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# ARCHITECTURAL-QUALITY ASSESSMENT STRATEGIES FOR AN ENVIRONMENTALLY SUSTAINABLE ROAD DESIGN

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## ABSTRACT

Does the design of the transport infrastructures, that characterise the environments we live in, interpret and enhance the oncoming expectations in regards to safety, accessibility, comfort, but also values related to environmental, cultural and historic preservation, sustainable development and scenic quality?

The scope of the research project presented in the paper is to identify and produce innovative and measurable Architectural-Quality Standards (A-QS) to be assessed into the existing environmental impact evaluation processes and transportation policies and strategically delivered to all urban and non-urban planning, design, construction and rehabilitation processes in the field. The research project involves 18 partners from 12 EU countries and 2 overseas countries (USA and Canada).

The dimensions that must be taken in consideration are many and can only be defined and assessed by an organic inter-disciplinary research group throughout highly innovative evaluation models built on a multi-criteria analysis base that, starting from state-of-the-art knowledge, regulation and practice in Europe, focuses on the role that design can express in the generation and promotion of a new idea(1) of “self-enforcing” street-to-highway infrastructures and related facilities.

The networking performed by this project will favour inter-disciplinary debate on the many required assessment processes, exchange of international expertise and the construction of the base principles and procedures for the future establishment of a Permanent European Observatory on A-QS in the transportation field.

*Keywords: sustainability, quality, design*

## 1. INTRODUCTION

The arguments treated by this paper regard the contents of a preliminary proposal that was submitted in application to the COST (European COoperation in the field of Scientific and Technical Research) “Open call”, in March 2007 and specifically addressed to the Transportation and Urban Design (TUD) Domain.

COST is an intergovernmental framework for the co-ordination of nationally-funded research at a European level, based on a flexible institutional structure. Established in 1971, COST has developed into one of the largest frameworks for research co-operation. COST research networks are called Actions. Co-operation takes the form of concerted activities, i.e. the co-ordination of nationally funded research activities, between research institutions from member countries or co-operating states. COST also welcomes Institutions from non-COST countries to join individual Actions where there is mutual benefit. In this sense this particular research project involves 18 partners from 12 EU countries and 2 overseas countries (USA and Canada).

The goal of COST is to ensure that Europe holds a strong position in the field of scientific and technical research for peaceful purposes, by increasing European co-operation and interaction in this field.

## 2. BACKGROUND

Environmental issues related to decision-making processes of transportation policies, plans programmes and projects in Europe have increasingly gained attention and strategic relevance, as well as complexity, due to both the evolving geopolitical asset of the Community and the growing demand of mobility and of quality in the transportation field. New procedures, moving in the direction of down-up “participated” planning processes, along with oncoming expectations of new unconventional stakeholders, reclaiming alternative quality standards and major attention to environmental sustainability, have not only started to modify the decision-making structures and strategies in the transportation field but have also put in evidence new priorities, goals and many white spots within the traditional planning, design and construction processes, at all scales.

During the last decades within the Framework of Transportation Research in Europe, the Strategic Environmental Assessment (SEA) and the Environmental Impact Assessment (EIA) Directives (European Council, 1985, 2001) have successfully moved steps towards the definition of a multilevel toolbox of evaluation techniques and parameters to be delivered to the many stakeholders, professionals and policy & decision-makers working in the field, in order to “*prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing plans, programmes*” or projects (European Council, 2001).

In general, though, the criteria set for determining the “*likely significant effects*” to be measured (direct and indirect) and the “*factors*” (human health, fauna, flora, soil, water, air, climate, land-use, landscape and cultural heritage values), along with the “*inter-actions*” involved (European Council, 1985), lack of an adequate qualitative representation, typical of the architectural dimension, in particular when referring to processes that regard road-infrastructure. Therefore, a quality-oriented “*sustainable*” approach to road-planning and design is an ultimate necessity and the fundamental step

so that the “road” can finally achieve the status of architectural body (three-dimensional) and its generating processes envisaged as an “opportunity” of environmental transformation (not just an inevitable environmental impact and cost to be mitigated), towards the construction of new contemporary landscapes and the possible rehabilitation and (re)qualification of urban fragments or entire sectors of our territories.

At the same time it will be important to bring to common understanding move beyond the, historically present, "dichotomy" that has characterised two diverging planning and architectural approaches and orientations in regards to transport infrastructure “Design”. The first, of particular interest, reserved to the "terminals of transport": ports, airports, train stations, urban parking facilities but also bridges and underground metropolitan networks, etc., represented as the modern “places” of contemporary mobility and often addressed to International Architectural Competitions. The other, regarding the so called transport “hardware”, represented by the principle infrastructure systems, of each grade and scale, generally responsible of the major environmental impacts and pressures because very often characterised by an inadequate level of architectural quality and scarce context integration, object of this study.

The continuous research and production of new green, high-performance, materials and technologies at competitive prices along with the introduction of innovative and sustainable construction techniques give a clear panorama of the interesting solutions and potentialities still to be experimented in the transportation field.

### **3. OBJECTIVES AND BENEFITS**

#### **3.1 General Objectives**

Sustainable Road Design (SRD) and Planning are the ultimate result of a wide variety of issues, needs and values including mobility, safety, accessibility and context sensitiveness.

The way towards the achievement of this delicate balance goes through the definition of a new “*road-design philosophy*”. A prospective according to which many strategic “intrinsic” road-design elements can “naturally” inform (Stamatiadis et al., 2007) and effectively influence users' and non-users' behaviours and perceptions, engendering in them scenarios that recall unconventional keywords such as: “travel experience”, “road-identity” and “visual comfort”.

The “actors” recalled above aren't only the “active users” (vehicle & bicycle drivers and pedestrians transiting within the road's functional body), but also the “passive users” (passengers) and the “non-users” (those that perceive the road's body, as a whole, from the outside environment: besides, beneath, above).

At the same time the definition of the intrinsic design elements goes beyond the traditional geometric layout standards (roadbed curvature, lane and shoulder width, clear zone width, presence and types of barriers, landscape features), and considers those elements that unexpectedly alter the road-perception such as: night time lighting, construction materials (type, colours, textures), the on-lane communication, fixed and electronic signage (roadside communication), the presence of close-by vegetation and much more.

The main objective of the research is to identify the road-design elements that have an effective influence and interaction on the users' and non-users' perceptions and behaviours, in terms of *road-comprehension*, establish their potential magnitude and translate the results into deliverable A-QS.

The research will ultimately produce new *A-Q-performing* standards that draw innovative guidelines rather than a handbook of typological solutions in which everything is referable to a specific pre-constituted model described in detail. The final users will be decision-makers, transport economists, EIA/SEA consultants and analysts, transportation authorities, stakeholders, but especially planners and designers.

The direct or indirect involvement in the Action of Transportation Officials, stakeholders and professionals from the major number of countries will adequately represent their complex socio-economic, geo-political and administrative structures and correctly reflect their “particular” identities, cultures and expectations. Sustainable road-design requires an early-stage multidisciplinary and organic approach to decision-making and planning.

Great importance will be given to the definition of appropriate communication and dissemination strategies within and out of the research's structure (web-site, open e-forum) in order to facilitate real debate and substantial comprehension beyond discussion forums and congresses, good networking around international research projects and legislation, exchange of researchers and professionals and implementation of the research results during open door meetings.

### 3.2 Specific Objectives

Specific objectives are the followings:

- B1.** Definition of sound methodological procedures and processes that can help to design new generation multi-level and multi-sector Architectural-Quality Parameters and Standards (A-QP/S) to be delivered to the Sustainable-Transport Research Arena in regards to sustainable road-design (SRD Euronorm);
- B2.** Construction of the base principles and procedures for the future establishment of a Permanent European Observatory on A-QS in the transportation field that has the authority to perform a Quality Certification Process based on the introduction of new European “Architectural-Quality-Class categories” A, B, C, D, E, according to which refer major project Financing Strategies (Beyond Best Practices procedures, towards Best Processes Assessments);
- B3.** Establish dissemination strategies and future priority research areas.

### 3.3 Benefits

The A-QP/S will stimulate the production of a great variety of design features and context-sensible “languages” that will elevate the standards of road-quality and safety in Europe while properly representing regional differences and the local identities that are the ultimate resource of our territories and landscapes.

The research's deliverables will also induce an A-Q assessment process within the current EIA/SEA procedures in terms of scoping strategies and transversal

comprehension of direct-indirect, cumulative and synergistic effects of road-infrastructure plans, programmes and projects on the urban/non-urban environments. Overall functionality and safety can meet aesthetics and environmental qualification.

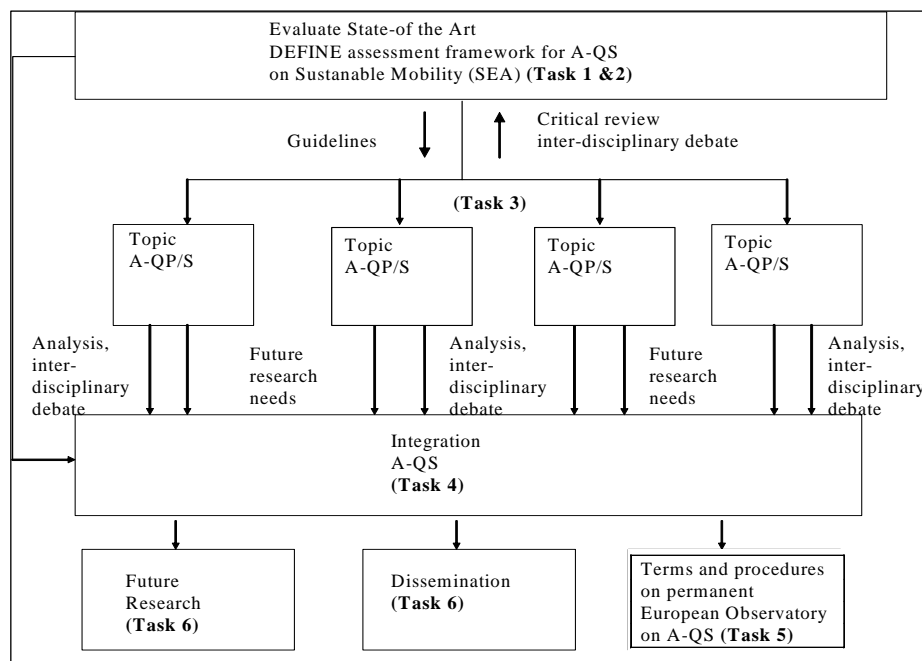
## 4. SCIENTIFIC PROGRAMME AND INNOVATION

### 4.1 Major research tasks

The overall project is structured in 6 main tasks:

- Task 1. Develop an open and flexible framework for assessing A-QS for an environmentally SRD in order to make it possible and easy for any interested country, single stakeholder or researcher, to join the research project (Objective B1);
- Task 2. Evaluate the state-of-the-art knowledge in regards to “street-to-highway” infrastructures and counter analyse case-study Best Practice realisations with the related Processes in order to achieve important feedback and trends. The exportability of the most performing realisations, as models, necessarily goes through the deep comprehension of the processes that have generate them (Objective B1);
- Task 3. Analyse the complex factors that are responsible of the lack of integration between urban design and road planning and design and produce an organic study on the possible measures to be taken in consideration. Analyse different Architectural-Quality Parameters and Standards ( A-QP/S) regarding SRD (Objective B1);
- Task 4. Promote the *understanding*, in terms of perceptions, identities and languages, of the major factors that better identify urban/non-urban A-QP/S necessary to build scientifically sound aggregation methods and technically innovative realisation models and scenarios for SRD. The methodological approach goes through a simulating process of the complex road-body environment using sophisticated animations based on an organic and specifically detailed *dictionary* of road-design and related landscape features in order to evaluate the on-road and off-road subjects' response in predetermined circumstances. A dynamic driving simulator will be used allowing to give both the visual perception of the road environment and the cinematic sensations by a six degrees freedom "Stewart mobile platform". This task requires public involvement (Objective B1);
- Task 5. Define terms and procedures for the establishment and promotion of a Permanent European Observatory on A-QS for the promotion of an environmentally SRD (Objective B2);
- Task 6. Establish dissemination strategies and future priority research areas (Objective B3).

The integration processes must go through an important inter-disciplinary debate for the evaluation of options and accommodate European policy drivers and related programmes and goals (see Figure 1).



**Figure 1 The relationships of Tasks.**

## 5. ORGANISATION

The research project involves 18 partners from 12 EU countries and 2 overseas countries (USA and Canada). In particular, the following partners are involved: 1) Department of Hydraulics, Transport and Civil Infrastructures, POLITO - Politecnico University of Torino, Italy; 2) Department of Construction of Architecture, IUAV University of Architecture, Venice, Italy; 3) Department of Transportation Engineering “Luigi Tocchetti”, University of Naples Federico II, Naples, Italy; 4) Ecole Nationale des Ponts et Chaussées, Institute of Urbanism – University Paris, Créteil cedex, France; 5) Structural Engineering Department, Faculty of Civil Engineering, University of Zagreb, Croatia; 6) Transport Research Centre, Environment Section, Brno, Czech Republic; 7) Laboratory for Environmental Research, University of Nova Gorica, Pristava, Slovenia; 8) VTT - Technical Research Centre of Finland, Finland; 9) VTI - Swedish National Road and Transport Research Institute, Linköping, Sweden; 10) Faculty of Landscape Planning and Regional Development, Corvinus University of Budapest, Hungary; 11) TRL Academy - Transport Research Laboratory, Wokingham,

Berkshire, United Kingdom; 12) Department of Civil Engineering: Transport, Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos, Universidad Politécnica de Madrid, Spain; 13) Research Group Energy, Transport and Climate Policy, Wuppertal Institute for Climate, Environment and Energy, Wuppertal, Germany; 14) DELFT University of Technology, TRAIL - TRANsport, Infrastructure and Logistics, Delft, The Netherlands; 15) Centre for Information Systems in Infrastructure & Construction, Department of Civil Engineering, University of Toronto, ON, Canada; 16) Ontario Ministry of Transportation, Canada; 17) Rhode Island Department of Transportation and Landscape Design, Providence, RI, USA; 18) Minnesota Department of Transportation, St. Paul, MN, USA..

In accordance with the COST Framework philosophy this research can rely on the achievement of individual, national funded, research programmes within the various different topics that characterise the proposed work. The multidisciplinary approach will produce profitable scientific, technical and cultural debate while the exchange of researchers between countries (EU, Canada, USA), the networking and the discussions in workshops and meetings, will favour the necessary dissemination of knowledge and experiences within the Work Groups and outside. The scientific work of the Action will be divided among 4 Working Groups with the following objectives and tasks:

- WG 1. Network building & Methodological guidance (B1, Task 1, Task 2);
- WG 2. Elaboration and definition of A-QS for the achievement of SRD guidelines and their integration in the traditional EIA/SEA processes, from the decision making down to the realisation processes. Mid-term and long-term process evaluation analysis is required for effective feedback data. (B1, Task 3, Task 4);
- WG 3. Terms and procedures for the promotion and establishment of a Permanent European Observatory on A-QS in Environmentally SRD (B2, Task 5);
- WG 4. Final report and dissemination strategies (B3, Task 6).

## 6. CONCLUSIONS

The final users of the research's deliverables will be decision-makers, transport economists, SEA consultants, National transportation authorities and the many stakeholders involved, but especially planners and designers. The definition of adequate A-QS will introduce new alternative and flexible road design parameters, in terms of added value, that will trace innovative and context-sensitive-oriented guidelines rather than a handbook of typological solutions in which everything is referable to a specific pre-constituted model described in detail.

The networking performed by this research will favour inter-disciplinary debate on the many required assessment processes, exchange of international expertise and the construction of the base principles and procedures for the future establishment of a Permanent European Observatory on A-QS in the transportation field.

In regards to previous Research in the field this study represents a complementary and coherent open platform that moves within and beyond environmental impact

conformity towards aesthetic, social, economic and environmental values, needs, constraints and opportunities in a larger community setting.

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