

MacDonald Bridge Rehabilitation

TAC Environmental Achievement Award submission



THE CITY OF
CALGARY
ROADS

Overview

Just before the confluence of the Bow and Elbow Rivers, where Fort Calgary, an 1863 Northwest Mounted Police post, keeps watch over the water, stands the MacDonald Bridge. Since 1911, the MacDonald Bridge has been a fixture over southern Alberta's Elbow River.

In May of 2006, this through truss steel bridge went through its annual inspection by The City of Calgary, Roads, and the decision was made that it was time to rehabilitate this heritage river crossing. Four paint samples were collected from strategic locations, and analysed for heavy metal content. Sampling results revealed that three of the four samples collected resulted in greater than 5000ppm (>0.5%) of lead by weight. Paint samples yielding over 5000ppm by weight of lead are classified as lead-containing. Due to the entire bridge being coated in a lead-containing paint, Roads decided to take the rehabilitation process a few steps further.

The Elbow River, originating in the Canadian Rockies, has very stringent environmental requirements. This river flows directly into the Bow River, a world class trout fishing destination populated with rainbow trout, brown trout, bull trout, and rocky mountain whitefish. The MacDonald Bridge, destined to undergo abrasive blasting and repainting, had the potential to release paint particulates containing lead, a highly toxic metal, into the air, land, and water. By using a system of complete containment during the project, Roads was able to completely avoid any negative environmental impacts for the duration of the project.

The process and the methods used to maintain critical transportation across the bridge while protecting the environment have set a new standard for The City of Calgary and for southern Alberta. Through sampling, frequent inspections, strict requirements, and attention to detail, Roads successfully maintained a balance between meeting environmental and OH&S legislation while allowing essential transportation over the river for local communities.

Here at Roads, we feel the MacDonald Bridge project successfully and innovatively protected the environment while maintaining critical transportation access to the surrounding communities, and submit it as a candidate for the Transportation Association of Canada's Environmental Achievement Award.

Implementation

The City of Calgary, Roads maintains 381 various bridges across the city, including vehicle and pedestrian bridges, subways, and tunnels. Annual inspections and maintenance checks of all bridges gauge deterioration levels and help establish a comprehensive repair schedule. The 95-year-old MacDonald Bridge, one of Calgary's few through truss steel bridges, required the removal of all lead-based paint through abrasive blasting, repainting, and the replacement of sidewalks and railings.

Contractors interested in this challenging bridge rehabilitation project had to meet The City of Calgary's stringent environmental requirements. Pre-qualification was required before contractors were able to participate in The City's RFP (Request for Proposal) process. Due to the project's environmental sensitivity, additional special conditions had to be met, including meeting Roads' Bridge Maintenance Best Management Practice (BMP), and creating an Environmental Construction Operations Plan (ECO Plan). The City of Calgary's ECO Plan process ensures that contractors are aware of their obligations under The City's EnviroSystem and Environmental Policy. ECO Plans require contractors to comply with applicable legislation, prevent pollution, conserve resources, and continually improve their environmental performance.

The contractor chosen for rehabilitating MacDonald Bridge was dp Coatings, a sub-contractor of Volker Stevin. The tender indicated that "Removed material shall not fall on the ground or on the surface waters." The contractor complied with these strict regulations completely. Throughout the project, The City of Calgary project team and Roads' Environmental Specialist were frequently onsite performing inspections, providing directions, and ensuring all requirements were met.

For the duration of the project, which began in May and was completed in late July, the entire steel framework was 100% contained in shrink-wrap plastic, while permitting critical vehicle and pedestrian access to neighbouring communities. Vehicular traffic was mostly limited to essential transportation such as emergency vehicles and Calgary Transit service. For a visual explanation, see Photo 1.

Before beginning the project, baseline/background soil samples were collected on all sides of the bridge (NW, SW, NE, and SE locations), including a control sample taken in a location unlikely to be affected by paint fallout. These baseline/background sample results to be compared to samples taken after the project. Several samples were taken, as lead levels varied greatly within a few feet due to the past use of the property or erratic distribution of paint chips. The pre-project samples showed a level of lead contamination; only one sample was over the CCME residential/parkland criteria of 140mg/kg.

Roads required the contractor to conduct remediation activities if lead levels originally at 140mg/kg had increased at least 50%. When soil samples were taken after the project was complete, the results were positive, making remediation unnecessary. Sample results showed a maximum increase of 5%. The total average variance between pre and post sample results was only 22%.

Before abrasive blasting began, a water diversion license was obtained to wash the bridge free of chlorides using low pressure water directly from the river. This process required a screen to be added to the pump's inlet to ensure no fish would be extracted, and the water removal velocity ensured that the impact on the river was minimized. The use of river water in the bridge washing process ensured that The City's potable water was not required, and as such, there was no need for de-chlorination before releasing it back into the Elbow River. To avoid contaminating the river during the wash process, a screening system was installed under the "dance floor"—the nickname given to the sub-floor—to catch debris loosened during the wash process.

After the bridge was washed and the containment completed, the removal of the lead-contaminated paint began. The process of removing the garnet abrasive materials each day from the containment area required a vacuum truck. Samples of used abrasive media were tested for lead, and because the results showed lead amounts were below the hazardous level, they were disposed of as non-hazardous waste.

Calgary receives most of its rain during May and June. In June 2006, below the Glenmore Dam, the Elbow River water levels had risen to over 2m; the average water levels for the river were 0.58m in 2006. With the water at times only a few feet below the dance floor, extra environmental and safety precautions became part of the daily procedures. To prevent a dance floor washout, an open communication line was established upstream with the Glenmore Dam, which released water volumes periodically to prevent dam overflow. In the event of a water release from the dam, the contractor had to be prepared to evacuate the crew and open the containment to allow water to flow through.

To ensure the containment did not negatively affect water quality if this occurred, the dance floor was cleaned daily during this high-risk period. For a visual explanation, see Photo 3.

As well as repainting, a new pedestrian railing was installed, and long-lasting Fiber Reinforced Polymer (FRP) sidewalks replaced the old timber pedestrian walkway. In keeping with the many parks and bridges in Calgary that make the city beautiful, MacDonald Bridge's appearance was greatly enhanced by the rehabilitation project and the upgrades.

The total cost for the bridge rehabilitation project was approximately \$2 million. Though this cost was slightly higher than a normal rehabilitation project, The City of Calgary's commitment to its Environmental Policy—which is focused on conserving resources, complying with environmental legislation, and continually improving environmental performance—ensured that the protection of the highly sensitive environmental resource took priority over cutting costs. Consequently, the cost effectiveness and financial benefit of this project was its investment in the future, as meeting the Environmental Policy results in the long-term protection and sustainability of the environment for the benefit and enjoyment of Calgarians.

The MacDonald Bridge project raised the bar for environmental protection in The City of Calgary and in southern Alberta for bridge rehabilitation involving lead-containing paint abatement in environmentally sensitive environments.

Innovation

When the need arose to rehabilitate MacDonald Bridge, The City of Calgary seized the opportunity of taking a leadership role in resetting the standard for bridge rehabilitation. Balancing these two objectives required an innovative solution, and after many hours of consultation between the contractors, Roads' Construction and Materials division, and Roads' Environmental Specialist, a comprehensive strategy was created.

A goal of 100% containment control was unusual and was a challenge to meet; 95% was the recommendation from the Society for Protective Coatings (SSPC). The containment was constructed not from the normal polyethylene (poly) plastic, but a shrink-wrap plastic wrapped around standard construction scaffolding. The airtight, 100% containment was constructed by putting up plastic sheets one at a time and heating them so they would adhere tightly around the aluminium scaffolding frame and the edges of neighbouring shrink-wrap sheets. For a visual explanation, see Photo 2.

A sub-floor—called the dance floor—was built below the bridge deck to allow for sandblasting and painting operations underneath the bridge, and was also fully contained. The Department of Fisheries and Oceans (DFO) was contacted for approval of constructing the dance floor from below, which required workers to go into the river. Instead of taking machinery into the river, workers waded in and set up standard construction scaffolding that would allow access to the bottom of the bridge to complete construction of the dance floor. All construction was completed without the aid of large machinery. Special care was taken to educate workers about minimizing the disturbance of the riverbed. As an added bonus, workers proactively removed all garbage found during the dance floor's construction process.

A vacuum truck, which contained high-efficiency filters that collected airborne particulates to prevent them from entering the environment, was connected to the containment area, drawing all dust and particles out. The truck created negative pressure that would make it difficult for contaminants to leave the contained area if a breach occurred. In fact, because of the high volume of air being drawn out by the vacuum truck, fresh air vents had to be strategically cut into the containment to permit adequate air exchanges.

To eliminate the potential of contaminants leaving the containment area, a detailed procedure was set up. Outside of the containment, workers put on their PPE, which included a long-sleeve Tyvek suit with hood, hard hat, steel toed boots, leather gloves, eye protection, and dust mask. Dust masks were deemed appropriate and effective as garnet abrasive blasting media was used instead of silica, which reduces airborne inhalation hazards. Each worker wrote his name on a board, indicating he was inside the containment, and then entered the dirty room, which was separated from the containment area by a plastic barrier. For a visual explanation, see Photos 4 and 5.

After their shifts, workers would leave the containment through the dirty room, where they used compressed air to remove loose particles from their suit. Outside, they would dispose of the Tyvek suits and dust masks, and proceed to the onsite trailer for a thorough wash at a wash station set up especially for this purpose.

For the standard bridge rehabilitation project, silt socks are set up in surrounding catch basins to prevent excess materials from entering waterways. For the MacDonald Bridge rehabilitation project, an opposite approach was taken. Because the east side of the bridge road was on a slope, rainwater naturally flowed down, onto, and over the bridge. To prevent rainwater from washing out the bridge deck and dance floor during a rain event, a rough asphalt berm similar to a speed bump was constructed across the sloped roadway to divert water towards the catch basins located across on the north and south sides of the road. This berm also cut off water from the stationary vacuum truck, so there was a low probability that a spill/release would breach the controls and negatively impact the environment. For a visual explanation, see Photo 6.

The innovative methods used by the contractors and The City of Calgary, Roads during this project can serve as a benchmark for similar projects within the city and for other municipalities throughout southern Alberta.

Impact

How did this project affect the environment?

The City of Calgary, Roads recognizes that the work it does impacts the environment, which is why since 2002 it has successfully achieved and maintained ISO 14001 registration. EnviroSystem, Roads' environmental management system, stems from The City of Calgary's Environmental Policy. Through management commitment, Roads can consistently act as a good environmental steward and initiate sustainable practices. The protection of Calgary's environmental resources, including the Bow River and Elbow River, is recognized as an excellent investment in Calgary's environmental future.

The Elbow River flows down from Elbow Lake high up in the mountains of the Elbow-Sheep Wildland Provincial Park, and is The City of Calgary's potable water source. The Elbow River is different from other Alberta rivers in that it feeds directly into the Bow River, and must comply with strict environmental regulations in order to sustain the Bow's status as a world-class trout habitat. In accordance with the *Federal Fisheries Act* and the Department of Fisheries and Oceans (DFO), Roads can not carry on any work that results in the harmful alteration, disruption, or destruction of fish habitat, or deposit a detrimental substance of any type in water frequented by fish.

Protecting this fragile environment from contamination such as heavy metal particles is vital. Even trace amounts of lead can be hazardous, as this highly toxic metal builds up over time. Elevated levels of lead in water can cause reproductive damage in aquatic life, and cause blood and neurological changes in fish and other animals. Bioaccumulation can also occur in predatory species, including humans.

How did this project affect transportation?

The MacDonald Bridge links 7 Street SE and 8 Street SE. The bridge has two lanes of traffic as well as a high volume of pedestrian traffic. An essential link over the Elbow River in a busy community near the downtown core, it was important to maintain critical transportation while protecting the workers, citizens, and the integrity of the containment. The north sidewalk was open for pedestrian use, and one traffic lane remained open to allow critical traffic, such as emergency vehicles and Calgary Transit, to pass through.

The 2006 Calgary Stampede, an annual ten-day rodeo and exhibition, brought 1.2 million people into Calgary's inner core. Roads accommodated the high volume of traffic by allowing all vehicles to use the bridge during this event, which ran from July 7 to 16.

How did this project affect the community?

Due to the fact that the MacDonald Bridge is near the downtown core, the covered area of the bridge became a draw for the local homeless community. Workers dealt frequently with disposing needle sticks in a nearby sharps box, and with repairing the containment when it had been slashed or tagged.

Efforts to protect the environment have a strong impact on our communities, and have been shown to bring people together. In Calgary, protecting the rivers is a very important issue for many residents, and The City of Calgary is committed to meeting Calgarians' needs and maintaining the city's status as one known for its natural beauty and quality of life.

During the project, because of rising water levels, it was deemed hazardous to allow the general public to continue to use the waterway under the bridge for recreational activities. To ensure public safety during critical times, portage points were enforced. It was required that all floating occupied devices be removed upstream from the rehabilitation site and re-entered at a safe distance downstream. As a result of proper communication practices and signage, no river recreational user near misses or incidents resulted.

All residents can take pride in the MacDonald Bridge project; it's evidence that their city is taking their concerns seriously, and is continually improving its environmental performance.

Involvement

The City of Calgary's goal is to deliver quality public service to Calgarians. To help do this, Roads' priority is to improve mobility in Calgary by increasing the functionality and utilization of the city's existing infrastructure. On major projects like the MacDonald Bridge rehabilitation, many people play a part in meeting this priority. Several divisions in Roads were involved in managing transportation issues while the bridge was being maintained by the contractor, dp Coatings, and by Roads' Construction and Materials division crews.

The Traffic Engineering division designed detours to direct traffic safely around the MacDonald Bridge area under construction, while the Traffic Field Operations division set up and monitored the detour signage. If a large amount of traffic was detoured to another area, the Signals division became involved, resetting area traffic signals to accommodate the increased number of vehicles. Roads' business and administration division, Support Services, maintained constant communication with local authorities and the public regarding the maintenance work and subsequent detours, and Environmental Specialists from Roads and from The City monitored operations to ensure legislative and regulatory conformance.

Settled in the shadow of the Rocky Mountains, and surrounded by rivers and water reservoirs, the City of Calgary continues to take environmental protection and sustainability seriously. The MacDonald Bridge project demonstrated The City's commitment to the environment, as environmental issues were central to every process. See what the bridge looks like today in Photo 7.

On behalf of everyone who was involved in the MacDonald Bridge project, we thank you for your consideration of our submission for the Transportation Association of Canada's Environmental Achievement Award.

Photos



Photo 1: Transportation

A sidewalk remained open for pedestrian use, and a through lane was maintained for emergency and Transit vehicles.



Photo 2: Containment

The shrink-wrap plastic and the vacuum truck created a negative pressure containment system.



Photo 3: Elbow River

The access floor below the bridge deck was cleaned routinely as a precautionary measure to minimize potential impact to water quality if water levels rose and immersed the floor.



Photo 4: Dirt Room

A plywood "Dirt Room" was constructed outside the containment area that was kept locked to prevent public access. Plywood also covered the containment walls along the sidewalk, protecting pedestrians from rogue sandblasting materials that could tear through the plastic.



Photo 5: Protection

Protective suits and dust masks, combined with the “dirt room” and full containment, was effective in keeping lead particles from affecting the environment.



Photo 6: Berm

A temporary berm was created to divert water flowing down St, which is located on a steep hill, into the catch basins to prevent flooding of the containment area.



Photo 7: MacDonald Bridge Today

A current image of the bridge showing the replaced railings, new paint, and early springtime water levels.