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Traffic and Space  
Review  
U. D. C.: 656(1-21):504.06  
Accepted: Jun. 5, 2000  
Approved: Oct. 10, 2001

## TRAFFIC INFRASTRUCTURE, ENVIRONMENTAL IMPACT AND URBAN SHAPE

### ABSTRACT

*In the twentieth century motor and railway transport has increased the accessibility to goods and people through mobility, flexibility and comfort they provide. The result is generally the improvement of living standards and better opportunity for commercial development of towns and regions as a whole. The increased number of vehicles in everyday traffic have increased the demand for new traffic infrastructures. A lot has already been built in open spaces as well as in urban environment with bad impact on urban shape.*

*Planning and construction of traffic infrastructure throughout the urban structure is neither merely an engineering nor just an aesthetic issue when integrating a new highway, freeway or railway into an urban environment. It is especially, if not primarily, an issue of urban design. This means joint efforts of engineering design and both urban and landscape architecture with focusing sufficient attention on possible multiple uses of common urban space in good environmental conditions. The Slovene Long Term Regional Plan, planning and construction of highways in Slovenia initiated consideration and search for a methodology appropriate for the assessment of suitable layouts, especially in the complex cases of traffic infrastructure passing by or through urban areas. New findings described in this paper supplement the methodological approaches used so far.*

### KEY WORDS

*traffic infrastructure, environmental impacts, urban shape, vulnerability study*

### 1. INTRODUCTION

The ten-year project of developing a new network of motorways in Slovenia is an unparalleled venture of national character that will bring an unlimited number of different impacts and consequences. The body of traffic infrastructure and its adjacent structures represent an aggressive environmental dimension in urban areas and in landscape. Consequently, the traffic infrastructure should be planned, designed, built and maintained on the basis of careful studies and examination. Such projects are characterised by special requirements since the new highways will cut through landscapes and environments with the highest rate of urban development in Slovenia. Careful approach to the design of urban areas and landscapes along motorway

corridors is then an opportunity as well as a challenge for everyone involved to contribute, both through systematic and specific solutions to the best feasible vision of the natural composition of traffic infrastructure.

The following paper should give an overview of the Slovenian efforts in planning and designing of traffic infrastructure.

Investors in construction projects, especially in the construction of traffic infrastructure are aware that construction costs are not the only ones to be included in the final price calculation. The price of the protection of the environment against possible impact, anticipated investments as well as from the cost of changes in design due to the search for still acceptable quality of urban shape and route layout were not included in the original construction plans and their price estimation a decade ago. Possible methodological procedures for the selection of an optimal alternative layout are outlined below. The Slovene Long Term Regional Plan initiated consideration and search for a methodology appropriate for the assessment of suitable layouts, especially in the complex cases of long routes of traffic infrastructure sections passing by or through urban areas as well as in open landscape. New findings supplement the methodological approaches used so far.

Because of profound changes in the approach to planning, and layout of the traffic infrastructure, with roads and railways, with the attention shifted from their technical to spatial quality, the scope of technical comparisons of alternatives and consequently the criteria spread from mainly comparing the lengths of roads construction and investment costs to feasibility studies about investments into the quality of environment and urban shape. The prevailing traditional approach in which plans and designs of roads are implemented by civil engineering, needs to be reversed, while negative impacts of the traffic infrastructure should only later be mitigated through environmental and architectural measures. Design considerations should be integrated in the traffic planning process from the very beginning. Prior design efforts can only alleviate negative impacts and moderately offset the consequences, but this cannot and should not become the standard procedure.

Anticipation and careful evaluation of political problems and benefits to the urban area, and environment are necessary before any traffic infrastructure is initiated. In urban area as well, the construction of roads and railways should begin with collaboration of all professions that can creatively contribute to a better result.

There is no special methodology for determining the type of criteria for alternative evaluation and the way of implementation for all professional disciplines. All criteria are based on experience. Usually, criteria are set forth by project documents, or chosen by engineers themselves [1].

Traffic infrastructure should be treated as part of urban tissue rather than as strange element in an urban area. Traffic infrastructure itself and the spaces it creates, such as safety zones, underpasses, overpasses and in the case of an elevated freeway the whole stretches of land that are often left neglected and without proper use might be substantiated by the purpose of buildings or landscape. One cannot offer any universal principles of design that would apply to a freeway through a city. Nevertheless, it is possible to use a traffic infrastructure corridor simultaneously for variety of purposes, thus alleviating commonplace spatial separations and conditioning its positive presence in the public realm.

Traffic infrastructure and its corridors are not seen as a means of transportation but also as a means of providing public space which could result in better operation of a city in technological, functional and aesthetic terms.

A city is a living organism. Shifting land-use priorities and continuous cycles of adaptation and reuse are opposed to the assumption that some programmes and functions are quite incompatible. On the other hand, many have changed after the issue of the Appleyard's, Lynch's and Myer's *The View from the Road*. They compiled a method of highway planning on the basis of continuous scenes. However, the authors did not deal with sideways views on the infrastructure. The authors claim that infrastructure could be an art form.

The urban shape of traffic infrastructure in urban areas has to follow design principles, meaning that infrastructure should be treated as part of urban environment, because of its contribution to town architecture in the positive or negative sense.

## 2. IMPACT OF TRAFFIC INFRASTRUCTURE ON URBAN GROWTH

Traffic infrastructure is important not only for questions of urban shape and as environmental issue but also as vital for the process of urbanisation by im-

proving the mobility of goods and as a factor of production. This allows greater specialisation both between economical units within the urban area and among urban areas and towns themselves. The greater specialisation allows town growth in size and in demand for traffic attraction. In this way urban growth feeds itself. As towns grow, economies of scale occur in the provision of basic public utilities and services, such as transport. Interurban transport facilities also become more extensive, thereby facilitating further growth of the urban area. Growth in size of the urban area of towns generates the amount of traffic, the deterioration of environmental condition and can eventually lead to agglomeration diseconomies. The following examples are possible:

- Higher transport costs; offices and shops, attracted by the accessibility of central locations, gradually replace residential uses, people begin to seek housing in suburbs. Thus, while employment increases in the centre, there is an increasing separation of workplaces and homes, adding the cost and inconvenience of commuting. Eventually the town centres may lose their long established functions, they cease to be commercial and social points of the town.
- Traffic congestion; as the urban area expands and offices in the town centre are built denser and higher, traffic congestion increases. This may result in fall in central land values, since accessibility diminishes with the saturation of transport network.
- Increased pollution; as urban areas expand pollution takes various forms: noise, smoke and overcrowded housing in the centre, urban decay in the transitional zone as commercial development is anticipated, the suburban housing extends along the main road and rail routes, the loss of open space for recreation and the despoliation of the surrounding countryside is envisaged.

Traffic infrastructure can generate new needs for increased infrastructure in urban areas of towns and cause new environmental, social and economic problems. This brings new challenges for urban shape on a much wider scale in an urban area. It causes also changes in zone determination.

## 3. TRAFFIC INFRASTRUCTURE EVALUATION

As far as traffic infrastructure is concerned, it should be stated that all alternative routes are acceptable from the technical point of view (traffic dynamics and safety), if they meet the requirements and the stipulations of project documents. Supposing that the engineer has considered all environmental limitations when laying out the routes of traffic infrastructure, a

multilayered technical comparison of the alternatives can be carried out.

- construction and investment costs,
- characteristics concerning the construction and use,
- impacts on the environment,
- impacts on the architectural and urban shape
- impacts which cannot be measured.

The criteria stated above do not have equal weight. Simplifications, when all alternatives are ranked according to all criteria and the ranks are added up, are neither correct nor sensible. Criteria are difficult or impossible to compare; they can be used only as an instrument for a gradual elimination of less appropriate alternatives. Of course, a sensible range of approximately equal values that, however, differ from case to case should be maintained. Therefore, it often happens that an alternative, rejected at first, is reconsidered because the rational reasons outweigh the technical ones and, judged by all other criteria, such an alternative is much better. The comparison of construction and investment costs of traffic infrastructure makes it possible to choose the alternatives that are more acceptable for investors, environment and the urban shape. There are no rules as far as the range of possible deviations is concerned, therefore the alternatives are eliminated differently in each case. For the remaining alternatives, other evaluation criteria are applied.

When choosing among the layouts which are similar with regard to the costs and investment, those that require as few interventions in the existing infrastructure as possible should be selected (interruption of its functioning, deterioration of the quality of urban shape, social changes in the area, increased impacts upon it).

When we choose among the alternatives of similar quality, the above mentioned criteria determine the relationship between the construction works and the activities as impacts in the environment. When there are several alternatives of equal quality of urban design, the ones with no significant impact on the environment beyond infrastructure to be constructed should be chosen. The use of land is important. If the costs have already been estimated it is also important to see what kind of land will be used. It is reasonable to use as much degraded land as possible [1].

As a rule, the impact of traffic infrastructures upon the area along them are considered already during the design stage. Noise, vibrations and other impacts are especially disturbing in residential as well as other areas and in disturbing the urban shape and landscape. To avoid subsequent or additional protective measures, negative impacts can be prevented by suitable technological, technical and even administrative solutions already at the design stage. The key question asked is how to guarantee optimal solutions concern-

ing the layout of traffic infrastructure. The question of standards to be applied to achieve the optimal choice of alternative routes is a complex methodological issue. The set of criteria should be designed in connection with circumstances in evaluated urban area and upon the characteristic of the infrastructure which should be built in this area.

#### 4. PREMISES FOR THE ASSESMENT OF TRAFFIC INFRASTRUCTURE UPON THE URBAN ENVIRONMENT IMPACT

The assessment of impact upon the urban environment is at the same time both a protective measure and an instrument of project design. Such attitude towards the assessment should be the basic guidance in determining its contents and procedures for its implementation as well as in judging the affective range and importance of various assessment procedures found in practice. Many unclear elements concerning the role and importance of assessment can be found during the actual assessment of environmental impacts. Sometimes the assessment is treated as a universal protection instrument, while sometimes its role is limited only to checking whether the requirements of the environmental legislation have been met [1]. Chart 1 is an attempt to show the entire scope of urban environmental protection [1]. The protection efforts can be divided into:

- Curative, that is sanitation measures concerning the improvement of the situation in the urban environment, and preventive measures. The latter try to prevent the damage to the urban environment in advance by applying reasonable guidance in carrying out any activities. This reasonable guidance can refer to the choice of technologies or the design character of works. There are basic approaches at the level of preventive instruments for urban environmental protection:

- Standardisation, conditioning and diagnosis. [2]

Standardisation can be seen as a set of standards which means limits for use and design of new environment and of new infrastructure, allowed levels for various emissions, for example in protected areas or in residential areas, educational areas, etc.

Conditioning means issued legal conditions adopted by local authorities in order to prevent bad conditions that can appear in the planning process.

Diagnosis means evaluation process or techniques in order to evaluate alternative possible solutions.

The first is based on certain standardisation of the forms of activities or its details, that is, on solutions prepared in advance. In the second case some design conditions can be established in advance and eventu-

ally the situation is analysed and the solutions or possible actions determined with respect to the results of simulations and possible consequences.

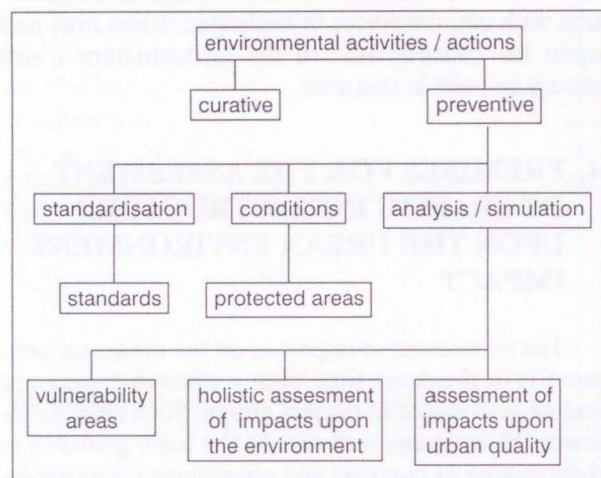


Figure 1- Forms of preventive planning action [1]

In the sensible and protected areas, the curative approach leads to standards and protected areas. They can be categorised as solutions in advance; when planning design actions in the environment, they are simply taken into account and thereby they meet the requirements of urban and environmental protection. When applying the noise prevention standard, for example, we do not ask if there are any circumstances in the environment intensifying or limiting noise perception, but simply regard the stipulated standard as a universal value applicable in any situation. The similar is true for sensible protected urban areas. They also represent some kind of solutions in advance. The use of such areas is determined in advance by protective regulations, other uses cannot be permitted (for example in areas of cultural or architectural heritage).

The other approach is marked by *protective procedure* (evaluation procedures) including analyses, simulations and forecasts of possible situations in the environment itself and in urban design. Such approach could in general be considered as a systematic and transparent planning with clearly delineated individual steps leading to the final solution. The assessment of impacts upon the environment and urban quality undoubtedly belongs to this type of planning [1]. It can be recognised as one of the steps forming part of a wider planning procedure. It is a stage of assessing the alternatives and selecting the best of them.

As already said, the assessment of impacts upon the environment and urban design occurs at the stage of the procedure when alternatives are compared and selected. From its very beginnings, it was conceived as a procedure for the evaluation of designs, that is the evaluation of already implemented conceptual solutions.

Because of its place in the framework of a wider planning procedure, the formation of alternatives in the impact assessment procedure is an exception. The practice of classical assessment of the impacts upon the environment soon showed that the assessment was introduced in the planning process too late to have a substantial effect, because it was not possible to generate substantially different alternatives in the procedure [2]. The requirements for the assessment of policies, programs and plans can simply mean that the assessment of impacts upon the urban design and/in environment in the form of the assessment and selection of alternatives is transferred to more general decision-making levels of the assessment of alternative solutions and development policies. They can also represent a requirement for a different position of preventive measures in the planning and designing of the process itself. Preventive requirements should not be included only at the stage of selecting the alternatives but also in the alternate preparatory stages [3].

## 5. ENVIRONMENTAL VULNERABILITY STUDIES

Vulnerability studies should establish protection requirements already during the analytical stage of the planning process [1]. It should be stressed, however, that this step of the analysis should be divided into several activities including inventory taking, that is the description of the environment/urban area, analysis of the situation, that is, the research of the existing environment/urban area and evaluation in view of possible design changes [3].

As shown in Chart 1, three forms of integrating the protection requirements into planning can be determined:

- vulnerability studies as preventive analysis of the environment, urban design and possible implications of the activities for them,
- holistic assessment of impacts upon the environment as a form of assessing more general plans,
- assessment of impacts upon the urban quality as a form of a preventive judgement aiming at designs for the execution of works.

Identification, prognosis and evaluation, which are the basic steps of any assessment of impacts upon the environment (Chart 1) are also the steps to be taken in any systematic analysis in the planning procedure.

They actually differ in the fact that, in the assessment of impacts upon the environment, the analysis concerns the assessment of the solutions already given, while in the planning process and vulnerability studies it aims at looking for acceptable urban design solutions. This can have certain methodological consequences. For example, in environmental assess-

ment, the analysis is limited to the areas of possible impacts and not the entire sphere of possible alternatives. The content of the analyses within the framework of the assessment of impacts upon the urban environment quality is limited to those components and characteristics of the urban design which are important for its protection in sensible areas and designing of new quality.

## 6. CONCLUSION

The planning of traffic infrastructure in urban and open environment has for ages been the work of engineers. And no doubt, it will remain so in the future. What is new is that the complexity of the planning process has become clearer, and recently other professions have joined in Slovenia as a group of supporters. It is a positive trend, both for professionals and for the building environment as well as for the landscape.

The most important point is that the involvement of an interdisciplinary team starts at an early stage, and is included into the planning team which actually decides, or at least has the possibility to influence the decision on how the traffic infrastructure will be implemented in the environment and how the urban quality will be designed.

Bearing in mind all the above said, it is obvious that the impact assessment of urban quality and urban design can become objective only with the final decision concerning the acceptability of planning and designing of traffic infrastructure in the planning procedure. All evaluations contain a larger or smaller subjective element.

The experts preparing the assessment also contribute to its subjective character, even if they try to remain objective; the same is true for other specialists participating in the assessment process. Therefore the professional public must play its role in final decision-making. Last but not least, a compromise on architectural and urban quality and development requirements must be reached. [3]

To design traffic infrastructure means to be able to see a road in an environment in which it does not exist yet. The construction should be harmonised with the surrounding nature in terms of all requirements that have to do with the landform, geometry dynamics of driving, traffic engineering, landscape, urban quality, optic perception, psychology and climate. Once the general features of the infrastructure and route have been determined, the real alignment and designing

work can start. Within this context designing is not an isolated venture but rather an element of an integral project manifested in an effort to make the new infrastructure become what we desire to see and experience. It is of paramount importance to make proper use of natural shapes of the landscape and of built environment and its special features, and let the new infrastructure add to the quality of the urban environment. The overcoming of obstacles should be practically unnoticeable and as sensitive as possible resulting in an integral structure. These should be the postulates on which the planning and designing of traffic infrastructure should be based.

## POVZETEK

### PROMETNI OBJEKTI, OKOLJSKE POSLEDICE IN URBANA PODOBA

*V dvajsetem stoletju sta motorni in železniški promet pospešila prevoz blaga in mobilnost oseb in z njim povezano udobje. Posledica tega je izboljšanje življenjskega standarda, boljši pogoji za razvoj trgovine v mestih in v regijah. Povečanje obsega motornih vozil v vsakodnevnem prometu povečuje potrebo po novih prometnih infrastrukturnih napravah. Veliko prometnih objektov je zgrajenih novih v odprtem prostoru kakor tudi v urbanem okolju z negativnimi posledicami za podobo mest.*

*Načrtovanje in izgradnja prometnih objektov skozi urbane strukture ni zgolj inženirska zadeva, niti ni zgolj estetska zadeva, ko gre za vprašanje vključitve nove avtoceste, hitre ceste ali železniške proge. Je posebno, če ne kar prvenstveno vprašanje urbanega oblikovanja. To pomeni skupni napor inženirske zasnove, krajinskega načrtovanja in arhitekturno urbanega načrtovanja, ob zadostnem naporu za večnamensko rabo urbanega prostora in kvalitetne okoljske razmere. Slovenski dolgoročni prostorski načrt, načrtovanje in izgradnja avtocest v Sloveniji so pospešili študije in iskanje primerne metodologije za kvalitetno načrtovanje kompleksnih primerov prometnih objektov ob in skozi urbana področja. Nova spoznanja dopolnjujejo sproti nove metodološke pristope načrtovanja.*

## LITERATURE

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