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From: [redacted]
To: Kursikowski, Stacey
Cc: Bob Maton
Subject: [WARNING: MESSAGE ENCRYPTED][WARNING: MESSAGE ENCRYPTED]Marr-Phillipo House: Heritage Permit Review Sub-Committee
Date: Wednesday, September 1, 2021 8:59:45 AM
Attachments: Christ Church Cathedral.pdf

Stacey:

I viewed the entire meeting of the sub-committee today. I would appreciate if you would distribute this email to all members of the sub-committee and the Heritage Committee.

The requirement to move the House was presented to the meeting as being driven by the need to remediate the soil beneath the building to a depth of 6-8 m. This is a false dichotomy. The House can be retained in position while the soil is remediated, but it requires just about the same amount of engineering ingenuity as is involved in moving it. In fact the methods are rather similar as both involve needle beams although having different vertical supports methods.

Diane Dent asked whether Christopher Borgal of GBCA knew of any buildings anywhere in the world that had been lifted in-situ or supported to allow work to be completed beneath. I was more than surprised at his response that he didn't know of any. Structural engineers have been underpinning buildings and constructing beneath them for over a hundred years. Recent examples in Toronto include Union Station and St. Michael's Cathedral but perhaps a more dramatic example is that undertaken by my old firm, Quinn Dressel Associates at Christ Church Cathedral in Montreal in 1987.

I am attaching a reader-friendly narrative (with a small technical section in the middle) of the Christ Church project which clearly demonstrates that a building can be supported on piles or caissons which extend to load-bearing soils or rock below the soils requiring excavation (or remediation, in the case of the Marr-Phillipo House).

Moving the House requires a steel grillage of beams mounted on jacks and dollies. A similar grillage of beams mounted on caissons or piles - instead of jacks and dollies - can be constructed to support the building while the soil is remediated. In fact, that grillage and the caissons/piles can remain permanently in place after remediation. The decision on the grillage materials would be up to the structural engineer but could be steel which would later be encased in concrete, or could also be reinforced concrete or pre-stressed concrete beams. Synchronized jacks could be used to elevate the House and separate the superstructure from the foundation walls, thus allowing for the foundation walls to be removed. A reinforced concrete slab could later be cast under the House to provide a fire-resistant barrier.

In order to retain the House in its present location, Christopher Borgal spoke of open excavations extending horizontally 50' (~15m) around the House for an excavation of 8 m with sloping sides to accommodate the angle of repose of the soil, and he stated that with the excavations encroaching onto Wilson Street relocation of the House was the only option. Obviously, shoring would obviate the need for open excavation.

Brenda Khes of GSP Group mentioned in her presentation that there would be one level of underground parking in the new development. The construction of such basement parking would normally have a minimum depth of 4-5 m below grade and shoring would be required along Wilson and Academy Streets. However, if the contaminated soil extends to depths of 6-8m at the south east corner of the development then the shoring would be significantly deeper to allow for the removal of all contaminated soil materials, including the foundation walls of the House. In those circumstances intersecting caissons with steel piles could be used for the shoring and the same equipment would be at hand for the caisson supports of the House. The House caissons/piles and grillage could be put in place prior to shoring and once the shoring is in position remediation of the soil could commence.

Ralph Di Cienzo of Lantec said soil remediation would take up to two months, but the shoring and overall excavation of the basement would take 8-12 months anyway. There would also be plenty of material on the rest of the site to fill the over-excavated southeast corner to the underside of the basement level in that area.

In conclusion, my point is that the House CAN be retained in its current location with probably less risk than would be involved in moving it to 15 Lorne or anywhere else along the Wilson Street frontage.

The sub-committee came to the correct conclusion today in rejecting the relocation of the House to 15 Lorne.

I would be more than willing to discuss any aspects of the structural engineering involved with your sub-committee members.

Regards,

Ben Burke, P. Eng.

CHRIST CHURCH CATHEDRAL, MONTREAL

Architect:	**WZMH Architects**
Structural Engineers:	**Quinn Dressel Associates**
Start Date:	**February 1987**
Completion Date:	**November 1987**
Original Church Construction:	**1859**

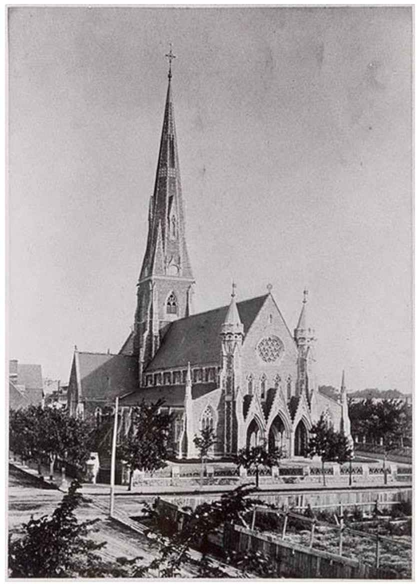
From early 1987 to November of the same year, Christ Church Cathedral, in the heart of downtown Montreal, was pointed to, gaped at and discussed by thousands of Montrealers morning, noon and night.

Resembling a giant ship in dry-dock, passers-by were arrested by the church's "floating" appearance; some were even heard to say "You wouldn't catch me going in there!" Sidewalk superintendents were numerous and eloquent - explaining their accurate (and not-so-accurate) engineering ideas to anyone who would listen.

This was in 1987, and the focus of attention was the "Cathedral-on-stilts", as it came to be called, the stilts bearing the caissons for the underground excavations and new foundations constructed as part of a multi-million dollar office and retail development.

The Cathedral-on-stilts

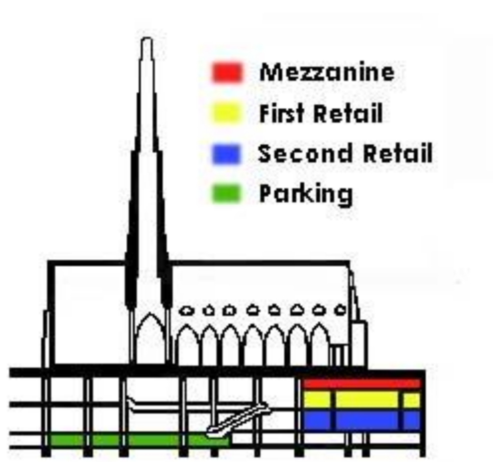
The Cathedral was completed in 1859 based on the design of Frank Wills, who also designed Christ Church Cathedral, Fredericton.



Original design with stone steeple

Architecturally it has always been regarded as a fine example of the English neo-gothic style but its engineering design was not in the same league. From its completion the heavy central tower started to sink into the soft ground on which the foundations were built; by the 1920s the spire was leaning 4ft to the south. There was a landmark lawsuit as a result of early foundation problems (Wardle vs. Bethune) often quoted in connection with Article 1688 of the Quebec Civil Code. In 1927 the stone steeple, weighing 3.5 million pounds, had to be removed. It was not until 1940 that a replica steeple made entirely of aluminium was erected as an anonymous gift.

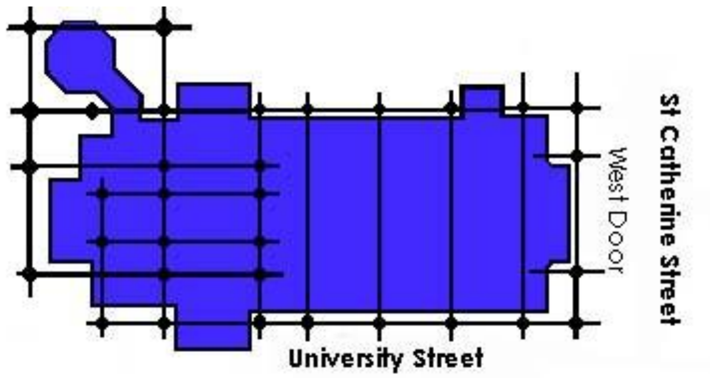
The 1980’s development project comprised the building of a 34-storey office tower immediately to the north of the Cathedral which included a single parking level and two retail levels below the Cathedral, underground connections to Eaton's and The Bay department stores, and re-landscaped grounds.



Under Christ Church Cathedral -
looking eastward from University Street

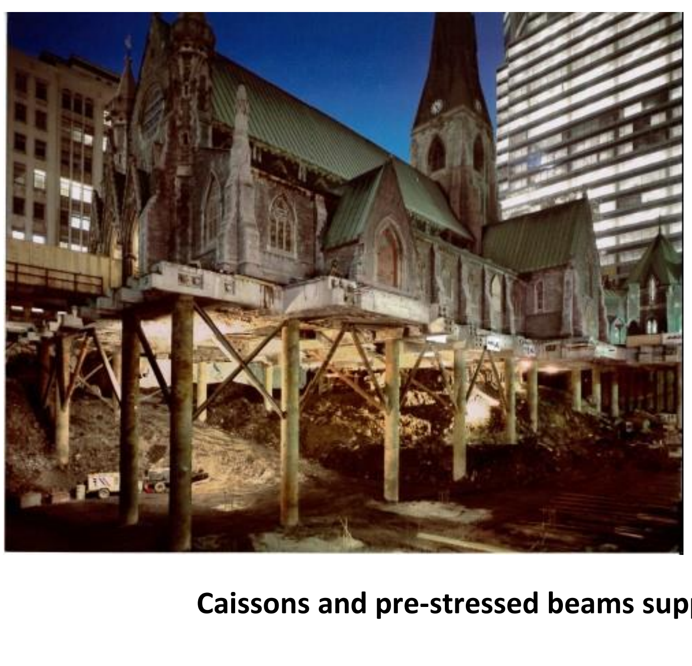
There is also a 10,000 sq. ft. mezzanine floor sandwiched between the Cathedral floor and the ceiling of the first retail level, which is occupied by the Canadian Bible Society, the Diocesan Bookroom and the Undercroft - home for the Cathedral's music, church school and out-reach programmes.

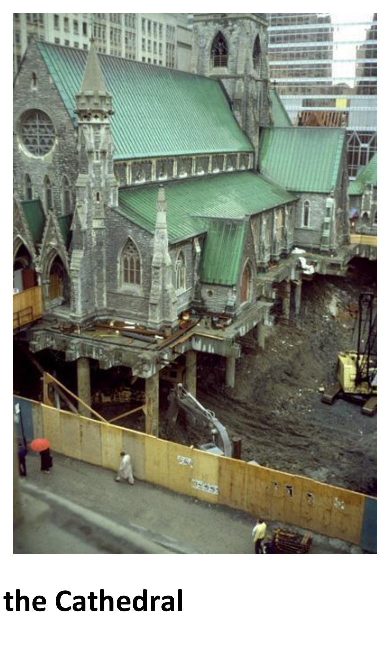
Underpinning of the Cathedral to make provision for the retail and parking levels was the engineering highpoint of the project. The work started at the end of February 1987, and was completed in November of the same year.



Caisson locations around and under the Cathedral

Thirty-three hollow cylindrical steel piles or 'caissons' were driven down to bedrock around the Cathedral walls and under the central tower. Twenty-three of these were just outside the Cathedral walls and were 36" in diameter. The ten driven from within the Cathedral crypt using a special machine were 26" in diameter. The caissons were driven to bedrock about 45-50 ft. below ground and a hole bored into the rock to ensure proper bearing. The contractor lowered steel reinforcement cages into the caissons and filled them with concrete to create a column on which the Cathedral was supported.



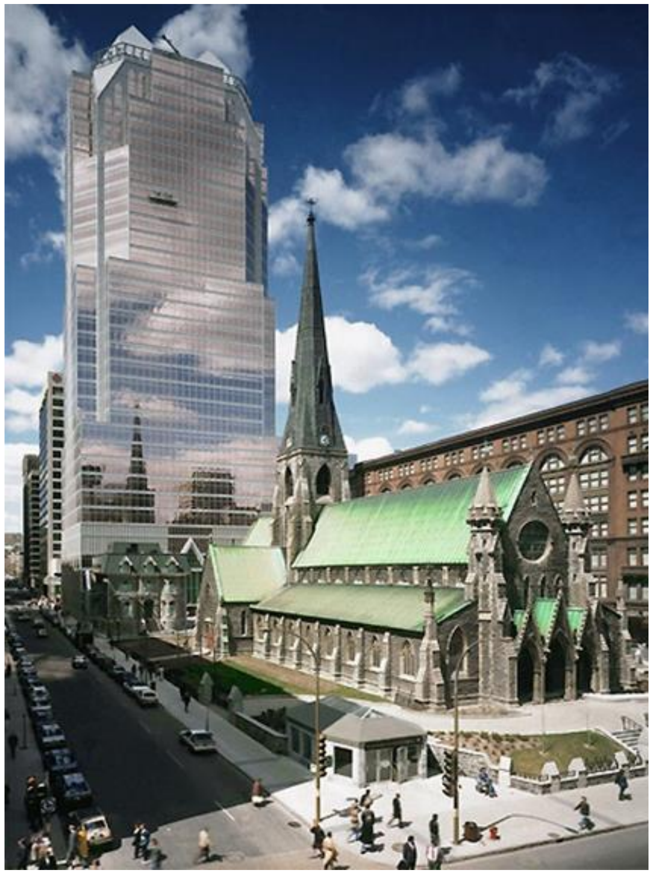


Caissons and pre-stressed beams support the Cathedral

On top of the caissons a grid of massive pre-stressed concrete beams was built, capable of carrying the weight of the Cathedral when spanning between the caissons after ground excavation was completed. The beams running across the Cathedral were generally 6' x 6' shaped in the form of a 'T'. The beams running from the back of the Cathedral towards the high altar were 4' deep x 3'9" wide.

An 8" concrete slab was poured just below the tops of the beams to create an effective sound and fire barrier between the wooden floor of the Cathedral and the retail level below.

The underpinning of the tower required carefully excavation by hand and chipping into the massive concrete foundations placed in 1939 to stabilize the original foundations and enable erection of a new aluminium spire which considerably reduced the weight on the Cathedral tower. Jacks were inserted during excavation and finally two massive concrete beams 14' wide 46' long and 5' deep were poured spanning across the pairs of caissons at each corner of the transept.



Completed project

The Cathedral was carefully monitored for movement and excess vibrations throughout the whole operation. In addition the stained glass windows were surveyed and checked again once the main construction was completed.