

CONTEXT-SENSITIVE DESIGN FOR RURAL SPEED MANAGEMENT

PAUL MACKEY
Safestreet (Ruesécure) Inc.

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Résumé

Up until the mid 1980's, transportation engineering issues tended to become more and more standardized. As such, the approach used for road design was prone to neglect the physical, economic and social environment in which the road was situated. In the past few years, a major change has taken place, with an emphasis on the importance of engineering judgement and an increase in the flexibility of design issues. Road design has become increasingly influenced by the relationship with roadside land uses and thus increasingly complex. The designer now has to respond to concerns about the safety of vulnerable road users, the aesthetics of the streetscape, the impacts on business activity, the identity of towns....

Impetus for change has come from successful examples of pilot projects in France through the "Ville plus sûre, quartiers sans accidents" program in the mid-80's, in Denmark with the "Environmentally-adapted through roads" program, in the United Kingdom with the "Village Speed Control Working Group" project, in Australia with the "Environmental Adaptation of the Main Street in Rural Towns". In the United States, passage of ISTEA in 1991 has led to greater interest in flexibility of design. An approach, initially labelled "Thinking Beyond the Pavement" in 1997, has evolved into Context-Sensitive Design or Context-Sensitive Solutions. The new TAC Geometric Design Guide has also adopted a flexible approach to design.

The Québec Department of Transportation is starting to implement projects which incorporate such a perspective, called "traversées d'agglomérations".

Our firm is currently working on its fifth such project. The presentation would discuss the Quebec approach, the latest developments occurring in the United States and present a case study in the hamlet of Massawippi. The underlying problems there include poor perception of the hamlet by drivers because of heavy vegetation (human factors), traffic speeds seen as excessive by pedestrians and the location of an intersection in a hollow. The proposed solutions respond to citizen and municipal concerns about protecting the natural environment and local identity as well as providing protected space for pedestrians. The Québec DOT has agreed to experiment an innovative road shoulder treatment, one part of the project. It should be underway next summer and a progress report will be provided.

Flexibility in Highway Design

Up until the mid 1980's, transportation engineering issues tended to become more and more standardized, as the name "Geometric Design **Standards** for Canadian Roads" implies. As such, the approach used for road design was prone to neglect the physical, economic and social environment in which the road was situated. In the past few years, a major change has taken place, with an emphasis on the importance of engineering judgement and an increase in the flexibility of design issues. Road design has become increasingly influenced by the relationship with roadside land uses and thus increasingly complex. The designer now has to respond to concerns about the safety of vulnerable road users, the aesthetics of the streetscape, the impacts on business activity, the identity of towns....

Impetus for change has come from successful examples of pilot projects in France through the "Ville plus sûre, quartiers sans accidents" program in the mid-80's, in Denmark with the "Environmentally-adapted through roads" program, in the United Kingdom with the "Village Speed Control Working Group" project, in Australia with the "Environmental Adaptation of the Main Street in Rural Towns". In the United States, passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 led to greater interest in flexibility of design, at first especially in relationship to historic or scenic areas. The Act states:

"If a proposed project... involves a historic facility or is located in an area of historic or scenic value, the Secretary may approve such project... if such project is designed to standards that allow for the preservation of such historic or scenic value and such project is designed with mitigation measures to allow preservation of such value and ensure safe use of the facility."(1)

"In 1995, Congress reemphasized and strengthened this direction through the National Highway System (NHS) Act:

*"A design for new construction, reconstruction, resurfacing... restoration, or rehabilitation of a highway on the National Highway System... may take into account...
- the constructed and natural environment of the area;
- the environmental, scenic, aesthetic, historic, community and preservation impacts of the activity; and
- access for other modes of transportation."*(2)

In 1997, the Federal Highway Administration (FHWA) published **Flexibility in Highway Design**. The introduction of the manual puts it clearly:

"An important concept in highway design is that every project is unique. The setting and character of the area, the values of the community, the needs of the highway users, and the challenges and opportunities are unique factors that designers must consider with each highway project.... there are no patented solutions. For each potential project, designers are faced with the task of balancing the need for the highway improvement with

the need to safely integrate the design into the surrounding natural and human environments." "Aesthetic, scenic, historic and cultural resources the physical characteristics of an area are always important factors because they help give a community its identity and sense of place and are a source of local pride." (3)

In May 1998, twenty nine state DOT met in Maryland for a conference entitled "Thinking Beyond the Pavement". The goals of the conference were to:

7. "Find and publicize the best ways of integrating highways with their communities and the environment while maintaining safety and performance;
8. Encourage continuous improvement in design of transportation projects across the nation, balancing all of our customers' concerns, whether transportation related or not; and
9. Achieve flexible, context-sensitive design in all projects." (4)

A number of conferences have been held since then, including a regional conference in November 2001 in Connecticut, one of the pilot states, the subject was discussed at the Transportation Research Board meeting in January 2000 and a National Cooperative Highway Research Project (NCHRP) contract was awarded to produce **A Guide to Best Practices for Achieving Context Sensitive Solutions**, which appeared in 2002.

Two main focuses are identified: involving stakeholders and the general public at the start of projects and using a multidisciplinary approach. The report recommends extensive public involvement, including interviews with stakeholder groups, but it underlines the need for additional activities: "Results from such interviews may not necessarily provide a complete picture of all community values and interests. Most good public involvement plans call for broad community outreach at an early point in the project to ensure mutual understanding between the agency and the stakeholders of the full set of concerns associated with the project... Outreach should be focused on understanding community attitudes about the nature of transportation problems or issues associated with the identified project... A problem definition can be crafted from the issues identified by the agency and the community through similar techniques as described for issue identification...The absence of general endorsement of the problem definition is a strong signal that the project is not ready to proceed to the next step.... (Agencies can use outreach to measure issues such as "quality of life" and "community cohesion")... if these issues are important to the stakeholders, they must be tackled head-on" (5)

Choosing Design Speeds and Ensuring Safety

Context Sensitive Design has raised the issue of selecting the appropriate design speed. "Traditional design practices and training of highway designers results in design speed being equated with design quality. In other words, many designers view a 60 mph highway as qualitatively better than a 50 mph highway.... (t)he substantive safety differences between the two are generally overestimated.... Interestingly, all pilot state staff noted that speed consistency along a highway is as or more critical to good operations than the design speed." (6) Americans have travelled to Europe in order to take advantage of their experience: "The CSD approach is a

current practice in several European countries, which use these highway geometric design concepts and tools to address mobility, safety and community issues.” (7)

The Europeans have made a clear link between design and operating speeds:

“All the experts now agree that road design influences driver behaviour, and speed in particular. When it appears necessary to request the driver to reduce his speed, such as when passing through small urban areas or when entering towns, a well thought out road design proves to be more effective than reinforced road signs.

In designing a road it is first necessary to decide what specific functions it serves: ... local, regional, national through road..., a scenic route. The objective is never simply to “reduce speed” but to suggest – or constrain drivers to adopt – a speed appropriate to the conditions. The choice of this speed should be dictated by the specific function a road serves...

The most problematic cases – and the most frequent – are multi-function roads on the fringes of or through residential areas. Such roads call for a least-risk management approach, i.e. very low speeds....

The behaviour of road users is dictated by their own experience and observations. Whether or not a driver can predict precisely what will happen next largely depends on how easy it is to read the road, i.e. on his immediate perception of the meaning of all kinds of information supplied by his surroundings.

Good infrastructure design can induce drivers to reduce speed “instinctively” – i.e. independently of speed limit signs or rules of the road....

Any obstructions, changes in the continuity of the road or hazards must obviously be clearly signed, but this is often not enough to produce the desired result.” (8)

The flexibility in highway design required by its sensitivity to the context has raised the issue of safety. “Best practice in engaging stakeholders and making decisions about what is acceptable focuses on two aspects of safety. Hauer refers to the concept of *nominal safety* and *substantive safety*... *Nominal safety* refers to a design or alternative’s adherence to design criteria and/or standards.... *Substantive safety* refers to the actual performance of a highway or facility as measured by its crash experience... It is important to note that the two types of safety, while often related, are not the same thing.” (9) This approach to considering safety was highlighted in the recent edition of the TAC Geometric Design Guide for Canadian Roads, which allows a greater degree of flexibility in design. It reflects the conclusions of the Professional Engineers of Ontario (PEO) panel that examined the design history of Highway 407.

Québec Experience with Context-Sensitive Design

The Québec Department of Transportation (QDOT) started examining the issue in 1989, when it formed a Steering Committee on Urban and Semi-Urban Road Design. The Department was influenced by the "Ville plus sûre, quartiers sans accidents" program undertaken in France in the mid-80's and benefited from a year-long stay in Montreal of one of the French district engineers that had led a project in Doyet. The approach seeks to harmonize traffic, safety and the built milieu. To this end, it attempts to ensure a fair sharing of road space amongst the different types

of users and to change the perception of drivers so that they adjust their behaviour to fit the area they are driving through.

The Department printed a manual in 1997, entitled Aménagements routiers dans la traversée des agglomérations, which was made public in 2000. The Department started to study projects which incorporate such a perspective, called "traversées d'agglomérations", first in Amqui, then in Amos, Saint-Irénée, Dosquet, Dunham, Angers, Massawippi, Carleton.

The approach consists of five principal steps:

7. Defining the problem;
8. Diagnosing the road and its surroundings: traffic levels, road safety, the spatial organization of the built-up area, sociological aspects, economic development and the environment;
9. Designing the road by first dividing it into visual and functional sections, defining objectives for each section, defining an overall concept, treating each section's cross-section and landscape treatment;
10. Construction;
11. Evaluation.

Case Study on a Small Scale

Our firm is currently working on its fifth such project (four of which are in Quebec and one was in New Brunswick). The case study that follows deals with a 1.4 km section of Highway 143 in the hamlet of Massawippi, in the Eastern Townships area of Quebec, consisting of a dozen houses and one antiques store. Responding to complaints by the town, QDOT wanted to reduce the operating speed. The highway descends and ascends because of the presence of a stream. In the hollow is an intersection with Highway 208 west. Because of safety concerns, the intersection was equipped with flashing signals and the speed limit was posted at 50 km/h. The highway is popular with truckers from the U.S. that need to go east from Lennoxville on Highway 108 in order to avoid going through Sherbrooke.

The Department had already identified underlying problems that include poor perception of the hamlet by drivers because of vegetation, traffic speeds seen as excessive by pedestrians and the location of the intersection in the hollow. The houses are set back far from the road, there are many trees that shield the houses so that the hamlet resembles the rural areas on each side. Massawippi is the only "built-up" area between Lennoxville and Stanstead. Operating speeds had an 85th percentile of between 74 and 77 km/h; according to QDOT's surveys, speeds had increased slightly when the shoulder was paved. The police were inclined to accept drivers' explanation that they had not seen the 50 km/h posted speed.

The hamlet is too small to have sidewalks, so pedestrians walk on the shoulder or close to it, in order to access the common mail box. The road is popular with well-trained cyclists, but gets limited use from everyday cyclists, because the highway does not have paved shoulders and gets considerable truck traffic. At a public meeting held in the information gathering stage of the

project, the residents were aware that attempting to reduce truck speeds too far would require them to change gears going uphill, thus creating increased noise. The citizens were also very protective of the natural environment and did not want any trees to be cut.

The overall objectives that were developed in the project included:

7. Improving the feeling of safety of residents in the heart of the area;
8. Influencing driver perception of the nature of the area;
9. Using measures that respect the scale and the character of the area;
10. Using low-cost techniques, if possible;
11. Enhancing the quality of the area;
12. Creating contrast with the surrounding area to alert motorists
13. Setting realistic speed objectives, specifically reducing the percentage of higher speed vehicles, for example from 27% to 10% over 70 km/h, with none over 80 km/h.

More specific objectives were to:

7. Determine the most strategic spots to modify;
8. Improve the readability of the entrances and of the heart of the hamlet;
9. Ensure the safety of pedestrians in the centre of the hamlet;
10. Ensure the safety of cyclists in the centre of the hamlet;
11. Improve the conspicuity of the intersection with Highway 208 west.

The small scale of the project required thinking out of the box to find some innovative ideas. The proposed solutions respond to citizen and municipal concerns about protecting the natural environment and local identity as well as providing protected space for pedestrians. In order to make it clearer to motorists that Massawippi has residents, three approaches were suggested:

7. Treating shoulders;
8. Installing tasteful signs highlighting points of historical interest;
9. Using the utility poles.

The recommendation was to remove the asphalt shoulder, replace it with structural soil and plant salt-resistant, ground-hugging flowering plants. Contact was made with QDOT personnel responsible for snow-clearing operations to ensure that the plants would survive plowing. QDOT has agreed to experiment the innovative road shoulder treatment. It should be underway this summer and a progress report will be provided. A narrow path on the outside edge is to accommodate pedestrians and inexperienced cyclists.

Signs announcing the hamlet were recommended at each end of the hamlet, as well as colour-coordinated signs near some historic homes, announcing a historic church and school on Highway 208 west and indicating the ruins of a mill.

Planters were proposed on the utility poles to reinforce the notion that the hamlet is there.

References

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