

***Submission for the Transportation Association of Canada
2008 Environmental Achievement Award***

***Extension of the Robert-Bourassa Autoroute
as an Urban Boulevard in the City of Québec***

An exercise in environmental integration

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***Ministry of Transport
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March 2009

**Transports
Québec** 

How to ensure the harmonious coexistence of a new high traffic urban arterial, a natural area and established residential neighbourhoods, while responding to the needs of pedestrians, cyclists, drivers, public transit and wildlife, in addition to maintaining an existing watercourse in its natural state?

This was the multifaceted challenge we faced in designing the extension of an existing highway as a new four-lane urban boulevard passing through a natural area, a subdivision under development and several established residential neighborhoods. In addition, the size of the infrastructure and expected traffic volumes were perceived as major concerns by the local population.

Furthermore, the project's visual aspect and the careful insertion of this new roadway corridor into a changing landscape were of key importance to the design team.

The residents of the City of Québec's north end have been waiting for the Robert-Bourassa Autoroute Extension for several decades. This new urban boulevard is the result of a multi-year joint effort by regional elected officials, City of Québec municipal authorities and the Quebec Ministry of Transport (MTQ). One of our key challenges consisted in achieving an overall understanding of the project's key characteristics and potential impacts in order to best fulfill public expectations from a functional and environmental perspective.

Project Objectives

- Increase the efficiency of the local and regional road networks
- Consolidate the existing network while ensuring the sound management of the new roadway corridor
- Consolidate the urban form and provide an anchor for the development of the Lebourgneuf sector, the sole remaining undeveloped area close to the downtown core
- Complete the project in full compliance with biophysical and human environment requirements, in keeping with the principles of sustainable development.

In 2004, this project was submitted to a full public consultation program, as required by the Government of Quebec's environmental assessment process. In total, seventy-three (73) briefs were submitted to Quebec's highest environmental hearings panel, the *Bureau d'audiences publiques sur l'environnement* (BAPE). These briefs provide a full and detailed description of issues and public concerns relating to the environmental integration aspect of the project. Indeed, the project was subjected to intense scrutiny by environmentalists and by the future users of this major urban arterial.

Key Issues

From a natural environment protection standpoint, the project focused on certain key issues aimed at maintaining the site's environmental integrity. They are described as follows:

In the southernmost section of the project area (see Figure 1), the boulevard crosses the *parc de l'Escarpement*, a linear park that encompasses one of the City's last remaining major wooded areas. The park includes several stands of mature trees, including groves of locally rare butternut trees, remnants of the local primeval forest, along with a healthy understorey providing shelter to the many animal species that inhabit the park or use it as a movement corridor.

To the North, the roadway corridor crosses the steep, densely forested banks of the *du Berger River*, which connects to the *parc de l'Escarpement*. The northern extremity of the project area (see Figure 1) includes a small marshy area located close to the roadway alignment. The remaining spaces include reclaimed agricultural wildlands slowly being reclaimed by the forest, albeit slated for housing development. The construction of new subdivisions and the roadway extension in the *du Berger River* drainage basin is likely to bring profound hydrological changes in the area, which will have a considerable impact on the watercourse's ecological characteristics. Also, these striking natural spaces are extremely popular with local nature enthusiasts.

In addition to the natural areas described above, all other components of the project area are heavily used, and this use will only increase in the future.

Although many new streets have been built in the vicinity in recent years, local area residents remain attached to the area's peaceful surroundings. The development of the roadway corridor will include a network of bicycle paths connected to the city-wide recreational pathways system, along with pedestrian spaces and a transit-only corridor to be implemented as the need develops.

Mitigation Measures

In regards to the natural environment, the most difficult challenge resided in the need to cross both the *parc de l'Escarpement* and the *du Berger River* while maintaining the area's ecological integrity and limiting the fragmentation of wildlife habitats.

In order to resolve this challenge, a series of measures were implemented to make the boulevard "permeable" to local wildlife. (see Figure 2 – aerial photo).

Three state of the art wildlife passageways were put in place. These new style structures had never been used in Quebec before. In addition, a raised walkway was built inside a culvert which channels the stream flowing along the base of the escarpment, a ten meter wide mixed use (wildlife/pedestrians) passageway was built under the roadway close to the center of the park and the bridge crossing the *du Berger River* was lengthened in order to limit the impact on both shorelines. Also included is a network of metal-reinforced, sunken fences which block wildlife from crossing the surface of the boulevard and channel the fauna toward the passageways.

Rows of stumps and rocks were placed in the mixed-use passageway and under the river bridge in order to provide a continuous line of cover for small animals. Dense plantings of indigenous plants were placed between the passageways and the natural areas to provide continuous vegetative cover. A carefully planned (tree by tree) tree

removal program combined with modifications to the final boulevard alignment resulted in the preservation of much of the forest cover right to the edge of the roadway. In addition, a densely planted median will one day reestablish the continuity of the forest canopy, which is essential to many local bird species.

The design also includes two storm water retention ponds, located on either side of the boulevard. Developed as wildlife habitats and fed by the drainage water from the boulevard, these strategically located features attract local fauna and contribute to the use of the nearby wildlife passageways.

In order to reduce the number of pedestrian/cyclist – wildlife conflicts, elevated footbridges spanning the *parc de l'Escarpement* stream were built on both sides of the boulevard, and the bicycle path crossing the park at that location now runs along the boulevard.

The project also involved the relocation of a trail including the construction of an elevated section crossing through a small wetland area. For all planting activities within the natural areas, a great deal of care was taken to select native plant materials compatible with the existing vegetation communities. A special effort was made to plant noble, deciduous tree species such as butternut and oak.

In the north section of the site, a small marsh area popular with the birdwatching community was preserved with a slight adjustment of the roadway alignment combined with the construction of an elevated passageway.

In order to minimize the impacts of additional runoff caused by the increase of impermeable surfaces stemming from the construction of the boulevard and new residential subdivisions in the drainage basin, a total of 10 storm water retention ponds were built in the project corridor. Their main purpose is to even out the flow of storm water to the river during heavy rainfalls and to allow for the gradual infiltration of storm water back into the soil throughout the lowland area. The areas surrounding the retention ponds are heavily planted with noble deciduous trees and shrubbery.

The retention ponds were all built within park boundaries, on reclaimed farm fields or on land unusable for construction (i.e. under hydro transmission lines). In addition to reducing the hydrological and ecological impacts on the river, these storm water management features contributed to lower project construction costs by at least \$100,000 by reducing the need for storm water piping and infrastructure. It also added new, high ecological value wetland areas.

In addition to the natural environment considerations, the impacts on the human environment and the needs of the local population were taken into account throughout the project. In that respect, the streetscape was designed to convey the transition from a highway environment to an urban environment by giving it more of a neighborhood look and feel. Specifically, it was essential to communicate to all drivers the need to reduce their speed from 70 km/h to 50 km/h along the boulevard.

Double rows of trees along with a median densely planted with shrubs and tall grasses accompany the driver along an urban boulevard punctuated by carefully designed intersections. A new bike path running parallel to the boulevard is given the widest possible berth from the roadway, whenever the terrain permits, in order to offer cyclists the most quiet and enjoyable experience possible. In addition, a new bicycle/pedestrian tunnel was built at the Lebourgneuf Boulevard intersection, which will significantly reduce the potential for user conflicts at this busy location.

Several new features were built throughout natural and urban areas of the roadway corridor in order to enhance the pedestrian experience and prevent user conflicts. The pedestrian trails network now includes a tunnel, an underpass through the park, several footbridges, two observation platforms (on the bridge), stone dust paths (in the natural areas) and paved sidewalks lined with lush vegetation, and each of these new structures featuring its own distinct architectural character.

Furthermore, in keeping with the sustainable development objective, the roadway infrastructure was designed to accommodate an additional bus-only lane when the level of urban development in the surrounding area warrants the expansion of the public transit system. Currently grassed over, this future transit lane could be built with only slight modifications to the existing roadway environment. The bridge across the du Berger River and the underpass through the park were designed to accommodate this future transit-only lane.

Finally, several measures were implemented to ensure the integration of the new roadway corridor with existing residential areas to the north and south of the project area. In the north section of the site, this included modifying the roadway alignment to provide more separation from existing houses and constructing a greenspace buffer strip complete with a noise-abatement wall. The materials used for the noise-abatement wall included slabs of granite salvaged from the Saint-Charles River Renaturalisation Project, an urban waterway reclamation initiative.

In the southern section, where the project area is wider, berms were built using project excavation materials and covered in vegetation, to provide an additional natural buffer to adjacent neighborhoods. In addition, all of the topsoil stripped as part of this project was either reused on site or brought to other MTQ project sites where it was needed.

An environmental monitoring program and an environmental follow-up program were also implemented.

- During construction activities, a rigorous monitoring program was implemented to ensure compliance with the plans and specifications, and to supervise the application of tree protection and erosion-control directives. Sediment barriers were used in all high-risk areas, and all affected shoreline areas were permanently stabilized through seeding operations and other soils engineering techniques.
- Now that the project has been completed, the environmental follow-up program is focusing mainly on reviewing the efficiency of the project's innovative features,

such as the storm water retention ponds and the wildlife passageways. For example, the program includes a detailed study of erosion activities along the banks of the *du Berger River*; monitoring of water quality at the storm water retention pond outlets; follow-up on the use of the wildlife passageways, and; monitoring the health and growth of all planted materials. Finally, a comprehensive assessment of noise conditions in the roadway corridor is under way, and will monitor the situation over a ten-year period.

Conclusion

The total project cost of this major endeavour was \$56 million dollars, funded jointly and equally by the MTQ and City of Québec. It should be noted that a full 8% of this total was allocated directly to environmental integration.

The planting program, implemented in 2007, included more than 2,700 trees, 26,000 shrubs and 24,000 perennials and aquatic plants. Recent inspections indicate a very high overall survival rate for all types of plant materials. The unique and innovative wildlife passageways, a first in Quebec, appear to be well used by local wildlife, along with the storm water management ponds, which have also become a popular destination for park users.

After certain adjustments, the storm water ponds now serve their intended primary purpose and have become effective hydrological management features. There has not been an increase of erosion activity downstream of the project area, and the quality of the water exiting the ponds is certainly acceptable, given the urban nature of the drainage basin.

Since the conclusion of construction activities, more plant materials have been added to certain vegetation areas, and the monitoring of local wildlife activity and storm water management features will continue over the next five years.

The high degree of success achieved with this project provides a prime example of environmental integration and of the many innovative technical solutions available to resolve a broad range of environmental constraints. This project has proven to be a showcase for environmentally sustainable roadway infrastructure development.