A Sustainable And Integrated Approach To Road Networks Planning

Marco Facchinetti – Anna Moretti
Politecnico di Milano – Dipartimento di Architettura e Pianificazione DiAP

SYNOPSIS

The paper focuses on the main results of the research developed by the authors and a group of researchers and planners for the Provincia di Bergamo, for the development of guidelines to plan the relationships between roads' networks, built-up areas and environment, for existing roads to be implemented or redeveloped and for new road projects.
The approach followed by the work shows the integration between different approaches: from a more traditional planning perspective on the design criteria of roads, to a *sustainable integrated road project*, able to envolve many dimensions, and above all able to show how road planning and construction can change the traditional vision of impact production and reduction, into a more integrated vision of sustainable development of new infrastructures for the whole territory.
The paper works on the different aspects involved in the research: assuming the existing and planned network for the local area around the city of Bergamo, the authors developed guidelines to analyze the existing relations between road networks, urban areas and environment, guidelines to study the new relations developing during and after the transformation of road networks, guidelines to plan the management of the different aspects of traffic on the road lanes, indications to design the shoulder areas of the roads, between road lanes and environment (a sort of interface between transportation network and urban or natural environment) and suggestions to transform in a sustainable relation the traditional overlapping between road network and urban or natural assessments.
The most interesting aspects are the integration between different points of view (the engineering one, the architectural one, the environmental one and the urban planning one), the development of a complete guideline to be followed by local administrations to face the aspects that they have to face planning road networks (decision-making over typologies of roads and routes, consensus-building on the selected routes and projects, agreement on the general vision of transformation, management of relations between infrastructural networks and urban development).
This approach tries to implement a weak cultural and technical tradition, that in Italy is not always able to transfer to local actors, institutions and users a technical and sensitive expertise to conceive in a different way roads and manufacts for circulation. It is important to remember the overview that this work does on European and American traditions, not just to learn good practices and good suggestions for projects, but also to study how to build a complete and useful set of tools to be used and to be stored in the technical culture of institutions (that usually are called to produce public works and infrastructures) and private actors (that even more in contemporary urban transformation processes are called as best and first actors in urban planning). All the steps developed can be used by local actors, public administrations and institutions to drive every project of road building, road improving and road transformations, aiming at considering every change as important occasion of restructuring territories and urban areas in a more complex, integrated, sustainable approach.

A Sustainable And Integrated Approach To Road Networks Planning

INTRODUCTION

The paper presents the results of a work and research made by the authors[i] for Provincia di Bergamo, about the development of guidelines to plan relations between roads, built-up areas and environment. The research aims to create a complete toolbox for existing networks of roads, impementing networks and for new roads' projects.

The occasion to develop a new approach to road planning and to integrate it into a more complex system of territorial transformation planning came from a work developed by the authors, together with other researchers and planners of Politecnico di Milano, Dept. of Architecture and Planning, for Provincia di Bergamo. The work was conceived to create a different point of view on infrastructural and transportation planning, and above all it was important to include a territorial point of view on roads networks planning.
Provincia di Bergamo is developing a new comprehensive plan for road networks, to improve the existing one and to create a complete and general network of arterial roads to serve all the territories of the Provincia and to connect in a correct way the national and regional networks to the local roads. Together with this effort, Provincia recognizes the difficult and congested situation not only of existing roads, but also of the major part of the territory. Urban growth, spatial transformations, land consumption are creating a difficult situation above all around some nodes of existing networks, along the major provincial arterials and in some heavily urbanized areas. For this reason, Provincia required a comprehensive study on how to manage a sustainable growth and transformation of existing conditions, without giving up to the idea of spatial, economic and urban development but transforming it into a complex occasion to rebuild territories affected by bad urban quality, to inhance the capability of existing road networks and to conceive transportation corridors strictly connected to urban and environmental aspects.
The original idea was transformed by the researcher into a more complex challenge, and it is here presented. It was important to change perspective and point of view to handle the situation.
Analyzing the situation of the urbanized areas of the Provincia, it was clear that many situations were completely unsustainable.
On the flat areas, around the major urbanized region of Bergamo, the existing network is congested more or less during the whole part of the day: the heavy urbanization and industrialization levels of the area, mirror of its economic good health, create a congested situation in time and space, with cars and trucks everywhere and for the most part of the day. Above all, this kind of congestion seems to be strictly related to the network conditions, above all built during the 60's and the 70's and with a radial structure focused on the central role of Bergamo (where all the major infrastructures nodes are concentrated) and it seems to have strong relations with the urban environment built around it. All the transportation corridors, and above all the roads' ones, are continously and seriously built up, even with heavy and land consuming uses, such as commercial and industrial areas.
On the metropolitan areas nearby the city of Bergamo, the situation is even more difficult. Historically, many territories close to the city are among the most industrialized and urbanized of all the region: the foots of the mountains valleys, the flat areas close to the south borders of the city and the urban connection between the east and the west of the region at the piedmont of the mountains are overwhelmed corridors of urban, industrial and commercial development.
Along the major routes to Milan the commuting traffic between Milan and Bergamo creates every day well known situations of heavy congestion, and these conditions are partly solved with the new infrastructural projects.

Looking at the existing situation, and at the projects developed by Provincia, it was clear that something had to change not only in the way projects are proposed and included into plans and comprehensive perspectives, but also in the way roads' projects are developed: old typologies of road and old typologies of connections cannot face the new development and the new transformations territories are facing, and above all old typologies of roads are not able to face and to serve dispersed movements in time and space.
It was above all clear that it hasn't any sense to create a perfect working road network if it is not connected to the geography of the territory and if it is not able to face the real urban development, the existing and planned urban transformation and above all if it is not open to a more integrated approach.
The leading idea developed by this work is to create a way to plan not only roads and routes. The effects developed by roads and networks don't end at the edge of the asphalted ribbon: a road is made by its paved lanes, by its borders, by the interface areas between roads and lands, and by all those areas close to the

roads, directly connected to the territory but usually forgotten both by roads planners and by urban developers. The idea is that a new corridor planning approach is required to face this situation, and to face all the similar situations of road planning into urbanized and sprawled areas, able to investigate the road dimension, its typology and its ability to answer to real traffic and movements geography, able to design the borders of the roads in connection not only to existing conditions but to the development and to the transformation territories are planning, and above all able to design a complex sistem of territorial transformations together its roads' answers.

THE RESEARCH

The approach followed by the work aims to show the integration between different approaches: from a more traditional planning perspective on disegn criteria for roads to a sustainable, integrated road project. This new approach is conceived to be able to envolve more dimensions, and above all it shows how road planning and construction can change the traditional vision of impact production and reduction, into a more integrated vision of sustainable development of new infrastructures for the whole territory.
The research work explains how road construction should be considered as one of the more complex spatial planning approach.
The research and the work are organized into *guidelines* for a precise choice of the authors and to direct them to the actors usually involved in the road planning process. A guidelines book is useful for public administrations involved into road planning process, to private developers and planners, usually called to plan roads and infrastructures into a more comprehensive public planning process, and to every planner and designer called to transform even small part of urban or rural territories, close to roads and infrastructures.

The research, before developing the guidelines for road planning, aims to define some *general criteria*, and above all:

- it is important to remember that a strong relational connection is always recognizable between roads, transport networks, spatial and territorial networks, and local communities networks.
- Road and infrastructures systems must be considered always as complex networks. All the projects are to be considered not only as parts of road and infrastructural networks, but also as parts of local and global relations, existing and to be planned. This aspect is very important, because it is through this point of view that it is possible to enlarge road projects perspective, considering them not only from their traditional frames, but also from a territorial and spatial point of view;
- Road networks must be considered not only as linear elements of connection between places, or between origins and destinations of possible flows of traffic, but also as *transverse element*s of connection between places and urban environments. Networks are required to create connections with places and environments crossed, and they must create connections with the use that people and local actors develop on places, built – up areas and open lands. It is important also to keep in mind how many uses are possible. Many of these uses are usually difficultly conciliable on the same networks (i.e. it is difficult to create good road environments both for pedestrians and drivers);
- It is important, for all these reasons, to define comprehensive framework and general visions and perspectives about existing and planned networks, about territorial development and in general about the state – of – the – art of urban and environmental transformations, opening up the process of road planning and design to territorial planning process;
- In this way, there are three fundamental goals, that cannot be forgotten: *safety* for all the types of users on road networks (from drivers to bikers and pedestrians); *urban and environmental quality* for the whole environment crossed by roads' networks; and *sustainability* of all roads' projects, above all for the health of citizens;
- It is very important to remember that roads' projects are not enough to create and to be sure to create high quality urban and natural environments: roads' projects and transformations must be included into territorial policies and practices, able to enlarge the perspective of roads' projects and to enrich it with all the aspects of spatial planning;
- Local partecipation to roads' transformations is very important to ensure a correct project, to control its outputs on existing places and above all to register the correct use of them by citizens and users.

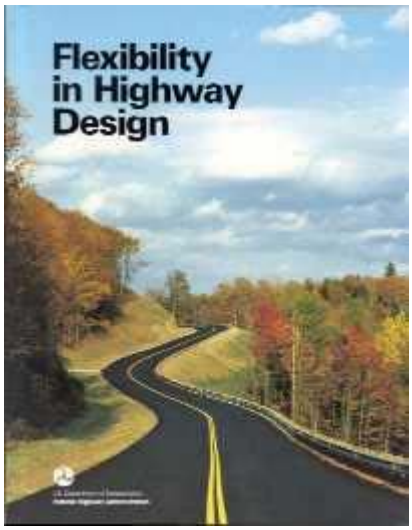
The research shows different aspects involved and considered by the researchers: assuming the existing and planned network for the local area around the city of Bergamo, the authors developed guidelines to analyze the existing relations between road networks, urban areas and environment, guidelines to study the new relations developing during and after the transformation of road networks, guidelines to plan the management of the different aspects of traffic on the road lanes, indications to design the shoulder areas of the roads, between road lanes and environment (a sort of interface between transportation network and urban or natural environment) and suggestions to transform in a sustainable relation the traditional overlapping between road network and urban or natural assessments.

Road design is only one element in the overall road network development process. Historically, detailed design occurs in the middle of the process, linking the preceding phases of planning and project development with the subsequent phases of right-of-way acquisition, construction, and maintenance. While these are distinct activities, there is considerable overlap in terms of coordination among the various disciplines that work together, including designers and planners, throughout the process. It is during the first three stages, planning, project development, and design, that designers, planners and hopefully communities, working together, can have the greatest impact on the final design features of the project.
In fact, the flexibility available for road design during the detailed design phase is limited a great deal by the decisions made at the earlier stages of planning and project development. For these reasons, it is very important to consider road design as a process of the overall spatial planning process: it is important to decide design assessments, design aspects and road planning process as a part of the general territorial project.
The process developed for Provincia di Bergamo and here presented is divided into *6 parts*, according to the idea to put together all the different aspects of spatial planning, but above all territorial assets, environmental perspectives and transport planning. All these parts can be considered as a good toolbox for all planners, designers and actors usually required to plan or design roads' systems. It allows to open up the process, to enlarge its boundaries and above all it gives the possibility to control many more aspects always involved, directly or indirectly, into roads' planning and roads' construction developments.

FIRST: A CRITICAL OVERVIEW

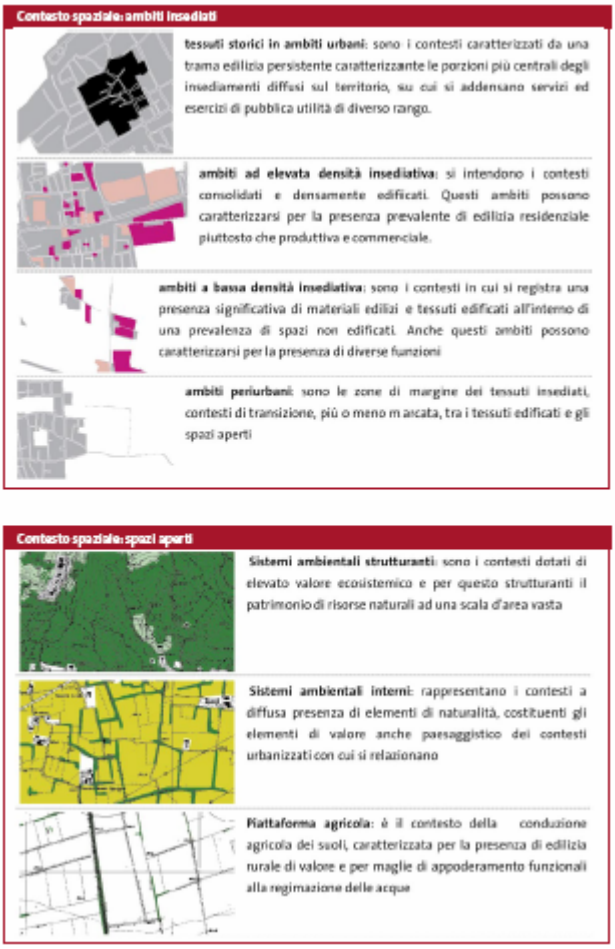
The *first part* is about the consciousness of the existence of many good projects and many good practices about roads' planning. Many times the case studies approach gives the possibility not only to enrich a personal background of acknowledgments but only, and more specifically, to learn good practices to be used into local planning development. Above all, this research work presents the possibility to look at few guidelines books produced in Europe and in the Us to learn how the construction of toolboxes has been in some circumstances a traditional approach to roads' planning, able not only to develop good projects, but also, and more important, to create a consciousness and a general culture about roads' planning. France, Great Britain, The Netherlands and US are traditionally recognized as places where the continous updating of guidelines and toolbox has developed a good and strong cultural and smart approach to roads'planning as a process of spatial and territorial planning, and above all it has permitted the creation of a sensitive and sustainable approach to roads' planning, where all the aspects of built – up areas and open lands are well considered.
It is important to remember that the production of these kind of documents, guidelines,toolbox, and practices has worked not only on the construction of a general culture, but also it helped the creation of local different cultures and practices, able to connect general aspects of roads' planning to local differences, local specifications and local needs, also working on roads' typlogies.
The definition of a correct typology is a central aspect on roads' design and planning: it is not true that every places can host the same kind of road and the same typology: working on the open approach that this research proposes, it is possible to create different typologies of roads, according to local and particular aspects of open lands and built up areas. Looking at the existing guidelines, regulations and toolbox, it is easy to see how roads' typologies are strictly connected to places and to the local needs of users.
In this section two parts are included: an overview on te best projects able to show not only good solutions but also good practices, and good solutions produced by good and complex theorical and practical approaches; and an overview on the best guidelines book and toolboxes produced to control and to guide roads' planning projects, able to show the creation and the implementation of a shared good culture on planning.
For the first part, it is important to remember the criteria that the research used to study and to shows the best selected projects: according to the idea that it is important to study and to learn the process that brought to the creation of a particular project, rather than studying and showing only the physical results of it, the research aimed to study projects of *juxtaposition*, when roads are separated from the urban environment by buffers, artificial hills, plantation of ribbons of trees, avoiding any relation with the surrounding environment; *adaptation*, when a particular typology of road, passing through a specific urbanized context changes its typology assuming what the context requires for improving its environment and its functional working (from a beltway to a urban boulevard); and finally *conciliation*, when the techical project, according to the necessity to create an integrated environment with the built up areas, gives up to some of its technical specifications to change them into a more environmental friendly criteria.
For the second part, the research studied some of the best practices developed in Europe and in the US, to show a continous process of improving a shared planning culture and an integrated approach among disegn criteria, good practices and sustainable policies.
The French *Dossier de Voirie d'agglomeration*, the Dutch report *Raad voor werker en waterstaat*, the British *Design Manual for Roads and Bridges*, or the US *Flexibility on Highways design* are among the best

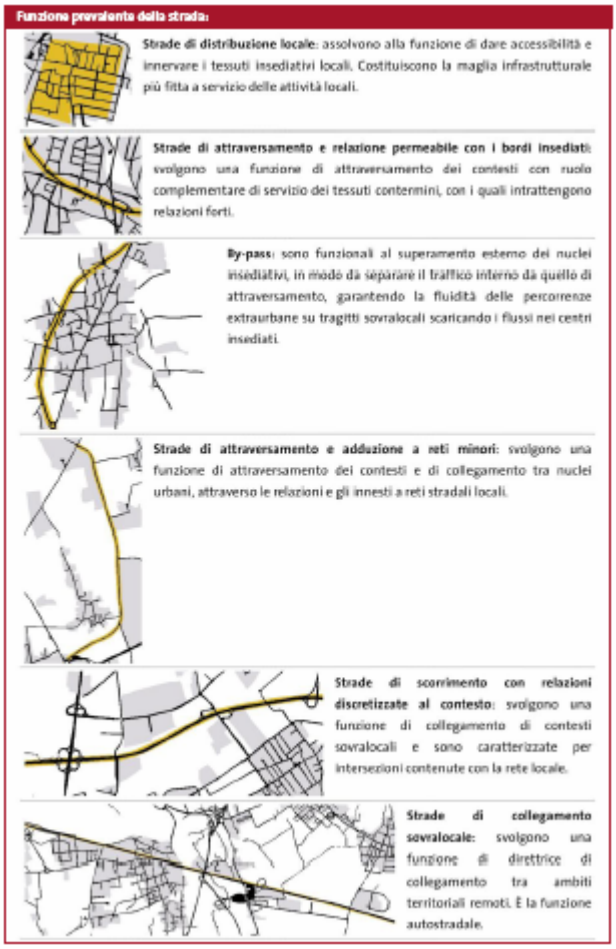
processes selected by the research and studied to find the correct relations between good projects, good practices and the creation of a different technical approach and culture to roads' design and planning.



SECOND: THE SENSE OF THE PLACE

The *second part* is about the importance of the specific place where roads' planning and construction must be developed. The analysis of the specific place that is going to be developed for roads' construction is very important, because it brings to the construction of specific 'families' of territory and space, able to describe not only the geography and the urban or environmental aspects of the place, but also the relations that roads' project can activate in this specific context. This section gives the possibility to recognize the existing characteristic of the places involved into the project, to define the interaction between existing data and new projects development. The principal aim of this section is to give guidelines on how to study a specific context and how to recognize the interaction between contex and roads' networks, according to the idea that there aren't transformations without strong interactions with existing places and with all the other transformations tendencies.
The process developed helps in recognizing first of all the typologies of roads that usually can be found, trying to force the functional classification that the Italian Road Code gives to roads, and using a more territorial and spatial oriented classification. And the same thing is done to study and to analyze the territorial typologies for built-up areas and for open lands.



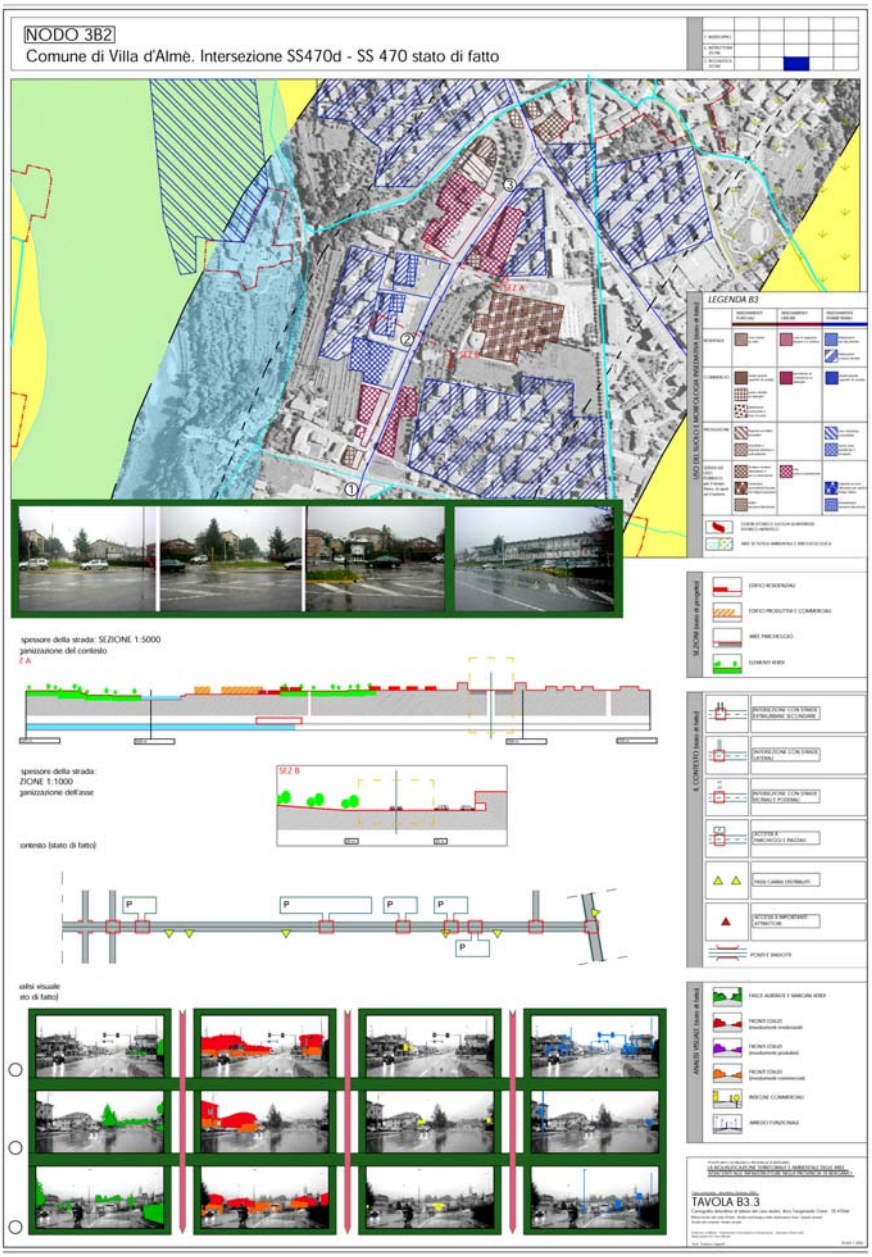


This analysis gives the possibility to read how roads and different territorial and spatial typologies can be seen together, to research those particular relations the project should consider and use as project references.
In this way, it is possible to study a matrix that shows at least four families of different relations between roads' networks and territories.

Una matrice per la lettura dei rapporti tra strada e contesto spaziale

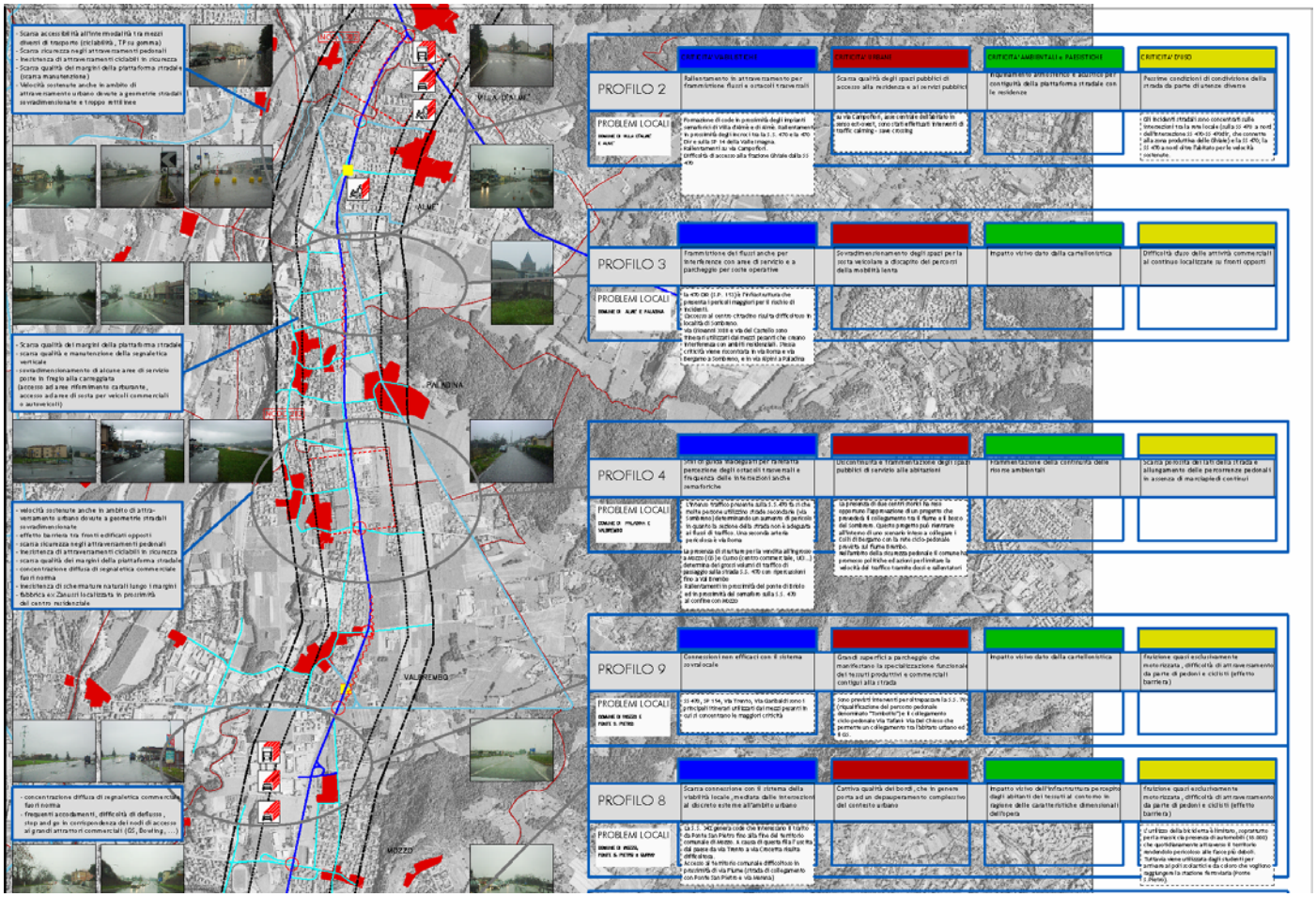
			LA STRADA: FUNZIONE PREVALENTE					
			Distribuzione locale	Attraversamento e relazione permeabile con i bordi insediati	By-pass	Attraversamento e adduzione a reti minori	Scorrimento con relazioni discretizzate al contesto	Collegamento sovralocale (autostrada)
IL CONTESTO SPAZIALE	TESSUTI INSEDIATI	Tessuti storici in ambiti urbani						
		Ambiti ad elevata densità insediativa – Prevalentemente residenziali						
		Ambiti ad elevata densità insediativa – Prevalentemente produttivi						
		Ambiti ad elevata densità insediativa – Prevalentemente commerciali						
		Ambiti ad elevata densità insediativa – Prevalentemente polifunzionali						
		Ambiti a bassa densità insediativa – Prevalentemente residenziali						
		Ambiti a bassa densità insediativa – Prevalentemente produttivi						
		Ambiti a bassa densità insediativa – Prevalentemente commerciali						
		Ambiti a bassa densità insediativa – Prevalentemente polifunzionali						
		Ambiti periurbani						
	SPAZI APERTI	Sistemi ambientali strutturanti						
		Sistemi ambientali interni						
		Piattaforma agricola						

According to this analysis, it is possible to study a more complex way of reading the relations between streets, roads and contexts. In the following picture it is possible to see a comprehensive tool of reading and analyzing how roads affect the urban environment, the open land networks and above all how users and citizens are affected by them, even analyzing the relations between land use zones and infrastructures. This could be considered as a comprehensive and useful way to analyse how existing or planned roads affect the territories they cross, and it can be used in any situation, according to the ability to study the typology of territory around roads.



THIRD: THE CRITICAL ASPECTS

The *third part* gives the possibility to recognize, according to the scenario and the vision of spatial assets studied and developed in the previous part, all the *critical aspects* that roads' networks have usually to face. There are at least *three typologies of critical aspects*: the first one is about theoric and generic critical aspects that every network of road usually faces in connection to the urban and natural environment that crosses. In this first group, it is possible to recognize *transport critical aspects*, connected to the way roads'network manage flows of traffic and different typologies of traffic; *critical aspects about the use* tha drivers and users do of roads'networks, and in this typology of critical aspects it is possible to recognize conflicts between drivers and pedestrian, or between public transportation and private cars; *urban critical aspects*, connected to the possibility to have conflicts between roads' networks and the developed environment around them (i.e., conflicts between roads and old town centers, or particular sensitive environments); and *environment critical aspects*, when roads' networks meet and affect the natural surroundings. This aspect relates not only to traditional problems such as pollution or congestion, but also to problems of perception, visual interruption of landscape, difficult uses for the environment due to the presence of the network. All these critical aspects, that can be studied just reading the interaction between roads' networks and the environment that cross (the same families of environments studied and defined in the second part of this work), must be related to *local critical aspects*: it means that the general definition of a critical aspect must be connected to the perception of difficulties and problems that local contexts have about connection of roads and environment. Usually, this local specification can be studied through traditional surveys. This passage is very important, because it helps in creating connections between roads' projects and local users, an above all between the global and general scale roads' networks are usually relating to, and local aspects traditionally affected by roads' transformations. At the end of this process, it is possible to study *effective critical aspects*, putting together general and theorical critical aspects with what the local context expresses. The effective critical aspects must be considered by the project and the desig process of roads. On the map below, it is possible to see how critical aspects can be studied, relating them to the typology of the road and to the territorial typologies recognized before, connecting every section of the road ('profilo') to the critical aspects typologies.



FOURTH: DESIGN CRITERIA

The *fourth part* of this process is directly connected to design process. In this part it is possible to learn how to create a toolbox of *design criteria and standards* able to drive roads' projects on the correct way. Connecting the families of contexts and the families of roads, it is possible to decide what kind of criteria must be developed. Usually, it is possible to recognize at least three kinds of criteria: *strong regulations* of the relations between roads and contexts, i.e. when it is required a reduction of visual or environmental impacts or when the project gives the possibility to reduce and to calm through traffic into sensitive urban context; *medium regulations*, when the particular geography of the place or the specific aspect of roads don't give any possibility to apply strong regulations, but many aspects of impacts or conficts should be regulated; *powerful regulations and possibilities exploitation*, when a specific context gives the possibility to use actively roads' project to transform its environment, or on the contrary when a particular projects shows how to transform the accessibility or the land use regulations of a specific context.
According to these general and theoric design criteria, and studying them with relations to the specific functional classification of roads, it is possible to define the *specific design criteria of roads* and what kind of *project regulations* must be developed to reach that particular territorial effect through the road's project. In this way, it is possible to define the correct typology of road for that particular context, and it is possible to create an active toolbox of criteria for the project. The toolbox gives guidelines for the treatment of the paved area of the road, for the border areas of it and for all the surrounding areas usually included into the roads' project but not directly affected by the design process. In this way, it should be possible to regulate the flow of traffic and the production of noise using specific noise-reduction pavements (guidelines on the paved area of roads), planting bushes and trees on the edge of roads (guidelines for the border areas of roads) and to regulate land use and locations into roads' corridors (guidelines for surrounding areas). Or again, it should be possible to understand how to use a specific road into a specific context: many roads serving commercial or industrial areas can be transformed into local by-passes o existing and congested older roads, or they can help in developing a more complex and itegrated process of planning for commercial corridors, or industrial parks.
At the end of this section, it is possible to create an evaluation process to study how the particular roads' project can follow the instruction included into the toolbox and how all the critical aspects defined before can be solved and transformed actively by the project, also according to the scenario and the planning visions defined in the second section of the work.

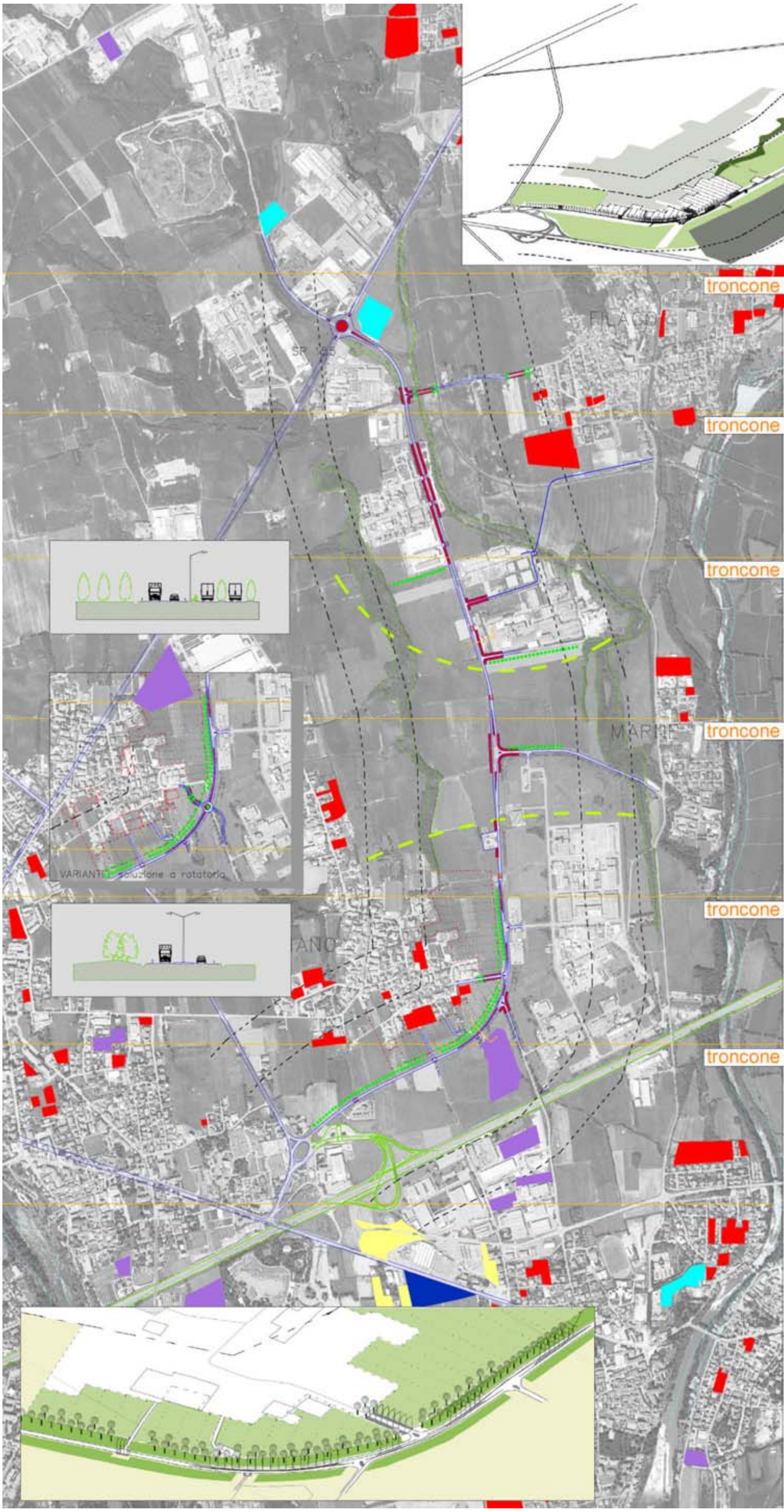
Classificazione funzionale della strada Secondo articolo 2 del Codice della Strada		A autostrade	B extraurbane principali		C extraurbane secondarie		D1 scorrimento veloce		D2 urbane di scorrimento		E urbane di qyartiere
Carattere della strada IMP= impermeabile PER= permeabile		IMP	IMP	PER	IMP	PER	IMP	PER	IMP	PER	PER
Centri storici		REGOLAMENTA FORTE *	REGOLAMENTA FORTE *		REGOLAMENTA FORTE *		REGOLAMENTA MEDIO		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA
Ambiti ad elevata densità insediativa	Residenziale	REGOLAMENTA FORTE *	REGOLAMENTA FORTE *		REGOLAMENTA FORTE *		REGOLAMENTA MEDIO		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA
	Produttivo commerciale	REGOLAMENTA FORTE	REGOLAMENTA FORTE		REGOLAMENTA MEDIO		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA
Ambiti a bassa densità insediativa	Residenziale	REGOLAMENTA FORTE	REGOLAMENTA FORTE		REGOLAMENTA FORTE		REGOLAMENTA MEDIO		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA
	Produttivo commerciale	REGOLAMENTA MEDIO	REGOLAMENTA MEDIO		REGOLAMENTA MEDIO		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA
Spazi aperti	Sistemi ambientali strutturanti	REGOLAMENTA FORTE	REGOLAMENTA FORTE		REGOLAMENTA MEDIO		REGOLAMENTA MEDIO		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA
	Sistemi ambientali interni	REGOLAMENTA FORTE	REGOLAMENTA FORTE		REGOLAMENTA MEDIO		REGOLAMENTA MEDIO		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA
Piattaforma agricola		REGOLAMENTA FORTE	REGOLAMENTA FORTE		REGOLAMENTA MEDIO		REGOLAMENTA MEDIO		REGOLAMENTA E POTENZIA		REGOLAMENTA E POTENZIA

Un esempio

C EXTRAURBANE SECONDARIE PERMEABILI	PRINCIPI DI PROGETTO	CRITERI PROGETTUALI		
		SULLA PIATTAFORMA	SUI BORDI	SULL'INTORNO
PROFILO 1: strada permeabile in centro storico Classe funzionale della strada C: extraurbane secondarie permeabili Tipologia progettuale: 1 C	REGOLAMENTA FORTE	Utilizzo di asfalti fonoassorbenti, divieto di sorpasso e riduzione delle velocità. Interventi di moderazione del traffico in assenza di varianti su cui deviare il traffico di attraversamento per favorire l'aspetto urbano della strada	Potenziare le caratteristiche di permeabilità della strada, definendo un sistema di protezioni artificiali per la sicurezza e la riduzione degli impatti inquinanti.	Strumenti urbanistici che salvaguardino le fasce di rispetto previste dalla legge, salvaguardia delle caratteristiche del nucleo storico per frenare effetti vetrina e la sostituzione funzionale in prossimità della strada, armonizzazione delle funzioni con la caratteristica della strada
PROFILO 2: strada permeabile in ambito ad elevata densità residenziale Classe funzionale della strada C: extraurbane secondarie permeabili Tipologia progettuale: 2 C	REGOLAMENTA FORTE	Utilizzo di asfalti fonoassorbenti, divieto di sorpasso e riduzione della velocità. Interventi di moderazione del traffico in assenza di varianti su cui deviare il traffico di attraversamento per favorire l'aspetto urbano della strada	Definizione di un sistema di barriere artificiali per la riduzione dell'inquinamento acustico atmosferico Regolamentazione della cartellonistica e della segnaletica, in maniera da non costituire elemento di disturbo per l'immagine urbana, interventi da armonizzare con l'immagine urbana della strada, e con le sue caratteristiche di permeabilità ai tessuti	Strumenti urbanistici che salvaguardino le fasce di rispetto previste dalla legge, aumento degli effetti barriera con altre barriere artificiali o naturali, salvaguardia delle caratteristiche dell'ambito compatto per frenare effetti vetrina e la sostituzione funzionale in prossimità della strada. Armonizzare l'immagine dell'ambito residenziale denso con l'effetto della strada. Definizione del sistema delle piste ciclabili

FIFTH: THE PROJECT

The *fifth section* shows how to design a road, according to these aspects. If we assume that roads' project is a so complex process, we must create strong connections between the project and the context that will be affected by it. For this reason, the research develops *typological roads'projects* to show how to put into relation the *references* of the projects (spatial and planned scenarios), the *components* of the project (design criteria and guidelines), the *proposals* for the project (working above all to the definition of specific typological solutions, that can be repeated into similar contexts) and the final *evaluation process*, to understand how that particulat project and that particular solution can face and solve all the critical aspects detected by the first stages of the process. This section can finally project a road, according to all the aspects studied in the previous sections, and according to the possibility to design every single strecth of roads following territorial and technical requirements, as it is shown on the following pictures.



troncone 600

- Riconfigurazione dell'ingresso a Filago: miglioramento della visibilità, inserimento di isole materializzate per la canalizzazione dei veicoli in svolta e adeguato arredo funzionale, messa in sicurezza per l'utenza debole
- Eventuale inserimento di elementi spartitraffico per incanalare i flussi in rotatoria e al contempo salvaguardando la sicurezza attraverso una riduzione delle velocità
- Necessità di monitoraggio delle attività produttive commerciali localizzate sui bordi ed in particolare in corrispondenza dei nodi.

PROFILO 3

troncone 500

- Razionalizzazione dell'accesso ai parcheggi dei dipendenti e alle zone di carico/scarico merci delle fabbriche (FAR spa) attraverso il miglioramento della visibilità e degli spazi di sosta e manovra dei rimorchi (cambio di pavimentazione, nuovo arredo funzionale e illuminazione)
- Riconfigurazione della zona di sosta per automezzi pesanti (cambio di pavimentazione, inserimento di eventuali attrezzature di tipo tecnico, colonnine acqua, elettricità)

troncone 400

- Migliorare la visibilità all'accesso del nuovo comparto produttivo - artigianale, intersezione da monitorare in previsione dell'apertura del collegamento per Filago
- Riqualificazione delle aree antistanti l'ingresso alla fabbrica Uvigal, razionalizzando (cambio di pavimentazione) lo spazio per la sosta dei rimorchi
- Messa in sicurezza dei margini stradali in corrispondenza della curva a chiusura del rettilineo

PROFILO 5

troncone 300

- Riconfigurazione dell'intersezione con strada per Marne e accesso a scarico merci Bayern: inserimento di isole materializzate per la canalizzazione dei veicoli in svolta e adeguato arredo funzionale, eventuale illuminazione.
- Riqualificazione dei margini in prossimità delle intersezioni e degli accessi laterali, attraverso piantumazioni e arredo funzionale adeguato
- Conservazione delle visuali libere
- Eventuali elementi orizzontali di dissuasione con funzione di riduzione delle velocità (sul lungo tratto rettilineo)

troncone 200

-Ingresso alla frazione di Grignano: riconfigurazione a "porta urbana" e messa in sicurezza dell'intersezione attraverso adeguato arredo funzionale
-Intersezione con strada per Brembate: miglioramento della visibilità e riconfigurazione attraverso l'inserimento di isole materializzate per la canalizzazione dei veicoli in svolta, rettifica degli assi della strada secondaria
-Riconfigurazione dell'ingresso dei dipendenti della Bayern, attraverso l'inserimento di isole materializzate per la canalizzazione dei veicoli in svolta e adeguato arredo funzionale.

troncone 100

- Messa in sicurezza dell'accesso al Motel attraverso l'inserimento di adeguata segnaletica orizzontale e di arredo funzionale teso a migliorarne la percezione
- Messa in sicurezza degli accessi laterali alla frazione di Grignano (via Gerra) e alle strade poderali (lato sud)

PROFILO 3

POLITECNICO DI MILANO e PROVINCIA DI BERGAMO

LA RIQUALIFICAZIONE TERRITORIALE E AMBIENTALE DELLE AREE ADIACENTI ALLE INFRASTRUTTURE NELLA PROVINCIA DI BERGAMO

TAVOLA 2a

SP 183, VIA DELLE INDUSTRIE

Trattamento A: contesto programmatico locale

Arch. Federico Zappelli

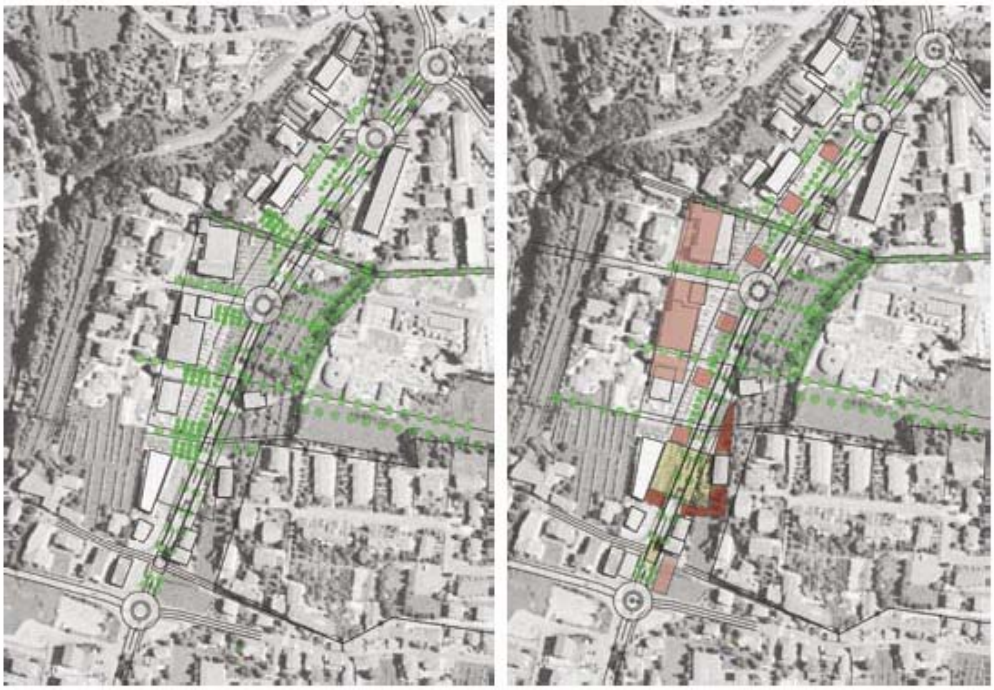
N

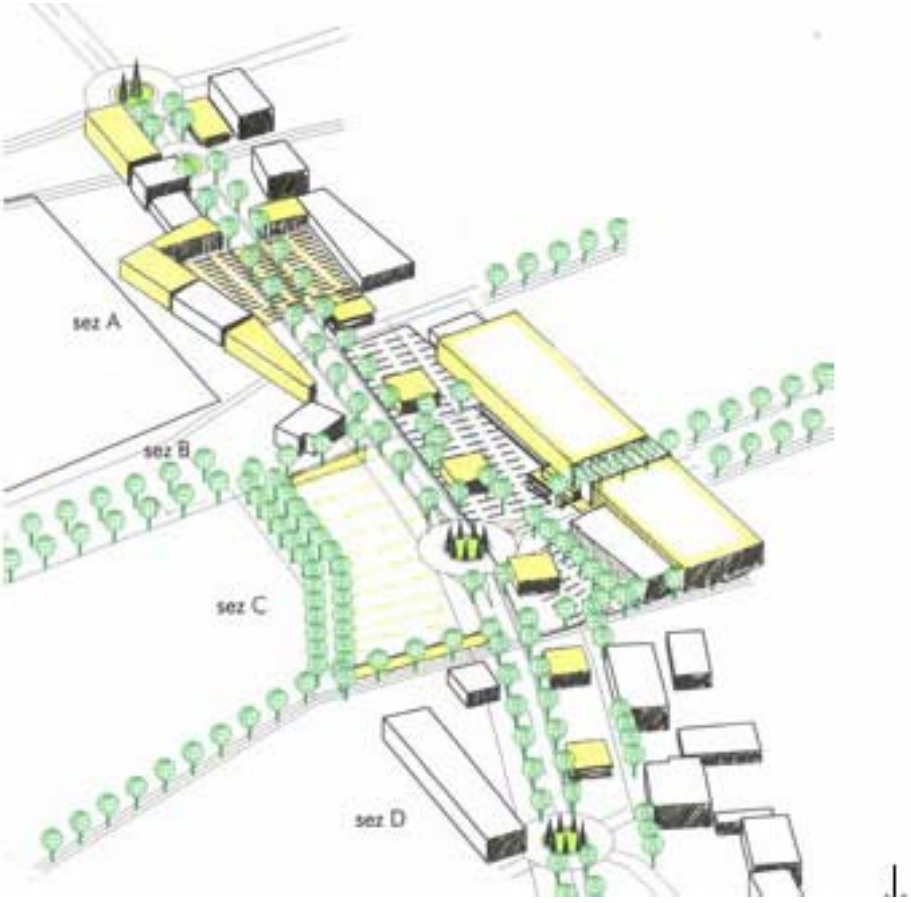
SCALA 1:6000

LEGENDA

Interventi proposti

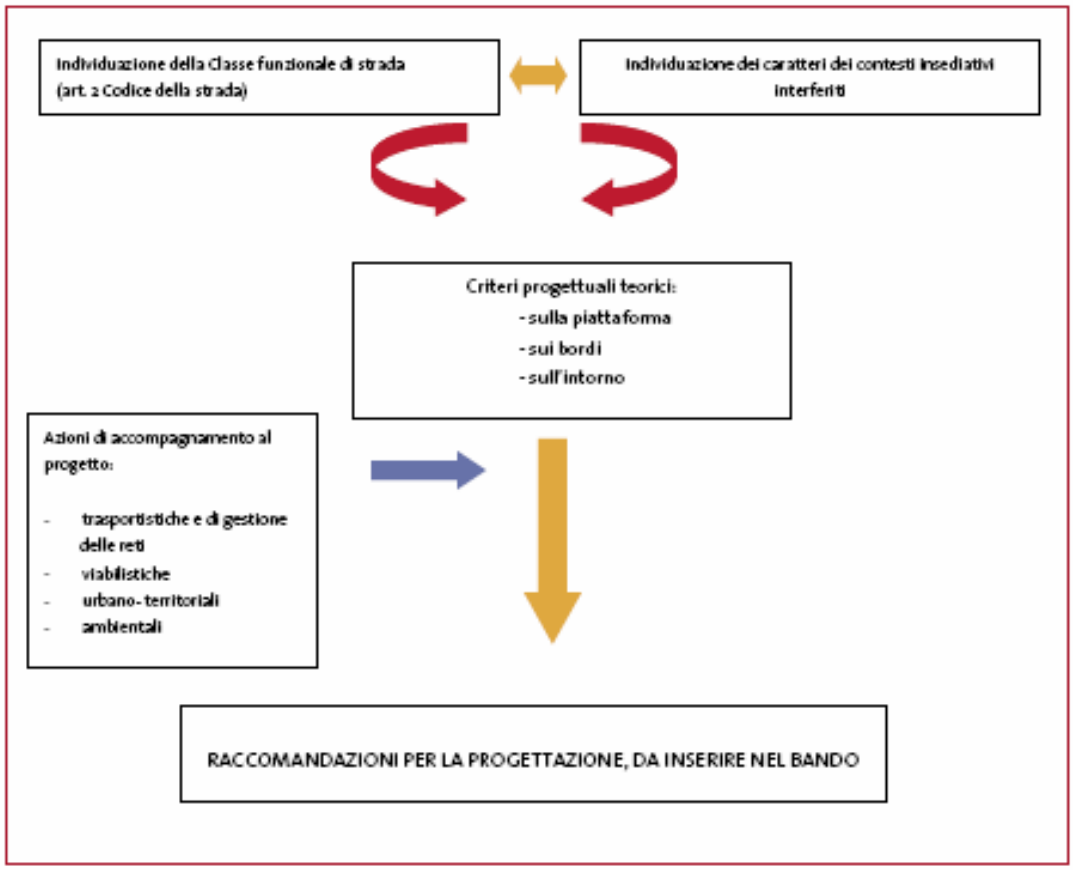
Rappresentazione planimetrica fase 1 e fase 2





SIXTH: POLICIES AND PRACTICE

The *sixth session* is about the necessity to create a complete framework of planning tools, policies and processes to give actively the possibility to put into practice these suggestions. And this section tries to enlarge the influence of the project and to extend it to other aspects, involving the creation of a complete set of policies to be developed to help the success of roads' project. This section is very important, because through it it is possible to evaluate the feasibility of what the project proposes, above all according to the spatial and territorial aims it tries to reach. It is possible to define a set of accompaniment policies and practices to help the sustainable approach that this kind of process develops, and above all this section helps in creating a way to introduce this practice into all the institutional processes that usually are called to design roads' networks. Public announcements, or public works descriptions and requirements are the places where a non traditional approach to roads'planning can be developed. Even architecture competitions can introduce this kind of regulations about roads and road planning. The picture below shows the complete process.



At the end, the work suggests a selection of good typologies and good ways to design roads, borders and surrounding areas, helping in recognizing the structural aspects of these examples and in understanding how to reproduce them and how to put them into practice.

CONCLUSION

This work shows how a traditional approach to roads' planning can change involving territorial and spatial planning aspects, to create a complex and integrated system of references and criteria. This approach helps in defining a complete set of tools, and above all a list of steps to be followed to manage every project of roads' design and every aspect of it, but above all the analysis of the context in which roads should be included and the definition of design criteria that the engineering project should include. And secondly, it helps in creating a system of references to improve a planning culture that traditionally, above all in Italy, seems to be poor and strictly focused on solving correctly the technical aspects of roads' projects. For these reasons, usually spatial aspects, territorial assets, urban and environmental spaces are forced to accept the technical logic that roads bring to them, assuming a concept of defense from impact that doesn't allow to use all the potentiality that every project of territorial transformation can express.

The approach shown in this research, used in the work developed for Provincia di Bergamo by the team of researcher, gives the possibility to create a different culture on road design and on technical analysis and evaluations for roads projects, including all the aspects of territories crossed by roads, allowing the same project to include in its design these aspects, and opening up the process of technical decisions and standards definitions to territorial, spatial, environmental and cultural aspects, once again considering roads not only as a longitudinal element of connection between places but also a transectional, physical connection between all the elements that face the infrastructural corridor.
Above all, this approach tries to implement a weak cultural and technical tradition, that in Italy is not always able to transfer to local actors, to the local institutions and to the users of roads a technical and sensitive expertise to conceive in a different way roads and manufacts for circulation. It is important to remember the overview that this work does on European and American traditions, not just to learn good practices and good suggestions for projects, but also to study how to build a complete and useful set of tools to be used and to be stored in the technical culture of institutions (that usually are called to produce public works and infrastructures) and private actors (that even more in contemporary urban transformation processes are called as best and first actors in urban planning). All the steps developed by the research can be used by local actors, public administrations and institutions to drive every project of road building, road improving and road transformation, aiming at considering every change as an important occasion of restructuring terriories and urban areas in a more complex, integrated, and sustainable approach. In this way, it will be possible to change the concept of impact, and the practice of a environmental impact analysis after the project into a more interesting and stimulating concept of possibilities and occasion for ever project, able to self evaluating its impacts on the environment and to trasnform them into positive outputs of the transformations proposed.

ENDNOTES

[i] The research and the work for Provincia di Bergamo has been developed by some researchers and planners of Dept. of Architecture and Planning, DiAP, Politechnic of Milan: Anna Moretti directed the group, composed by Marco Facchinetti, Fulvio Adobati, Federico Jappelli, Alessandro Oliveri, and Paola Pucci. The group worked at the research and at its applications at Provincia di Bergamo selected contexts, and right now it is working on the final publication of it

REFERENCES

Borruey, R., (1997), *Reves et réalités de l'infrastructure habitable*, in Picon – Lefebvre V.*, Les espaces publics modern*, Paris, Le Moniteur, pp. 155 - 174

Certu, (1996), *Grandes enseignes en périphérie. La zone commerciale de Champ du Pont, agglomération Lyonnaise*, Lyon

Certu, *Les boulevards urbaines*, fiche technique, n° 28 , Lyon

Dematteis, G., Governa, F.,(2001),*Contesti locali e grandi infrastrutture*, Milano, FrancoAngeli

Di Giampietro, G., *Infrastrutture di trasporto e politiche urbanistiche*. In *Urbanistica*, n° 115, pp.52-59

Facchinetti, M., (2002) *Corridoi infrastrutturali e trasformazioni del territorio*. Firenze, Alinea

Ferraresi, G., Moretti, A., Facchinetti, M., (2004), *Reti, attori, territorio. Forme e politiche per progetti di infrastrutture*. Milano, Francoangeli

Gourdon, J.L., La Rue. (2001) *Essai sur l'économie de la forme urbaine*. Editions Léopard Mayer, L'aube essai. Paris

Mialet, F., Fouque, V., (2001), *Voirie rapide urbaine et espace public : quelles liaisons ?.* Dossiers, n° 115, Collection du Certu, Paris

Moretti, A., (1996), *Le strade. Un progetto a molte dimensioni*, Milano, Francoangeli

Secchi, B., *Lo spessore della strada*, in Aa.Vv., *Sulla Strada*, Casabella nn° 553-554, pp. 38 – 41

Smets, M., *Il nuovo paesaggio delle infrastrutture in Europa*, Lotus International, n° 110, pp. 116-125

Werquin, A.C., Demangeon, A., (1998), *Boulevards, rondas, parkways...des concepts de voiries urbaines*. Certu

Wiel, M., Rollier, Y., (1993), *La peregrination au sein de l'agglomeration*, in *Les Annales de la Recherche Urbaine*, n° 59-60, pp. 152 – 162

Wiel, M., (2002) *Ville et automobile*, Descartes & Cie, Paris