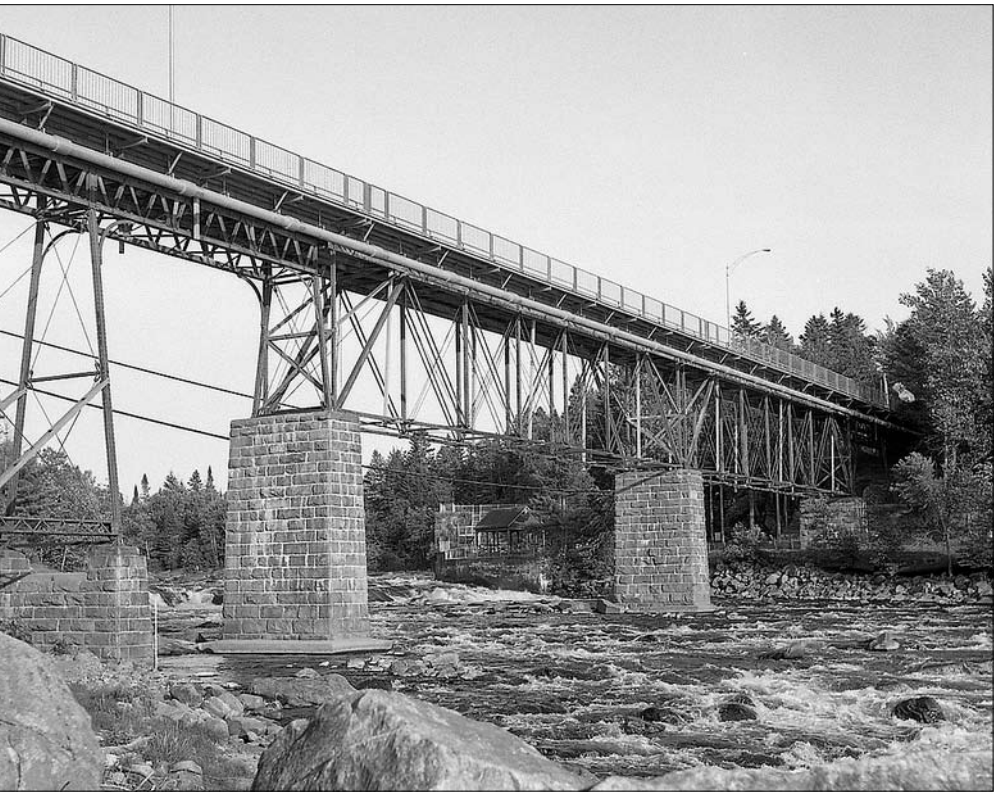
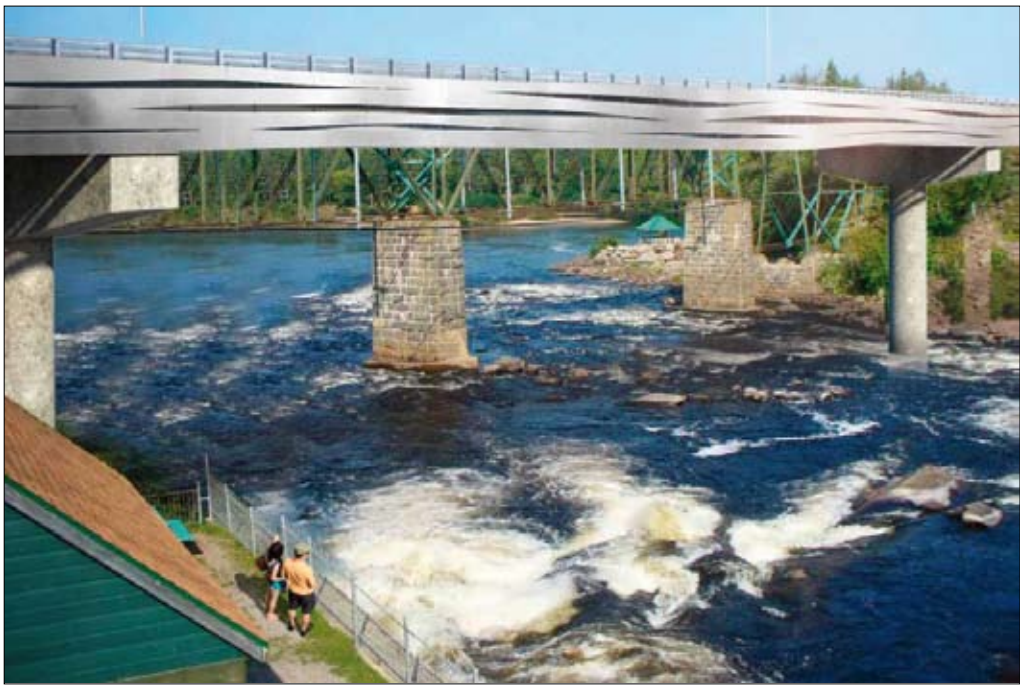


This new bridge - that will be opened to traffic in December 2017, is one of largest civil engineering projects in Canada has a value of $ 32 million - will solve all traffic problems arising from property development of the past decade of the surrounding Shannon north of Quebec City

The construction of the new Gosford Brigde

The Gosford old bridge, as superb civil engineering work, has a huge asset value based on its historical interest, its architecture and location. The old bridge was built 137 years ago for the passage of trains carrying timber from the forests Portneuf and was later converted to the single and alternate pass cars also including a bike path and walkway.

The Ministry of Transportation in Quebec (MTQ) considers such bridge as a true monument, because it is one of the last examples made with reticulated metal structures and Pratt type metal beams assembled to its base. Oddly enough, before deciding where to build the new bridge, the MTQ technicians have studied every corridor on the Shannon territory between the Valcartier military base and area of Sainte-Catherine-de-la-Jacques-Cartier to realize that more than a century and



Gosford Bridge was built 137 years ago, in 1879. The new two-lane bridge will be built just to the east of the current structure

a third ago their ancestors had made the best choice placing the old bridge there. Actually, the best place for the new bridge is properly there, near the old one tells the engineer Bruno Beauregard coordinator for the great works of bridges, who states that its position will not upset the habits of local population. New bridge has been designed and will be built to be as non-invasive as possible, moreover its cost at the end of construction will be less than $ 30 million instead established in the first tender step.

Further upstream of about 10 mt to the east of the old bridge, the new one will be made of two lanes, conventional steel beams, concrete slab with a length of 166 mt, width of 10 mt, height on the level of river of 10 mt and will be slightly lower than that existing. It will be elegant and modern, with clean lines that will perfectly merge with the surrounding landscape; its unique distinctive trait will be external barriers on the sides made of corrugated steel. Even its foundations must satisfy the aesthetic needs, they are being actually realized bored piles instead of the traditional driven piles. Much attention has been paid to the environmental impact of such work, in detail everything will disturb as little as possible the passage of fishes in the Jacques Cartier River. For safeguarding of wildlife, water is filtered to remove all suspended solid particles; even more environmental teams assist the project by transporting salmons upstream of the work area in order to avoid damaging their reproduction.

Soil & Foundation Structures

The environment in which Gosford bridge is being achieving is the town of Shannon in the park of San Gabriel along the Jacques-Cartier River north-east of Quebec City. From the geological report site have emerged rock counters with values of Rock Quality Designation RQD (%) between 0 and 100 and the resulting values of Rock Compressive Strength (RCS) up to 204 MPa, as consequence it is clear the presence of very hard rocks as classified in literature. Following, the most representative soil sequence is the following.

Delmag RH34 with SIP&T rotary tools during drilling operation

Qualitas

RAPPORT DE FORAGE

Page 1 de 1

CLIENT : Ministère des Transports du Québec, Direction Capitale-Nationale
PROJET : Pont proposé
ENDROIT : Chemin Gosford, Shannon (Québec)
DOSSIER : 126803

FORAGE : F-5
DATE : 2014-10-28
COORDONNÉES : MTM Nad 83
E: 226682 **N:** 5195439

PROFONDEUR (m)	NIVEAU (m) GÉODÉSIQUE	DESCRIPTION	NIVEAU D'EAU 2014-11-07	ÉCHANTILLONS TYPE ET NUMÉRO	ÉTAT	RÉCUPÉRATION (%)	ESSAIS IN SITU ET EN LABORATOIRE N ou RQD (%)	TENEUR EN EAU ET LIMITES D'ATTERBERG (%)	AUTRES ESSAIS
	159,64								
0,30	159,34	**Sol organique**		CF-1		85	2		
		Till : 0,30 à 1,50 m : sable brun, un peu de silt à silteux, traces de gravier. Présence de cailloux et de blocs. 1,50 à 6,10 m : sable graveleux à sable et gravier gris-brun, un peu de silt. Présence de cailloux et de blocs. Compacité moyenne à dense.		CF-2		50	Refus		
				CF-3		50	Refus		
				CF-4		85	Refus		
				CF-5		50	Refus		
				CF-6		75	Refus		
				CF-7		70	45		G
5,05	154,59		▼	CF-8		65	17		
6,10	153,54	**Roc** : gneiss granitique de qualité moyenne		CR-9		100	53		
				CR-10		100	70		
7,40	152,24	**Roc** : gneiss granitique. Présence d'une famille de fractures subverticales et d'une autre famille de fractures inclinées de 40 à 60° par rapport à l'horizontale. Qualité du roc bonne à excellente.		CR-11		100	100		
				CR-12		100	100		qu : 204 MPa PV : 27,0 kN/m³
				CR-13		100	84		
				CR-14		100	95		
				CR-15		100	90		
13,66	145,98	Fin du forage à 13,66 m de profondeur							

REMARQUES : Le niveau de l'eau souterraine a été observé à 5,05 m de profondeur dans le tube d'observation le 7 novembre 2014.

MÉTHODE DE FORAGE : Rotation de tubes de calibre NW dans les sols; carottage du roc avec carottier diamanté de calibre NQ

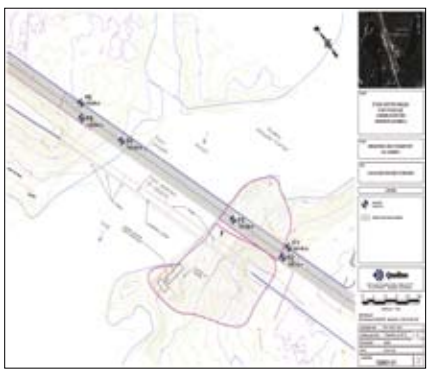
Part of the geological report which indicates a values of RCS equal to 204 MPa-RQD (%) of 100

Up to 12 mt depth: sand and sandy gravel, some silt traces; presence of pebbles and boulders; compactness classified as medium-very dense; gneiss metamorphic rock; fractured rock; presence of thin layer of gravel and silty sand at the bottom of an organic soil; Significant existence of pebbles and boulders with a compactness classified as dense to very dense.
From 12 up to 19.76 mt depth: sands silt and traces of gravel; presence of a layer of silt depth between 1.0 and 1.3 mt; compactness classified as loose very loose; pebbly sand with presence of siliceous material, blocks and empty stones that characterize the compactness as very "loose" until thick; gneiss granite of medium and excellent quality.
It is important to stress Rock Quality Designation values RQD (%) merged from different depths:

Depth 6.50 m	RCS 158 MPa	RQD (%) 95-100
Depth 8.50 m	RCS 204 MPa	RQD (%) 100
Depth 9.50 m	RCS 161 MPa	RQD (%) 90-80
Depth 12.50 m	RCS 153 MPa	RQD (%) 96
Depth 14.50 m	RCS 165 MPa	RQD (%) 95-100

The project includes a number of six bored piles OD.2.6 m, which have features shown in below figure and table:

Drilling places	Bored pile number	Bored pile depth (m)	Geodetic level (m)
South river piles	F-1	10.2	164.95
	F-2	12	166.12
Central south piles	F-3	19.76	157.68
Central north piles	F-4	16.61	153.48
Nord river piles	F-5	13.66	159.64
	F-6	10.52	158.95



Location of the six bored piles

The base of each bored pile is set on bedrock by developing a length between 10.20 and 19.76 mt. The upper part of the pile is contained in a permanent metal sheet for an average length of 8 mt which joins to the under consolidated rock. After the execution of many preliminary load tests, foundations adopted for the viaduct were those of drillings type of large diameter equal to 2.6 mt.

SIP&T role

In August 2015 the foundation piling company MSE Group have ordered to SIP&T spa through ML AIR & Talbot Inc. (the official SIP&T distributor for Canadian market) all rotary drilling tools used for the bridge execution; goods have been delivered to the jobsite at the end of September 2015.
All Items have been manufactured in Super Heavy Duty version, with special technical details due to the huge pile diameter 2.6 mt.
Below the list of tools supplied:

- **Double bottom bucket for Rock** - for Rocks with a RCS range of 12.5 – 50 MPa and a RQD (%) range of 25-50;
- **Conical rock auger** - for Rocks with a RCS range of 12.5 – 50 MPa and a RQD (%) range of 25-50;
- **Core Barrel** – for Rocks with a RCS range of 50 – 100 MPa and a RQD (%) range of 50-75;
- **Roller Bits Core Barrel** – for Rocks with a RCS range of 100 MPa and a RQD (%) of 100;
- **Cross Cutter Core Barrel** – for Rocks with a RCS range of 50 – 100 MPa and a RQD (%) range of 50-75;

Several consumable spare parts to avoid waste of time during drilling operation.
The selection of these specific tools is not random but it comes up as result of SIP&T high experience that represents a worldwide benchmark for the rotary drilling tools and kelly bar production applied to the vertical foundation engineering. In detail, after having studied the geological relation, SIP&T supplied tools with high performance in hard rocks with a massive level of RCS and RQD (%).
After a short introduction phase, the local rig operator achieved an average net drilling rate with Delmag RH 34 of 0.8 m/h in granite with compressive strength ranging from 153 to 204 MPa. After drilling 80 m (90 m^3) in rock, all Betek

Conical Rock Auger OD 2,6 m - SHD type

Rock bucket OD 2.6 m - SHD type

Delmag RH34 using Rock Bucket

Core barrel with Roller Bits OD 2..6 m - SHD type

Chisels replacement on Core Barrel Cross Cutter OD 2.6 m - SHD type

chisels were still in good condition and no need for their replacement, especially the roller bits appeared in excellent condition as well. This results is truly impressive, particularly when compared with the usual wear coefficient of around 0.5 rock rollers/m^3 of loosened rock when using locally manufactured second hand rock roller bits. The result were very positive and highly promising for MCS Group and SIP&T team. We also proof the importance and benefit of know-how transfer and the utilization of global synergy effects.

Applied Technologies

The construction method, used for the execution of bored piles especially in water, has been widely used by the MSE Group in many similar works in other parts of Canada. The drilling with rotary and kelly bar has been proved to be the most suitable system in relation to the type of rocks detected into the site. The MSE equipment, including tools provided by SIP&T, have shown their special qualities: high potential and at the same time high degree of reliability. The excavation of the piles was performed with the drilling rig Delmag RH 34 having the following specifications:

DELMAG RH 34 Piling Drilling Rig	Data Sheet
Stroke	17,500 mm
Max. Casing length	6,000 mm
Max. Force Pull	530/420 kN
Max. Force Crowd	420/330 kN
Max. Speed Working	5.5/28.5 m/min
Max. Line Pull	320/250 kN
Max. Rope Speed	71 m/min
Transport Weight (with Kelly K495/3-27 and Rotary head)	101,250 kg
Interlock Kelly type K495/3-27	6,800 kg
Rotary Head Torque	0-335 kNm
Revolutions	0-26/55 rpm

A drilling fluid prepared with polymers has been used, recommended for the minimal environmental impact, and led to a careful study of the land and the drilling method. The optimal dosages were defined through numerous tests led in the laboratory and on site. The placement of the steel cage has been one of the most delicate and complex phases of the entire production process. The weight of the cage, the use of longitudinal bars and non-destructive tests to be performed on each completed pile, required the use of special lifting systems and a laying technique in place that would ensure compliance with the quality and safety requirements. The main and the service pontoons have been specially designed and equipped to operate in the various production stages and with the possible tides variations. MSE Group has worked closely with the main contractor taking equipment, staff and line of work programs aligned to the construction site needs, at the early stage of construction site equipment and set up work.

Quality and Safety

The yard has been organized and is proceeding according to the quality system in force in Canada, establishing, in agreement with the Ministry of Transportation Canada, any procedure related to each stage of MSE Group operations. Strict quality checks are conducted on the manufacture of steel pipes, on the pontoons and on the operations of the piles construction. The pile integrity is tested by using the non-destructive testing SCL (Crosshole Sonic Logging) that uses sound waves to reproduce the pile. This method has been used to complete the Gamma-Gamma registration system to furtherly define the nature and extension of any possible damage. A Mini SID camera (Shaft Inspection Device) is used for visual inspection, which highlights the cleanness of pile basis. In conclusion, the concrete mixture is self-compacting with 35% of Portland cement, which is replaced by granulated slag. It was finally set up in the yard a special Department of Industrial Security to follow the prevention and application aspects of the Safety Standards for each phase of the work entrusted to the MSE Group.

Delmag RH34 during drilling operation

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