

Winnipeg's Provencher Bridge

# Wise up with 'smart' bridges

By Terry Ross



With cash-strapped municipalities suffering from deteriorating infrastructure that must be replaced, officials are always on the lookout for new technology that will save them money. That is where 'smart bridge' technology comes into play.

Officials concerned only with the immediate bottom line may claim that the new technology is more costly and, in the short term, they are correct – by about 20%. However, the longevity of smart bridges more than compensates for the extra cost.

'Smart' structures incorporate sensors in the building materials that allow the monitoring of the structure via computers. The

application of smart structure for bridges provides the following benefits:

- Less time and expenses required for inspections.
- The response of the structure can be monitored remotely in real time.
- Performance of new advanced composite materials can be monitored.
- The long-term performance of composite materials can be compared to conventional girders, also outfitted with fibre optic sensors.

Confederation Bridge, connecting Prince Edward Island and New Brunswick, utilizes

smart technology to monitor the long-term effects of wind, ice and traffic loads.

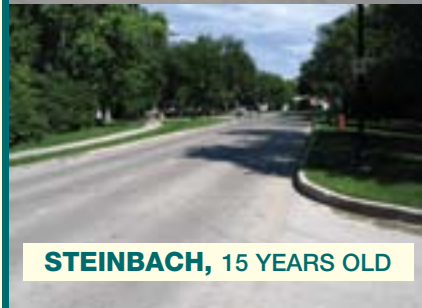
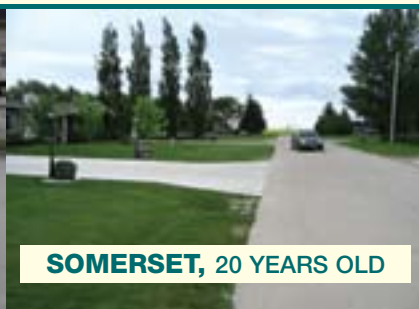
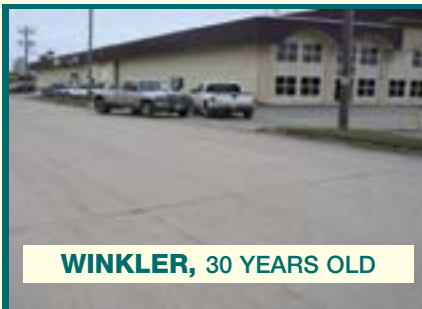
In October 1998, the Taylor Bridge in Headingley was opened and deemed the 'smartest bridge in the world.' It was built as a demonstration project by ISIS Canada using new-age materials that are lighter than steel, yet 10-times stronger. It also houses 111 sensors (65 fibre optic sensors, 26 electric foil strain gauges and 20 temperature sensors).

The two-lane, 165.1-metre-long span has four out of 40 pre-cast girders reinforced with carbon fibre reinforced polymers (FRP) stirrups. These girders are pre-stressed with carbon FRP cables and bars. Glass FRP reinforces portions of the barrier walls. The instrumentation will allow officials to monitor the behaviour of the bridge structure and the new advanced materials over time. It will also allow the real time, dynamic sensing of singular overweight events (when special permission is granted to overweight loads).

ISIS Canada is a non-profit network of 15 universities based at the University of Manitoba's Faculty of Engineering. Its mandate is, in partnership with the private sector, to develop Canadian Civil Engineering and construction capability through the development and application of advanced composite materials (ACMs) and integrated Intelligent Fibre Optic Sensing technologies.

More recently, Winnipeg's Provencher Paired Bridges joined the line-up of smart bridges. These structures, a pedestrian bridge and a vehicular bridge, strengthen the connection between The Forks and St. Boniface's French Quarter. They've become a symbolic gateway between two of Winnipeg's most historically significant areas, while promoting commerce and tourism. The system measures movement, traffic flow, wind speed and direction, stay cable forces and strains, ambient temperature, temperature gradient, and 3-D acceleration of the deck and pylon. ISIS Canada installed 20 fibre optic sensors, lead wires, and a fibre Bragg grating strain indicator. §

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