Safety improvements in Urban Areas based on Human Factors principles

A case study: Via Pistoiese

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Safety in Urban Areas

THE MAJORITY OF FATAL AND INJURY ACCIDENTS OCCURRED ON ITALIAN URBAN AREA (ACI – ISTAT, 2012):

76% of the total accidents with injured and/or fatalities occurred in the whole Italian road network

Looking at the European data the trend is increasing

Number of urban road fatalities and proportion on total fatalities in EU-19, 2001-2010

Source: CARE Database / EC
Date of query: September 2012
DaCoTA Project

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Florence Context

From 2001 to 2012 the decrease in the number of road victims occurred in Florence has been 45% (ACI – ISTAT, 2013)

ALTHOUGH THE SIGNIFICANT REDUCTION OF FATAL AND INJURY ACCIDENTS ~ 30%, SEVERE ONES ONLY DECREASED BY ~ 10%

![Graph showing trend of accidents and hospitalizations from 2006 to 2012.](source: ISTAT, Polizia Municipale, Carabinieri, Polizia Stradale, Ospedali Santa Maria Annunziata, Santa Maria Nuova, Torregalli, Careggi, CTO e Meyer)
From 2001 to 2010: 256 accidents caused 264 deaths
Mopeds, bikers and pedestrians account for more
70% of both deaths and injured people

**VIA PISTOIESE**
ranked as the **SECOND MOST DANGEROUS ROAD** in Florence city

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Case of study – VIA PISTOIESE

VIA PISTOIESE IS AN URBAN STREET WHOSE MAIN FUNCTION IS TO CONNECT THE WEST SUBURB AREA TO THE CITY OF FLORENCE.

On both North and South sides Via Pistoiese gives access to two crowded residential and commercial areas.

THE DUAL ROLE OF VIA PISTOIESE, TOGETHER WITH THE MASSIVE TRAFFIC FLOWS AND THE UNFRIENDLY USE OF THE AVAILABLE ROAD SPACE, GIVES RISE TO GREAT SAFETY PROBLEMS IN THIS STREET.
Case of study – VIA PISTOIESE

- The lanes width currently is excessive
- A discontinuous median curb is sometime present along the street

The reduced length of each curb section induces two wheelers to overtake engaging the opposite traffic lane.
Accident Analysis

THE ANALYSIS WAS CARRIED OUT ON A SAMPLE OF 342 ACCIDENTS IN THE PERIOD BETWEEN 2009 AND 2012

ACCIDENT TYPE

- injury by falling from the vehicle
- collision
- sideswipe collision
- injury to sudden stop
- collision with obstacle
- run off road
- front-lateral crash
- rear end
- collision with the vehicle stopped or parked
- unclassified

INJURY TO SUDDEN STOP

FRONT-LATERAL CRASHES

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IDENTIFICATION OF THE HOMOGENEOUS SECTIONS

CRITERIA: the Via Pistoiese segmentation activity considered features such as the presence of intersections, straight and bended road segments, traffic volumes and density of driveways.
“SAFETY POTENTIAL” Index - SAPO

“Best Practices for Cost-Effectives Road Safety Infrastructure Investments” CEDR April 2008

The SAPO index identifies the savings in terms of social costs that the implementation of the safety measures on each of the identified homogeneous section could allow, regardless of the cost of the interventions.
Accident Analysis

“SAFETY POTENTIAL” Index - SAPO

IDENTIFICATION OF CRITICAL SECTIONS

The diameter of circles are in function of the section SAPO value

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Potential Critical Issues

✓ NO CLEAR IDENTIFICATION OF THE HIERARCHICAL ROLE of the street

✓ the PREVAILING LONGITUDINAL TRAFFIC FLOW which conflicts with the diffused crossings of vehicles and pedestrians coming and accessing from and to the side residential areas

✓ the HIGH DRIVING SPEED during periods with low traffic volumes or at night

✓ the STRONG PRESENCE OF MOTORCYCLES AND MOPEDS often involved in front-lateral collisions

✓ the NON-ALLOWED PARKING along both of the street sides
Human Factors Approach

THE RECONFIGURATION PROJECT HAS BEEN PERFORMED BY APPLYING THE HUMAN FACTOR PRINCIPLES OUTLINED IN THE "PIARC GUIDELINES FOR SAFER ROAD INFRASTRUCTURES"

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Human Factors Approach

6-Second Rule: the road should give the driver enough reaction time

Field of Vision: the road must offer the driver a safe field of view for to enable appropriate speed and lane tracking

Minimal adapting time = 4-6 sec

- vehicle response
- technical time to break/slow down
- drivers response detection + decision time, 2-3 sec
- anticipation time for identification of unexpected situations, 2-3 sec
- preparation of driver with signing and warning, 3-4 sec

Manoeuvre section

Response section

Anticipation section

Advance warning section

Speed-related point of view:

- 100 km/h = 600 m
- 65 km/h = 350 m

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Scope of the Intervention

The whole project takes the form of a set of measures of “TRAFFIC CALMING”, aimed at:

- reducing the conflict between the different types of road users → to protect vulnerable road users
  - to reduce speed
  - to avoid diffused left turns
- improving the perception of the potential critical points of the road
- ensuring a more equitable use of the public space

ROAD SAFETY ISSUES AND REQUIREMENTS HAVE BEEN GIVEN PRIORITY

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Scope of the Intervention

TRAFFIC CALMING MEASURES PLANNED CERTAINLY IMPROVE THE SAFETY OF ALL THE USERS, MAINLY OF VULNERABLE ROAD USERS AND IN PARTICULAR OF THE *ELDERLY ONES*

THE PROGRESSIVE LOSS OF COGNITIVE ABILITIES ASSOCIATED WITH AGING, SUCH AS A LOSS OF ABILITY TO SEE, HAS A SIGNIFICANT IMPACT ON THE DRIVER'S ABILITY TO CAPTURE THE INPUT GENERATED BY OTHER ROAD USERS AND BY THE INFRASTRUCTURE

MEASURES THAT AIM TO INCREASE THE PERCEPTION (COLOUR SURFACE, PAVEMENT MARKINGS, GATEWAYS, ETC.) ARE CERTAINLY AN ADVANTAGE FOR OLDER USERS
Design Solutions for Via Pistoiese

- IMPLEMENTATION OF A CONTINUOUS CURB in the road to avoid left turns
- REDUCTION OF THE LANE WIDTH to slow down the vehicle speed
- Introduction of PLANIMETRIC DEFLECTIONS to reduce the length of the straight sections
- Introduction of ALTIMETRIC DEFLECTIONS to reduce vehicular speed, protect the vulnerable road users and identify the intersections locations
- REMOVAL OF ARCHITECTURAL BARRIERS
- CONTROL THE PARKING ACTIVITIES along the street
- Equip ALL INTERSECTIONS and the MAIN PEDESTRIAN CROSSING with a SIGNALIZATION SYSTEM which should be COORDINATED
“Road Diet” – Roadway Reconfiguration

CONVERSION OF the TWO-LANE ROADWAY INTO a THREE-LANES ROADWAY

THE DECREASE LANE WIDTH REDUCES:
- DISPERSION OF VEHICLE’S TRAJECTORIES
- DRIVING SPEED
To increase the long range visibility of the third lane closure, capturing the attention of drivers, **vertical breakable stubs** have been placed in the median island with “**eye catching”** functions.

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Median Curb

A continuous curb has been installed in the median of the road all along the street:

- To separate the two driving directions
- To inhibit left turnings
- To prevent motorized two wheelers to engage the opposite lane

Left turns are only allowed in correspondence of the signalized intersections
PARTICULAR ATTENTION WAS PAID TO THE INTERSECTIONS IN WHICH THE GREATEST NUMBER OF CONFLICTING MANOEUVRES ARE CONCENTRATED (main interaction points between the dual functions of the street: penetration and access)
City Portal

SIGN INSTALLATIONS THAT ANNOUNCE TO DRIVERS THAT THEY ARE MAKING A TRANSITION FROM A SUBURBAN AREA TO A DENSELY INHABITED AREA
Conclusions

VIA PISTOIESE IS ONE OF THE MOST DANGEROUS ROADS IN FLORENCE
The reconfiguration project has been aimed at solving the serious safety problems affecting this urban street
For this purpose a combination of TRAFFIC CALMING MEASURES has been designed

**PHYSICAL MEASURES** → measures which use vertical/lateral deceleration to discourage speeding

**PERCEPTUAL MEASURES** → measures which use a psycho-perceptive sense of enclosure to discourage speeding and increase users' attention to the potential critical points of the street

THE GENERAL SCOPE IS TO UNCONSCIOUSLY SUGGEST THE CORRECT DRIVING STYLE, COHERENT WITH TO THE TYPE OF AREA PASSING THROUGH AND THE CHARACTERISTICS OF THE ROAD AND MAKE THE LAYOUT MORE “READABLE” TO ALL USERS