

ACEC Awards 2015

Highway 401 / Holt Road Interchange Preliminary and Detail Design



Aerial photograph of Darlington Nuclear Station is provided courtesy of Ontario Power Generation

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PROJECT DESCRIPTION

This project was completed by URS which became a part of the AECOM family of companies in October 2014.

Two-lane roundabouts in place of traffic signals at ramp terminals – not only a first for Ontario; but one of a total of three multi-lane roundabouts in less than one kilometer along Holt Road at Highway 401. Merely one of the innovations incorporated in URS' design for the Ministry of Transportation's Highway 401/Holt Road Interchange project.

The Ontario Government is committed to providing modern and reliable sources of electricity. To this end, the Ontario Power Generation (OPG) has planned works at the Darlington Nuclear Generating Station that will result in significant employment growth, increasing traffic volumes which cannot be supported by the area's existing roadway network.

Coupled with this is the need to expand existing provincial transportation infrastructure. A new freeway-to-freeway interchange between Highway 401 and the East Durham Link (Hwy 407 East – Phase 2) is planned just west of Holt Road. In addition, long term planning has

Highway 401 widened to ten lanes through this area. Neither of these projects can proceed with the existing Holt Road Interchange configuration.

Consequently, the Ministry of Transportation hired URS to provide preliminary and detail design services for the Highway 401/Holt Road Interchange project. The URS team produced a design to accommodate

the immediate needs of OPG while allowing for future widening of Highway 401 and future connections to the East Durham Link. Maintaining smooth traffic and plant operations during construction works, improving traffic flow after construction, environmental concerns and addressing the unique challenges of an operating nuclear plant were key areas of the project's success.



INNOVATION

The planned refurbishment of Darlington Nuclear Generating Station (DNGS) by Ontario Power Generation (OPG) will result in significant employment growth, increasing traffic volumes that cannot be supported by the area's existing roadway network. In particular, the existing Highway 401/Holt Road interchange provides partial access to the highway only, and the aging infrastructure is considered unsafe and in need of improvement. URS was consequently hired by the Ontario Ministry of Transportation (MTO) to provide preliminary and detailed design services for the re-construction and upgrading of the existing interchange. The project was undertaken under a compressed timeline and in close coordination with OPG, in order that the improvements would be constructed in advance of the DNGS works.

The lands surrounding the existing interchange have been designated for future expansion of Hydro One and OPG facilities, and minimizing impacts to these lands and an adjacent service road was a key consideration in the design process. A further key objective was to improve traffic flow into and out of OPG lands, and to accommodate access requirements of an operating nuclear power plant throughout the duration of the project with only minimal disruption. An innovative design incorporating a series of three successive roundabouts along Holt Road was subsequently developed by URS, representing the first

roundabouts at freeway ramp terminals on an MTO facility and representing a notable shift away from the traditional MTO interchange configuration. This design allowed for the alignment of the service road to be shifted further north than could be accomplished with signalized intersections, minimizing encroachment into adjacent lands. The three roundabouts in lieu of traffic signals also allowed for a continuous flow of traffic to be maintained through the interchange.

Given the uniqueness of this design for MTO, complex traffic analysis was completed to understand the projected operations of vehicles through the three closely spaced roundabouts, with design refinements incorporated as required based on results of the analysis. A wide variety of interested stakeholders with competing interests were involved throughout the project, and early and ongoing consultation was integral in successfully completing the project and obtaining all necessary endorsement and approvals within the necessary timelines. The use of innovative interactive demonstrations at public and agency meetings, ranging from 3D traffic models, brochures, and roadway mat with model cars, provided public education on the benefits and safe use of the three roundabouts and assisted in obtaining support for the recommendations.



Screenshot from Traffic Microsimulation Analysis of Roundabouts.



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COMPLEXITY

A key challenge in this project was balancing the design requirements and future highway expansion needs of the MTO, while meeting the unique requirements of OPG and an operating nuclear power plant. A nuclear power plant is not a typical stakeholder in these types of projects and as such, impacts to various infrastructure including radiation monitoring equipment and a Green Peace time capsule had to be handled in a sensitive manner. URS worked tirelessly with OPG to adjust the design to suit their needs. Where impacts to equipment were unavoidable URS identified relocation strategies and worked with OPG to implement the work.

Additional challenges that further compounded the complexity of the project included various environmental constraints, including Species-at-Risk concerns within the project area. These concerns restricted certain work from

being performed for a crucial three-month construction window, and the construction staging design was subsequently updated including preparation of an advance clearing contract to maintain the overall schedule. The design required removal of a substantial amount of soil from a former landfill site, and subsequent contaminate testing was required to determine the suitability of this soil for new roadway construction.

The proximity of the three closely spaced roundabouts required complex traffic analysis to understand operations through the interchange. Provision of adequate signage through the roundabouts that would minimize driver confusion and improve operations was also a challenge, and this was addressed through a combination of standard ground mounted and overhead signs approaching and between the roundabouts.



URS worked tirelessly with OPG to adjust the design to suit their needs.



Bridge under construction.

SOCIAL AND/OR ECONOMIC BENEFITS

In choosing to refurbish the Darlington Nuclear Generating Station, the Province is demonstrating its commitment to provide Ontarians with reliable access to modern sources of power. The refurbishment will lead to a significant increase in employee population at the plant, providing a major boost to the area economy. Consequently, additional strain will be placed on the transportation infrastructure, and the refurbishment activities cannot fully proceed until the interchange upgrades are complete.

The roundabout design and improved access to Highway 401 will improve overall safety conditions for drivers, and will improve traffic flow and reduce travel times by up to five minutes for OPG employees and area residents in the surrounding road network. While improvements in the transportation system are necessary, they must be implemented with minimal impacts to the public and stakeholders who currently use these systems. In providing an innovative and technically complex design while meeting required timelines, the design enables construction to proceed while minimizing disruptions to the travelling public and plant operations, as well as allowing refurbishment work on the plant to begin in 2016.

The project also includes significant enhancements to a two-kilometre section of the *Waterfront Trail*, a 1400 km network of paths, neighbourhood streets and rural roads running along the shores of Lakes Ontario, Erie, St. Clair and the Niagara and Detroit Rivers. Improvements include better access, enhanced walking surface and a new parking lot for trail users of this recreational and tourist-friendly green spot, marking an important ancillary achievement of the project's undertaking.



Proposed enhancements to the *Waterfront Trail*.



Existing Holt Road Interchange and South Service Road.

ENVIRONMENTAL BENEFITS

Three roundabouts along Holt Road were incorporated in part as they have proven to be the better environmental choice. The avoidance of traffic lights eliminates idling vehicles and provides for a continuous flow of traffic, minimizing vehicular emissions and subsequently improving overall air quality levels. The proposed enhancements to the *Waterfront Trail*, and incorporation of pedestrian and cyclist-friendly crossing measures at the roundabouts, will promote Active Transportation choices for both recreational users and commuters.

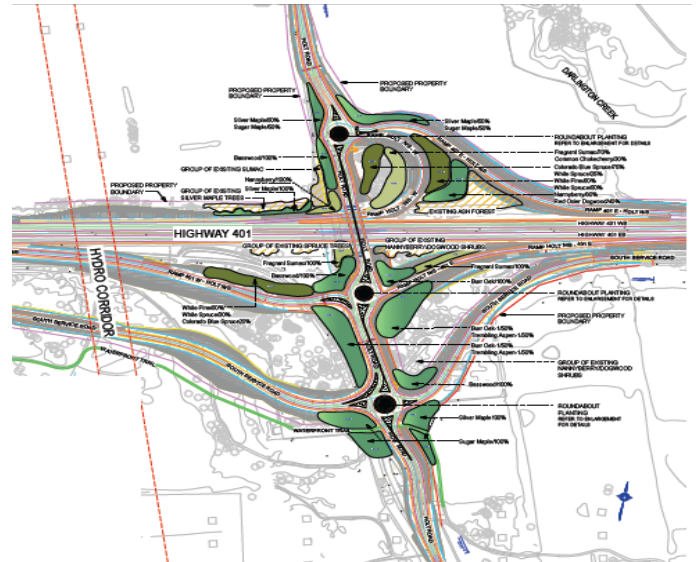
The expedited upgrading of the Holt Road interchange, which was designed to minimize ongoing OPG operations, allows for refurbishment work on the DNGS to begin in 2016. In and of itself, refurbishment of the plant is considered a major environmental and sustainability benefit, maintaining a clean and reliable source of power for the Province.

The presence of identified Species-at-Risk imposed a restriction of when certain key construction activities could commence. An advanced clearing contract was prepared to allow trees to be removed and vegetation stripped prior to start of the restriction window. This advance work was successfully completed, avoiding adverse impacts to Species-at-Risk while allowing the project to proceed on schedule.

The removal and testing of soil from a former landfill site was required to confirm potential for contamination and adequacy of soils for use in new roadway constructions. Careful design allowed these soils to be used within the new roadway embankments but below the frost line. This allowed site generated material to be reused onsite where possible, limiting excess material to be deposited in other landfills.



New Alignment of South Service Road.



Highway 401/Holt Road Landscape Concept Plan.

MEETING THE CLIENT'S NEEDS

As with most government funded projects, success is best measured by how the project meets the needs of the real client, the resident and commercial population of Ontario. It's simple. Ontario is committed to providing Ontarians with access to reliable, up-to-date sources of power. One of the ways the Province has chosen to do this is through refurbishment of the Darlington Nuclear Generating Station. The growth in jobs and traffic and the transportation infrastructure to support this growth requires better and timely delivered transportation improvement projects. Any improvements in that transportation system must be implemented with minimal impacts to the public and stakeholders who currently use these systems. In providing an innovative and technically complex design while meeting required timelines, URS has enabled construction to take place while minimizing disruptions to the travelling public

and plant operations, as well as enabling refurbishment work on the power plant to begin in 2016.

Ontario Power Generation required work to be conducted within a tight time frame and be conducted seamlessly so as not to impact transportation flows. URS made sure all approvals, permits and property accesses were acquired and extensive consultations undertaken to keep all stakeholders apprised of project progress and allow for constructive discourse with the general public. The project was delivered impeccably to the client's complete satisfaction and the extended client, Ontarians, benefit the most. The transportation infrastructure can now support Darlington's employee growth which will increase power output giving Ontarians greater access to more sources of power.



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About AECOM

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