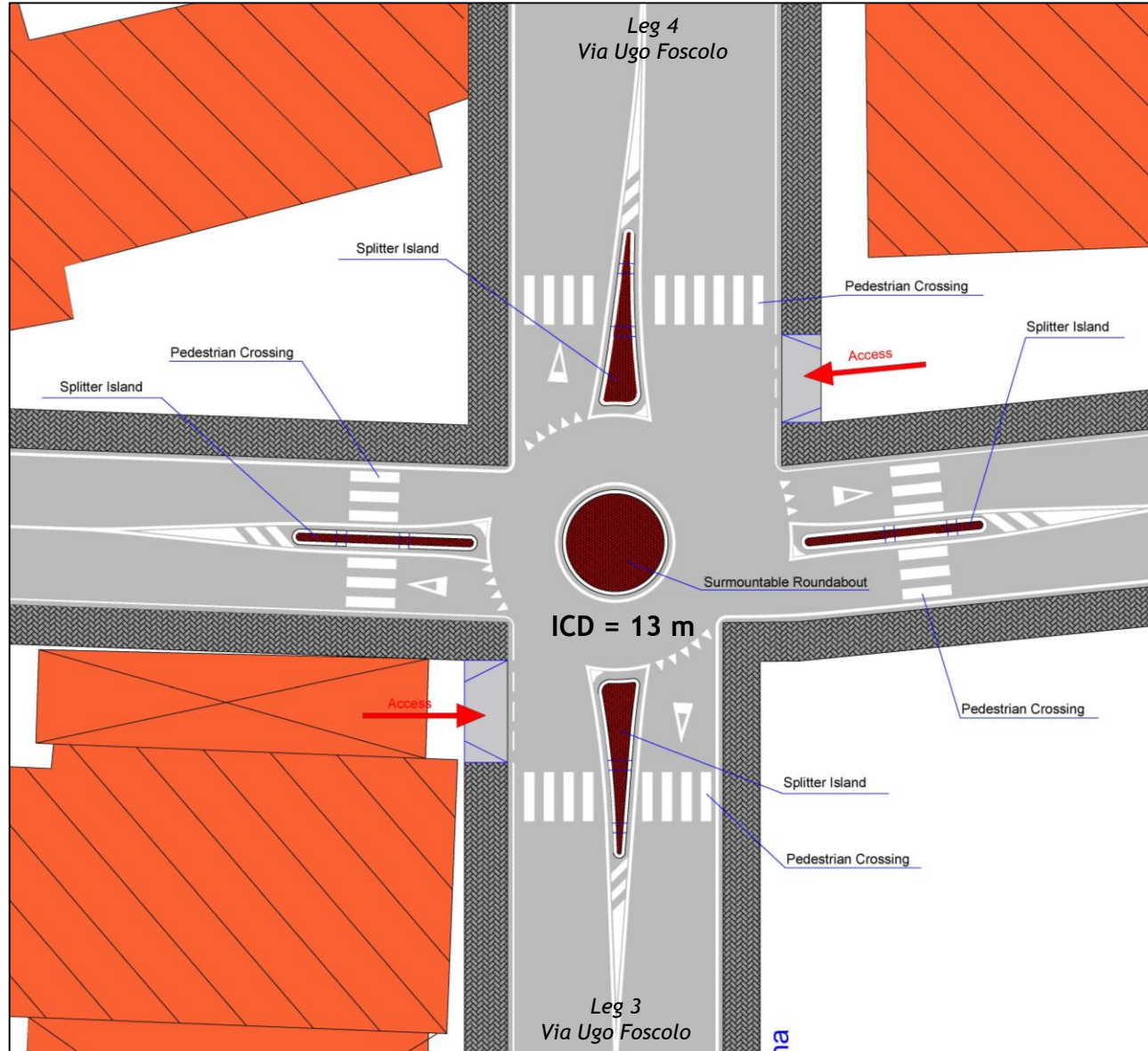
Nuncy Somavilla

# PROPOSAL LAYOUT

## General Plan View

### Final Proposal

Leg 1, Corso Meridionale



Leg 2, Corso Meridionale

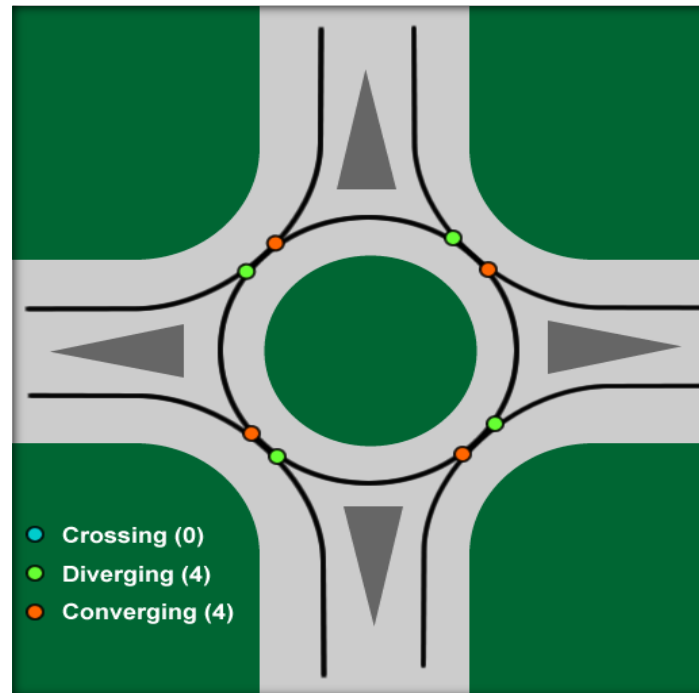
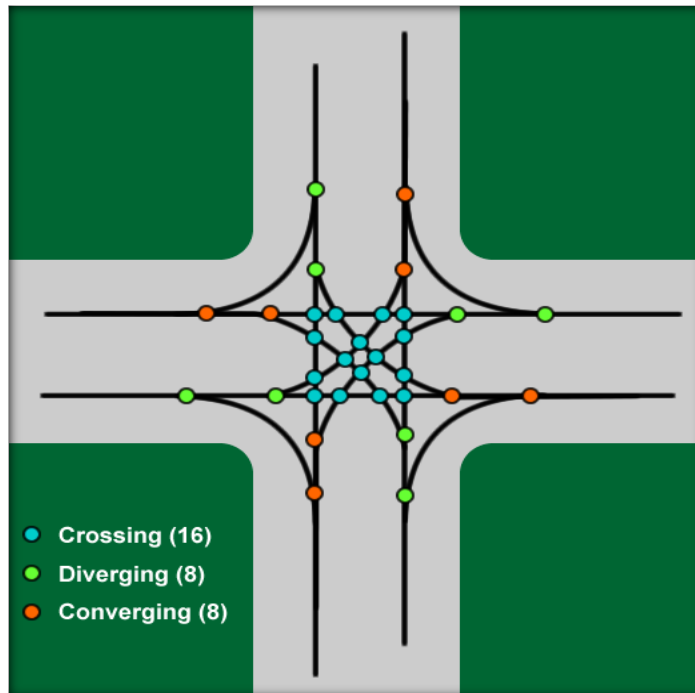
# PROPOSAL LAYOUT

## Mini-roundabout Benefits

The improvement proposed to solve the road safety issues at Corso Meridionale / Via Ugo Foscolo intersection consists in a mini-roundabout.

Several reasons make mini-roundabouts a great alternative for cities to consider when redesigning an intersection:

- They are usually the lowest-cost option, both in construction and maintenance.
- They provide an improvement in terms of traffic congestion.
- Construction is usually of short duration.
- As shown in the following figure, they eliminate crossing conflicts that are present at conventional intersections, thus reducing the total number of potential conflict points at the most severe of those conflict points.



# PROPOSAL LAYOUT

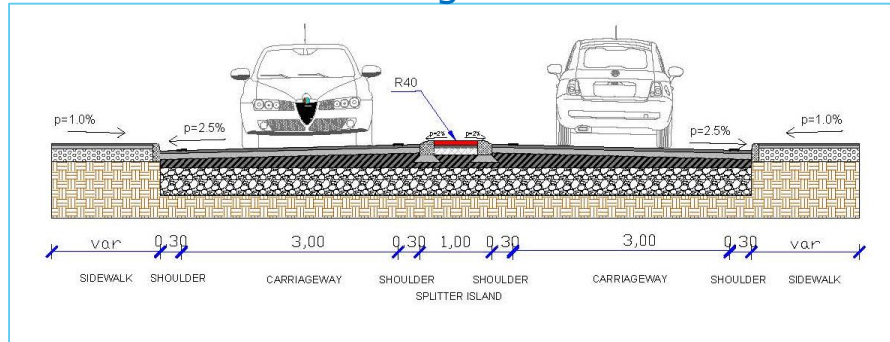
## Description

The central island and the splitter islands are designed in red brick paver to give drivers a visual impact to let them slow down and to give the perception of being in the urban setting.

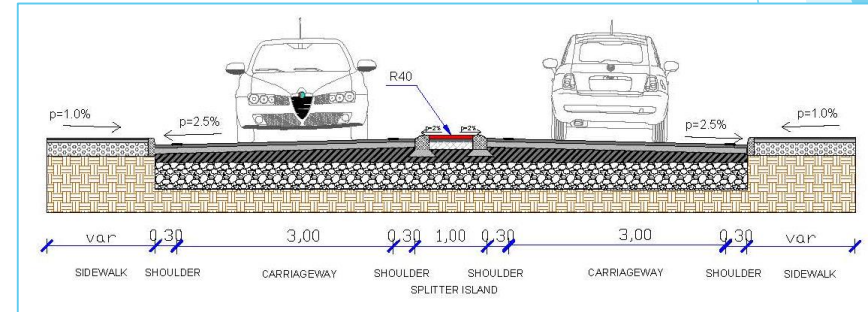
The shape of the splitter islands has been designed to reduce the carriageway width and to improve the priorities perception on the minor road.

## Cross Sections

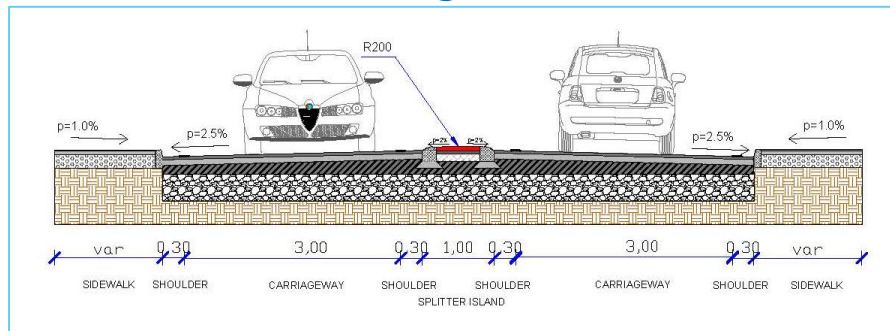
### Leg 1



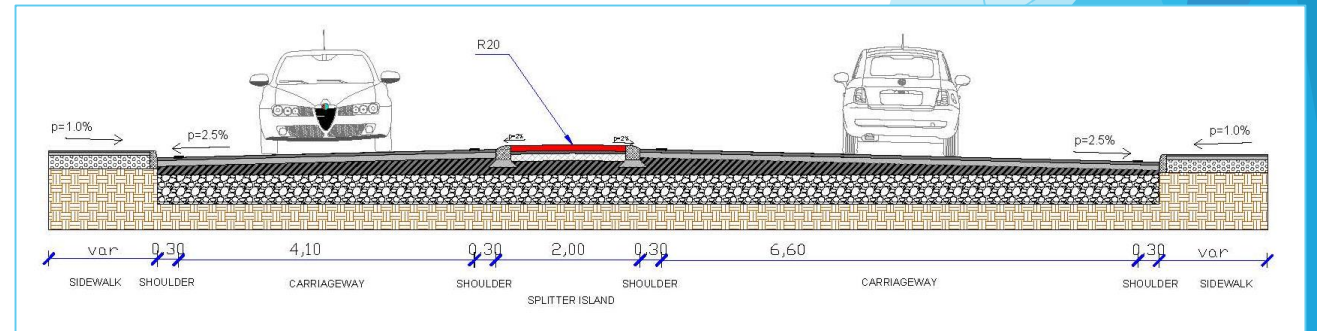
### Leg 3



### Leg 2



### Leg 4

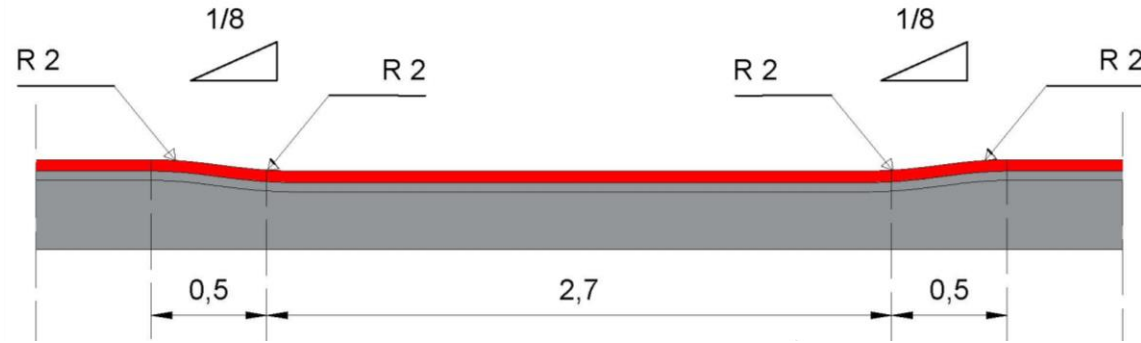




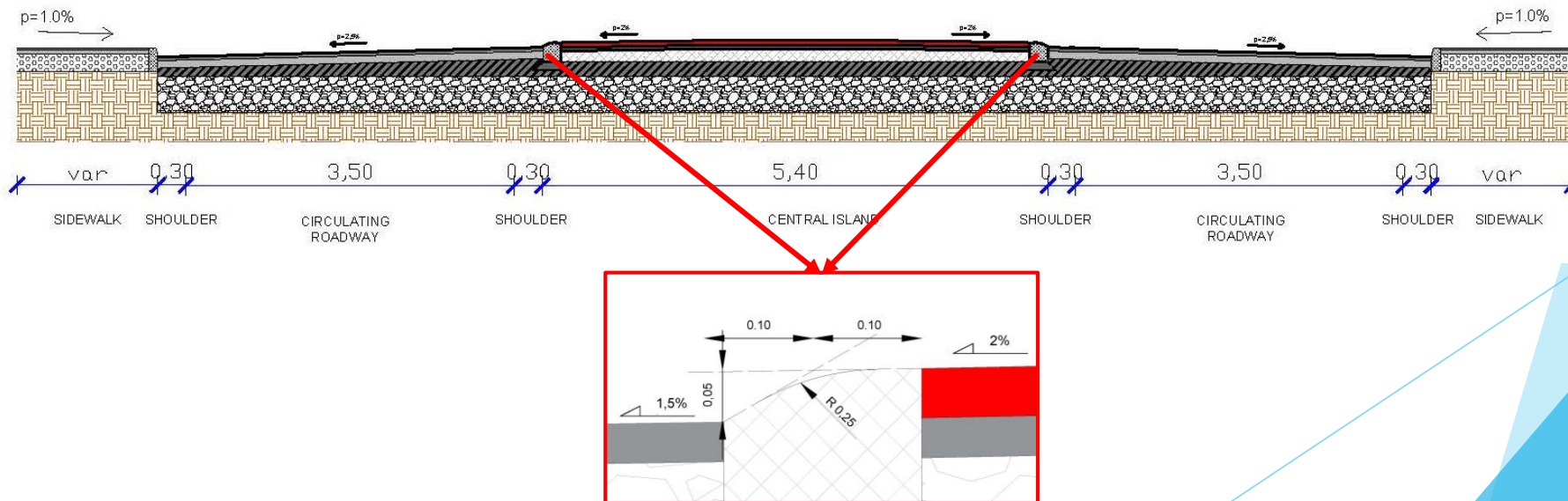
# PROPOSAL LAYOUT

## Splitter Islands

As shown in the following figure, splitter islands height has been reduced at pedestrian crossing proximity to improve the accessibility of the walking routes.



The central island and splitter islands curbs are totally surmountable. As indicate in the following figure, a curbs height of 5 centimetres has been designed to reduce the danger for vulnerable road users.

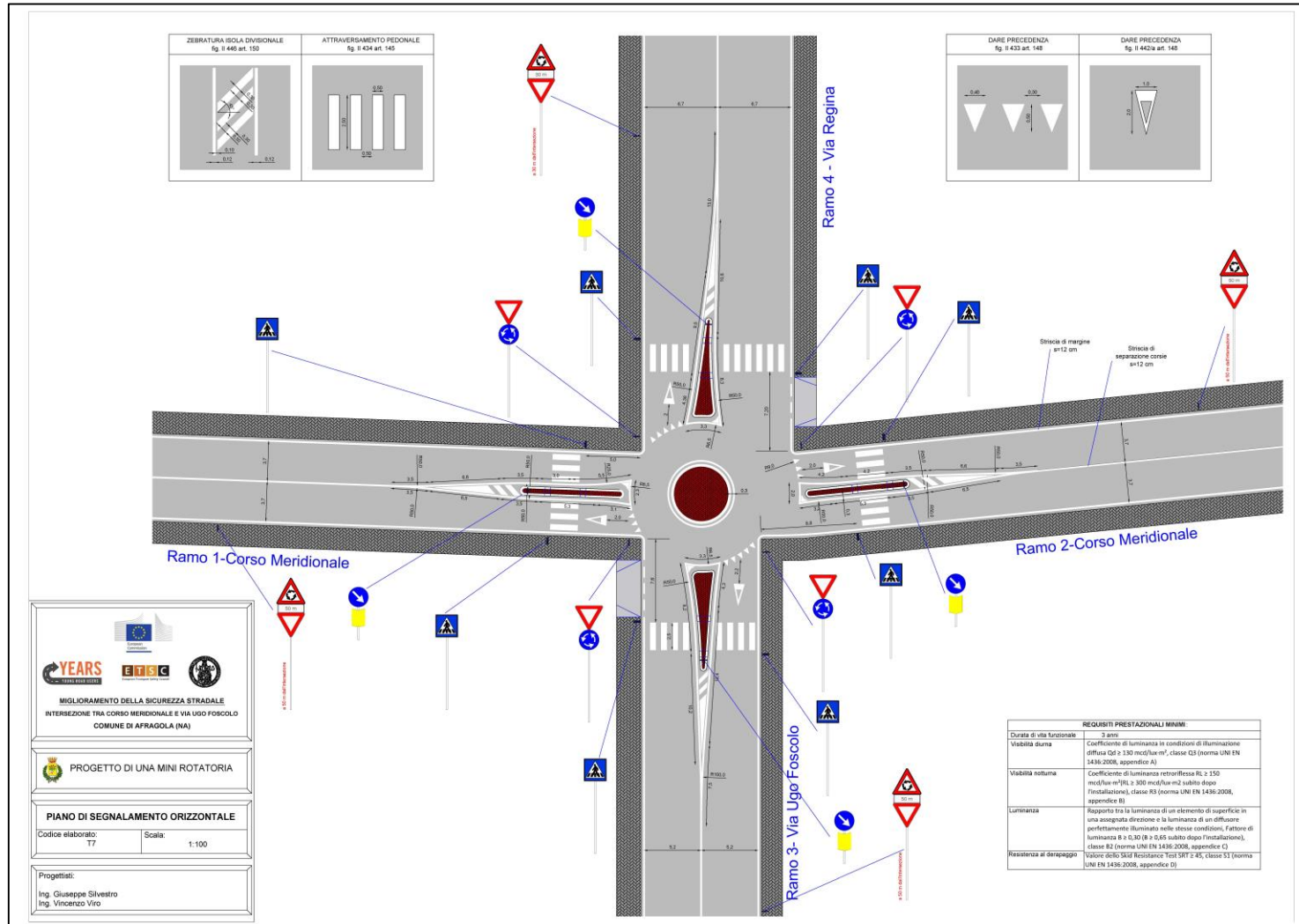




# PROPOSAL LAYOUT

## Markings

An adequate Marking Plan has been provided to improve the perception of the intersection.

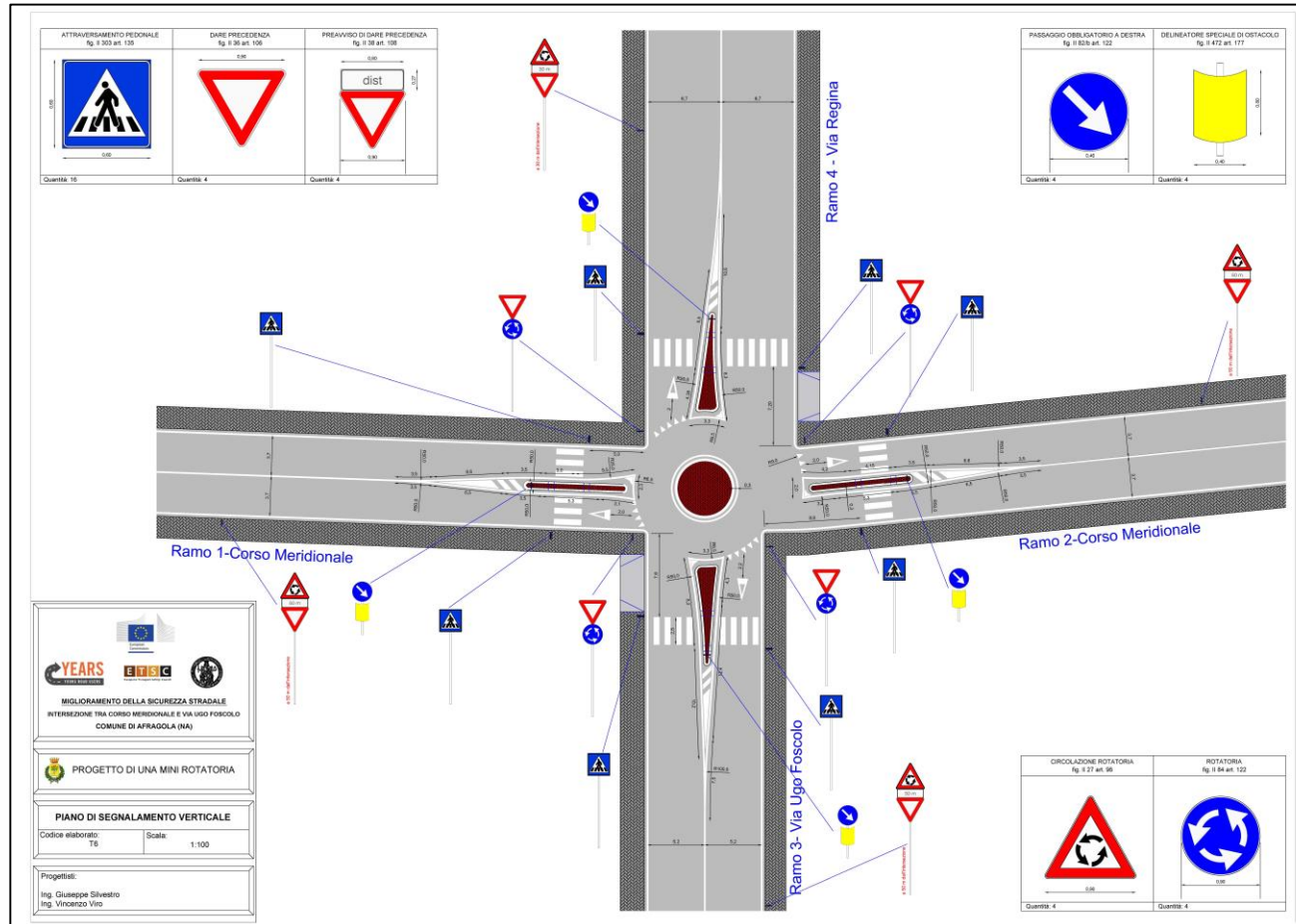


According to European Standards, high quality of reflection have been recommended to improve the intersection visibility during the night.

# PROPOSAL LAYOUT

## Signs

A pruning of trees has been recommended to improve the signs visibility. Furthermore, a new signs plan has been designed in line with the proposed roundabout layout.



According to European Standards, high quality of reflection have been recommended to improve the perception of the intersection during the night.

# PROPOSAL LAYOUT

## Costs

The Road Safety improvement proposed costs were computed based on the Italian schedules and experience in the field. Costs are summarized in the following table:

Description	EUR
Roundabout and Splitter Islands	4.925,38
Markings	1.225,35
Signs	2.167,00
Pavement	13.641,00
Taxes	4.716,99
<b>TOTAL</b>	<b>26.675,72</b>

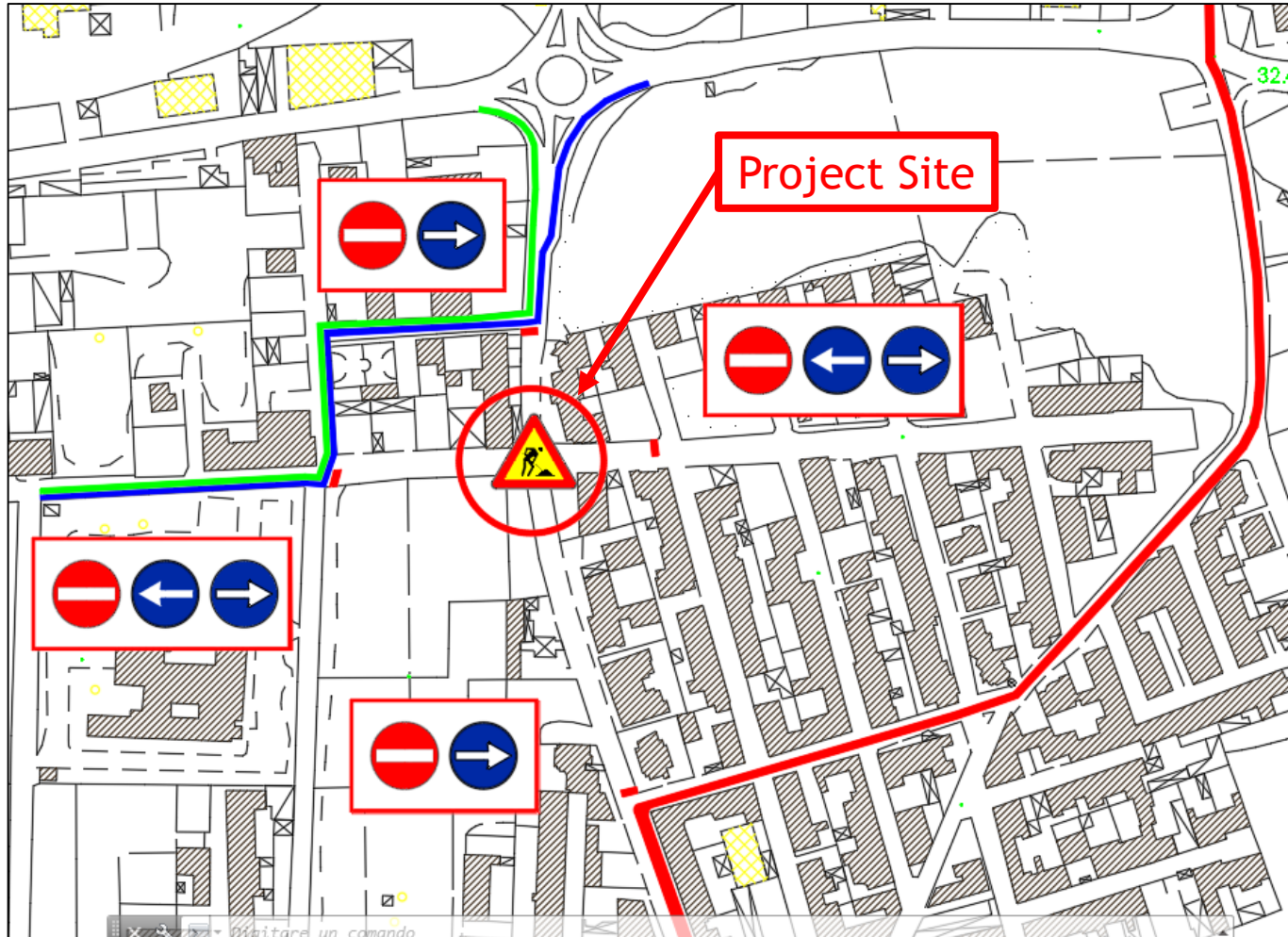
Based on the Bill of Quantities summarized in the following table, LTN (the construction company) realized works for a total amount of **26.157,87 €**.

# CONSTRUCTION TIMELINE

## Phase 1 – Temporary Traffic Plan

Date: November 26, 2017

To allow the construction of the designed roundabout without compromising the vehicles flows, a temporary traffic plan has been provided.





# CONSTRUCTION TIMELINE

## Phase 2 – Management of the construction site

Date: November 27, 2017





# CONSTRUCTION TIMELINE

## Phase 3 – Roundabout and Splitter Islands realization

Date: from November 28, 2017 to December 11, 2017

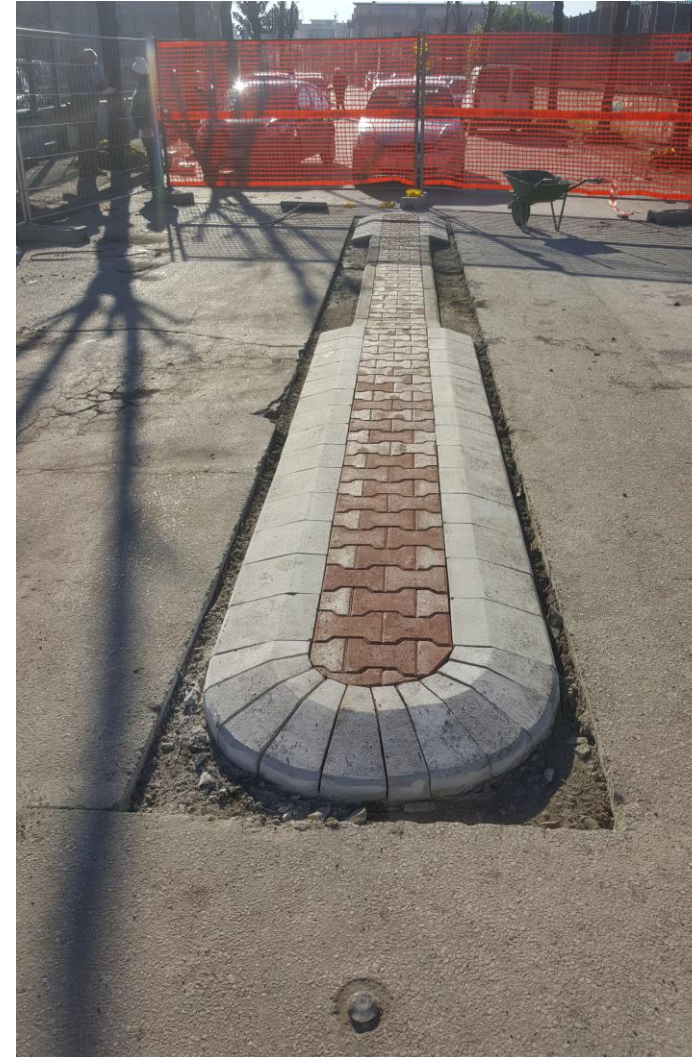
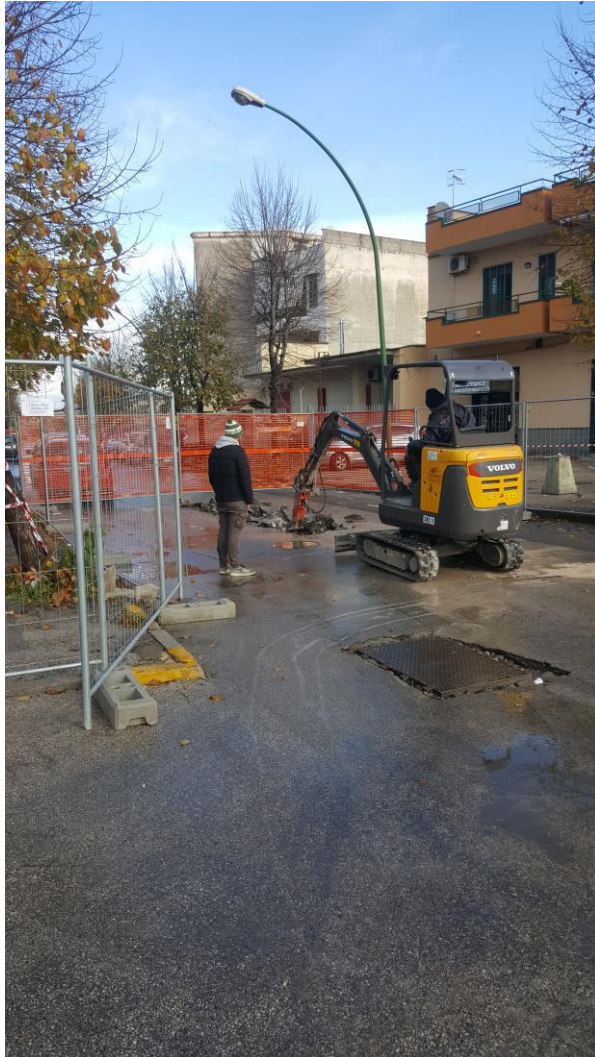




# CONSTRUCTION TIMELINE

## Phase 3 – Roundabout and Splitter Islands realization

Date: from November 28, 2017 to December 11, 2017





# CONSTRUCTION TIMELINE

## Phase 4 – Wearing Course realization

Date: from December 12, 2017 to December 18, 2017





# CONSTRUCTION TIMELINE

## Phase 5 – Markings and Signs

Date: from December 18, 2017 to December 19, 2017





# CONSTRUCTION TIMELINE

## Phase 5 – Markings and Signs

Date: from December 18, 2017 to December 19, 2017





# CONSTRUCTION TIMELINE

## Phase 6 – End of Works

Date: December 20, 2017





## SPONSORS



December 18, 2017



# SPONSORS



July 18, 2018







# COMPARISON BEFORE/AFTER Splitter Islands

Before



After





# COMPARISON BEFORE/AFTER Signs

Before



After





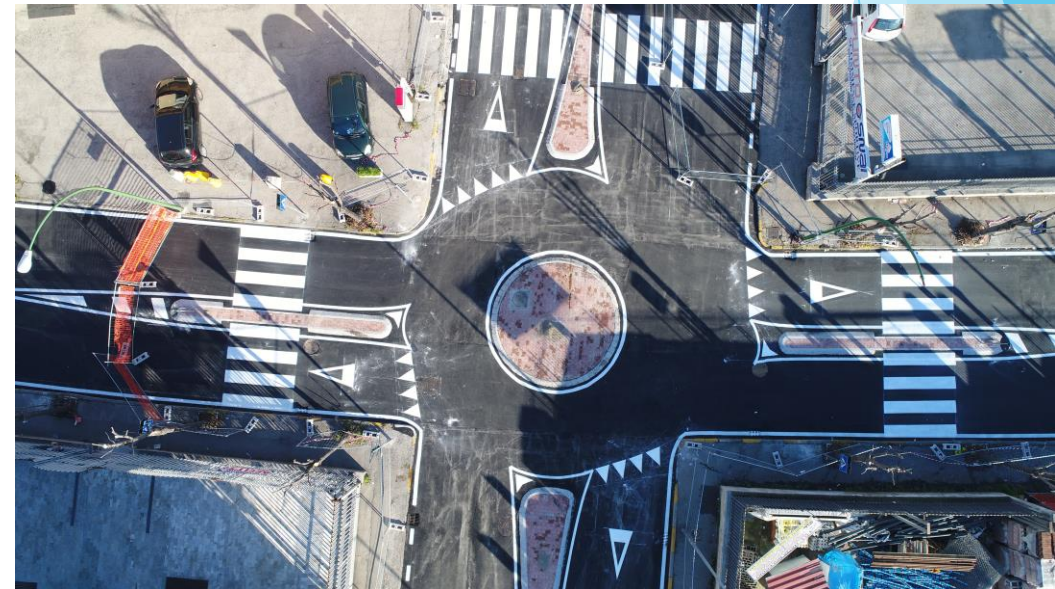
# COMPARISON BEFORE/AFTER

## Markings and Pavement Condition

**Before**



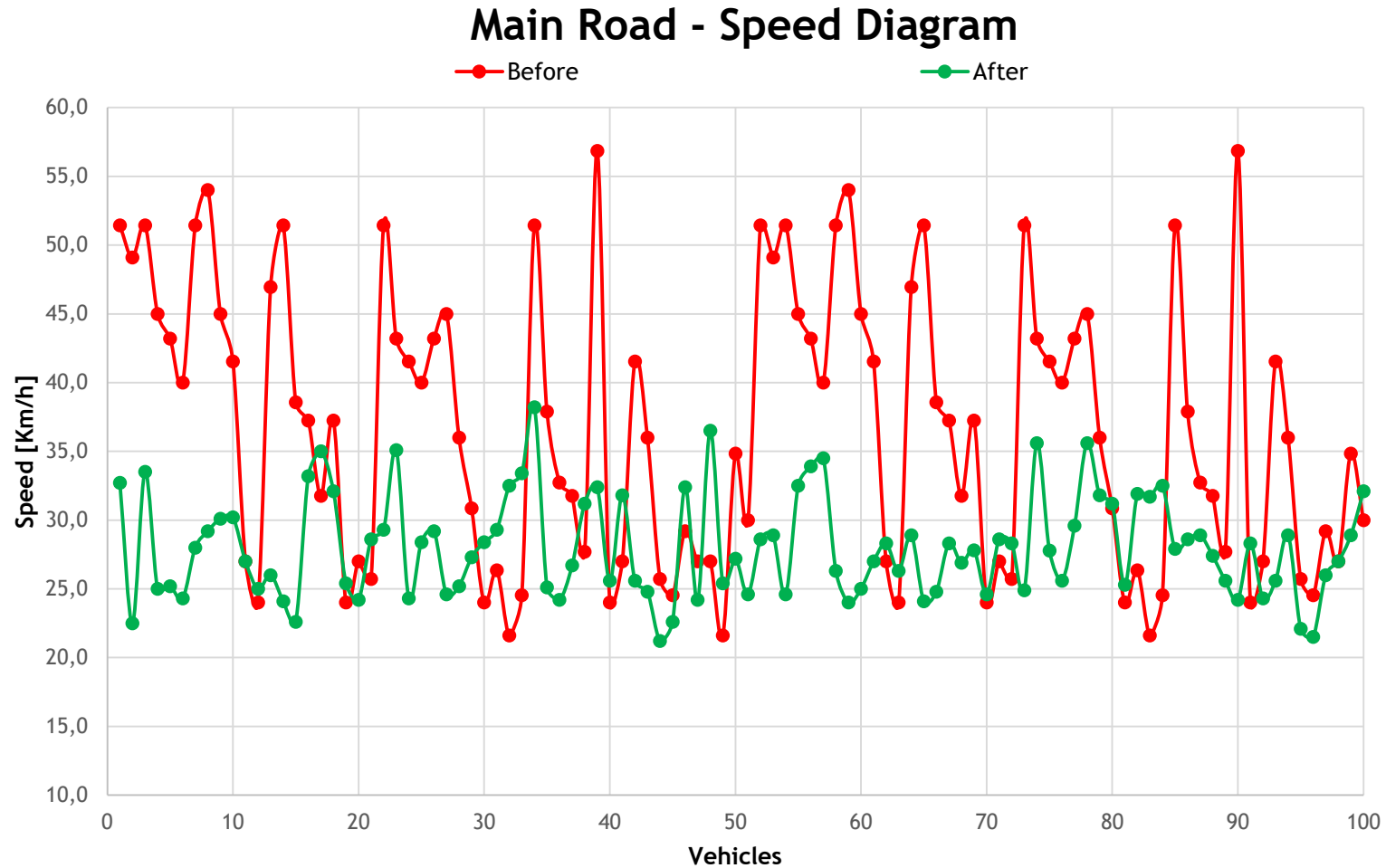
**After**





# COMPARISON BEFORE/AFTER

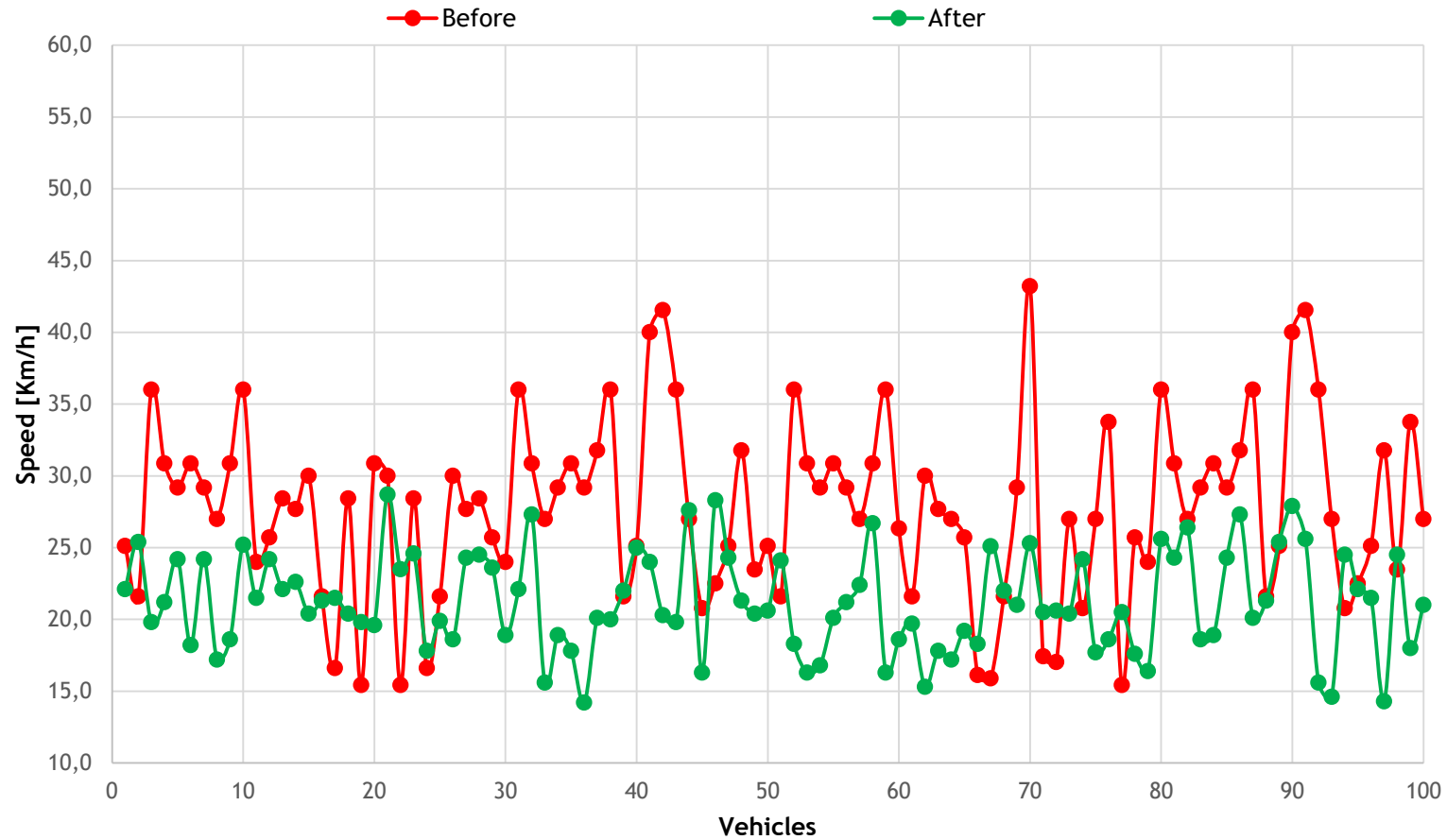
## Speeding



	Before	After
<b>Average Speed [Km/h]</b>	36.7	28.0
<b>85th Percentile Speed [Km/h]</b>	51.4	32.4

# COMPARISON BEFORE / AFTER Speeding

## Minor Road - Speed Diagram



	Before	After
Average Speed [Km/h]	27.7	21.2
85th Percentile Speed [Km/h]	34.1	25.0



# DISSEMINATION

## University Lectures

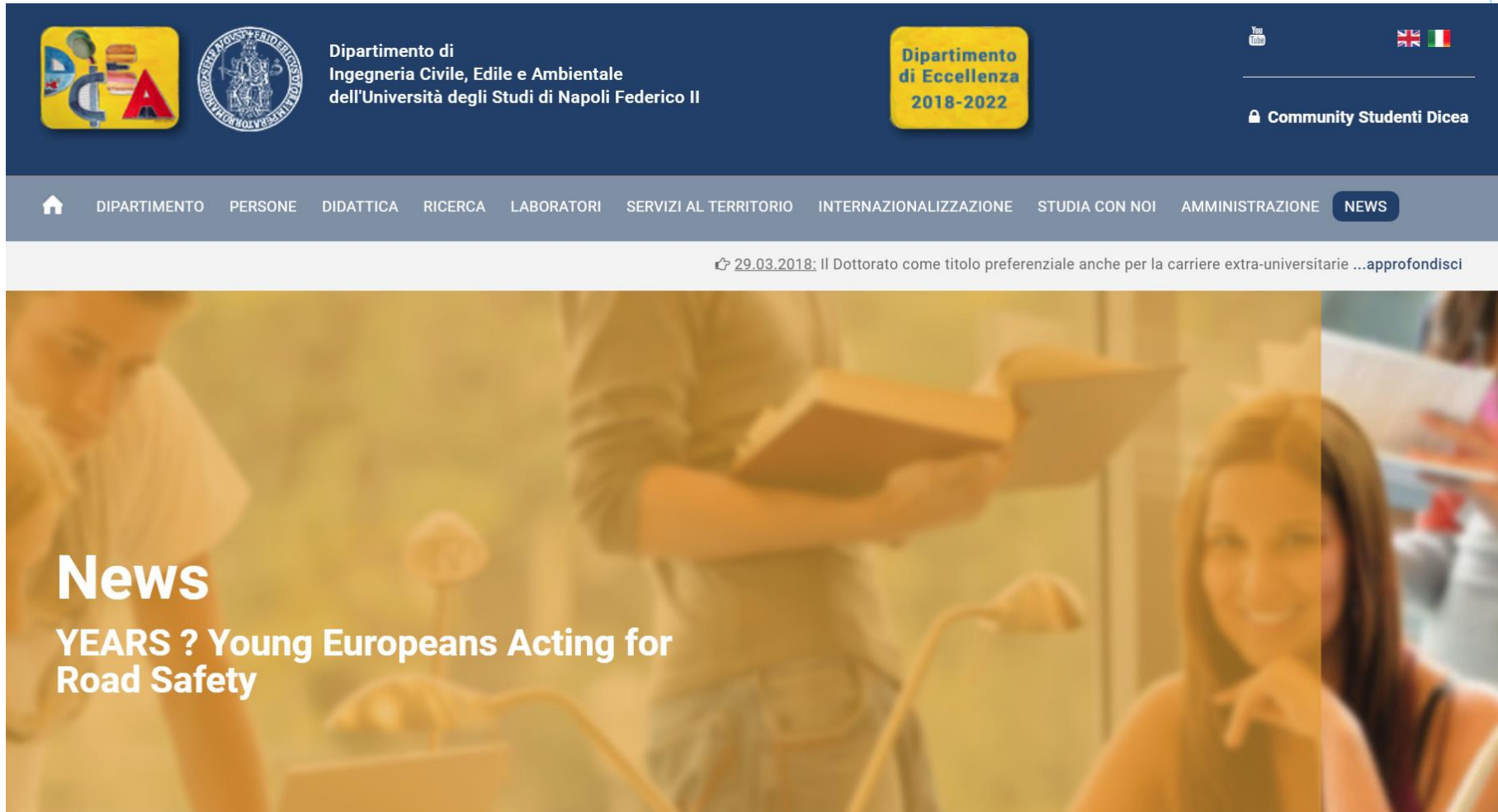
Courses of Highway Design and Road Safety



# DISSEMINATION

## WEB

Website of the Department of Civil, Architectural and Environmental Engineering



The screenshot shows the top navigation bar of the website. On the left, there are two logos: a colorful one with 'DCEA' and a circular university seal. The text next to them reads 'Dipartimento di Ingegneria Civile, Edile e Ambientale dell'Università degli Studi di Napoli Federico II'. To the right is a yellow badge that says 'Dipartimento di Eccellenza 2018-2022'. Further right are icons for YouTube and the Italian flag, and a link for 'Community Studenti Dicea'. Below this is a horizontal menu with items: 'DIPARTIMENTO', 'PERSONE', 'DIDATTICA', 'RICERCA', 'LABORATORI', 'SERVIZI AL TERRITORIO', 'INTERNAZIONALIZZAZIONE', 'STUDIA CON NOI', 'AMMINISTRAZIONE', and 'NEWS' (highlighted in a dark blue button). Below the menu is a news snippet: '29.03.2018; Il Dottorato come titolo preferenziale anche per la carriere extra-universitarie ...approfondisci'. The main content area features a large image of students in a classroom with the text 'News YEARS ? Young Europeans Acting for Road Safety' overlaid on the left side.



# DISSEMINATION

## WEB

Website of Professor Alfonso Montella



UNIVERSITA' DEGLI STUDI DI NAPOLI  
FEDERICO II  
DOCENTI



ITALIAN

SEARCH

CONTACTS

PROFESSOR ACCESS



## MONTELLA ALFONSO

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7/12/18

**[YEARS - Young Europeans Acting for Road Safety, Giuseppe Silvestro e Vincenzo Viro saranno premiati a Brussels il 12 settembre](#)**

Published on 7/12/18 in **AVVISI DI CARATTERE GENERALE**

Modified on 7/12/18

# DISSEMINATION

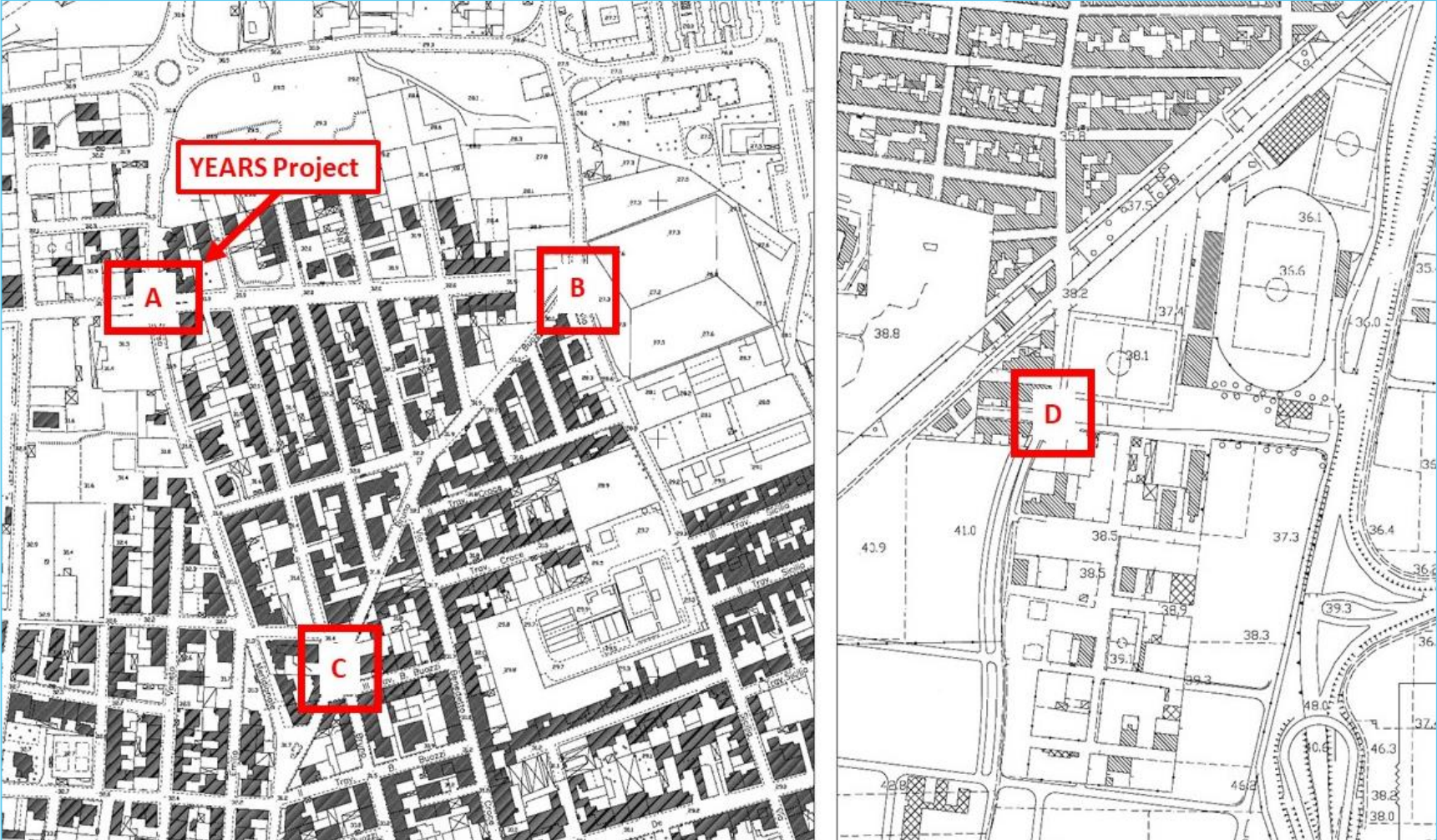
## SOCIAL MEDIA



Thanks to the support of University of Naples, Giuseppe Silvestro and Vincenzo Viro have been involved in a national radio program focused on road safety.



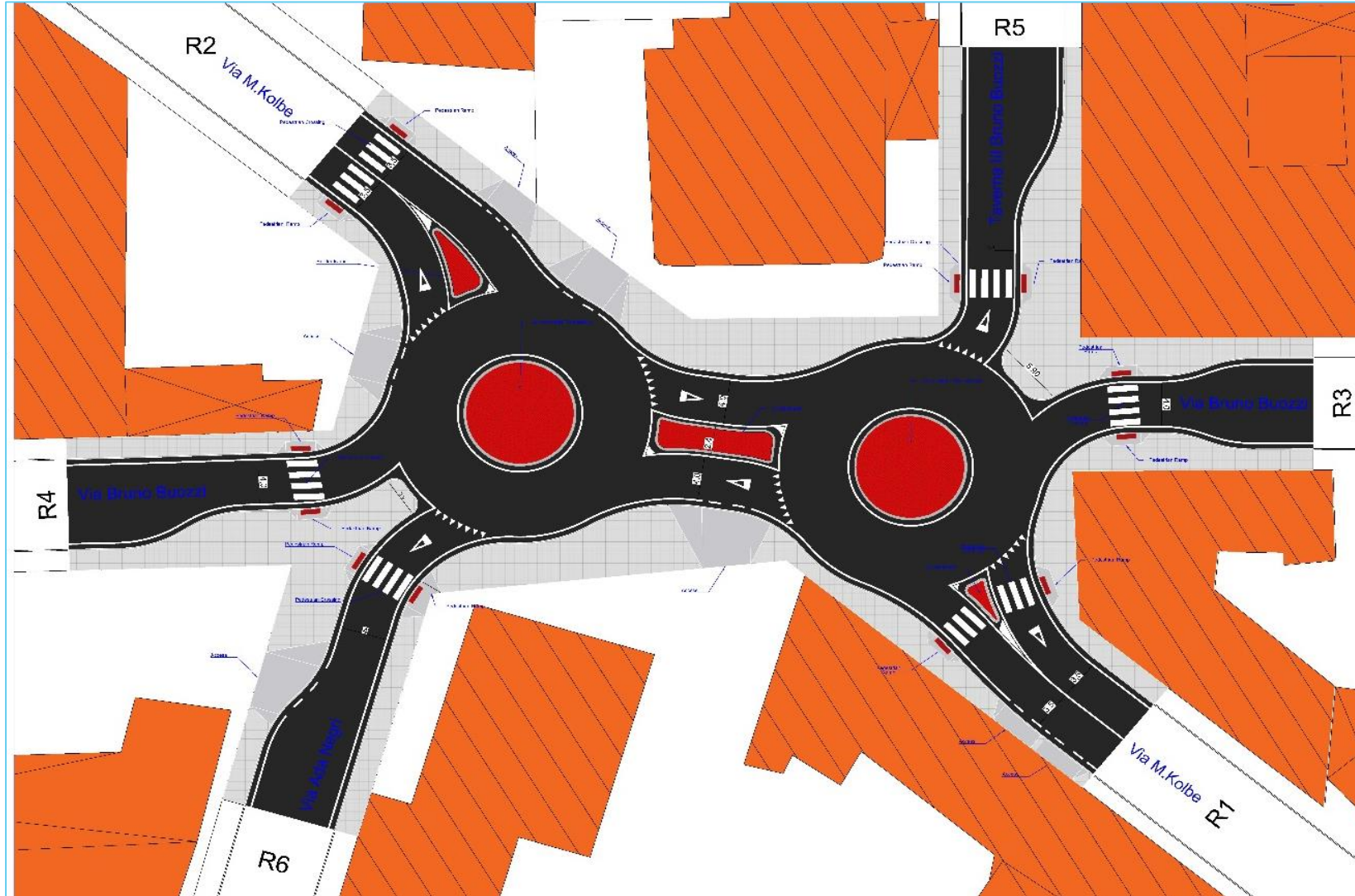
# FUTURE PROJECTS





# FUTURE PROJECTS

## Via Kolbe / Via Buoizzi intersection



Under evaluation



Thank you  
for your kind attention!

SAFETY FIRST

