

SOIL PROPERTIES: HVSR and F_0

- Efficient method in the field (~ 10 min at each site)
- Reliable estimate of F_0 for the sites investigated
- Good correlation with depth to bedrock



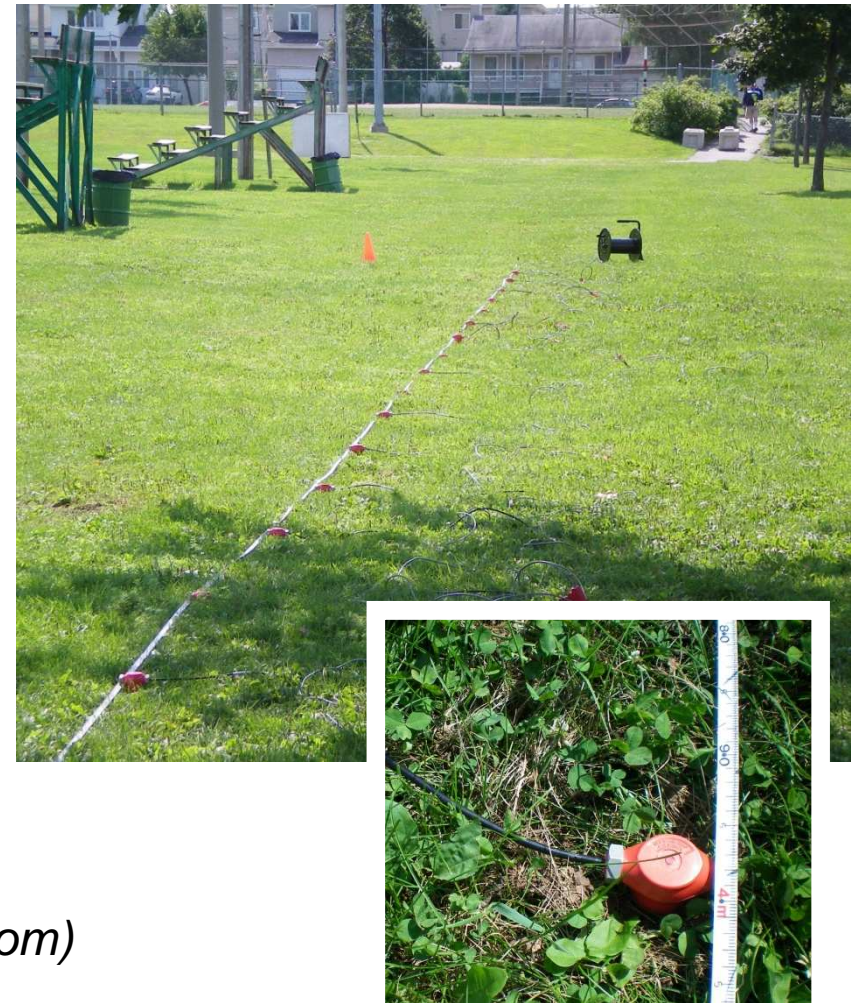
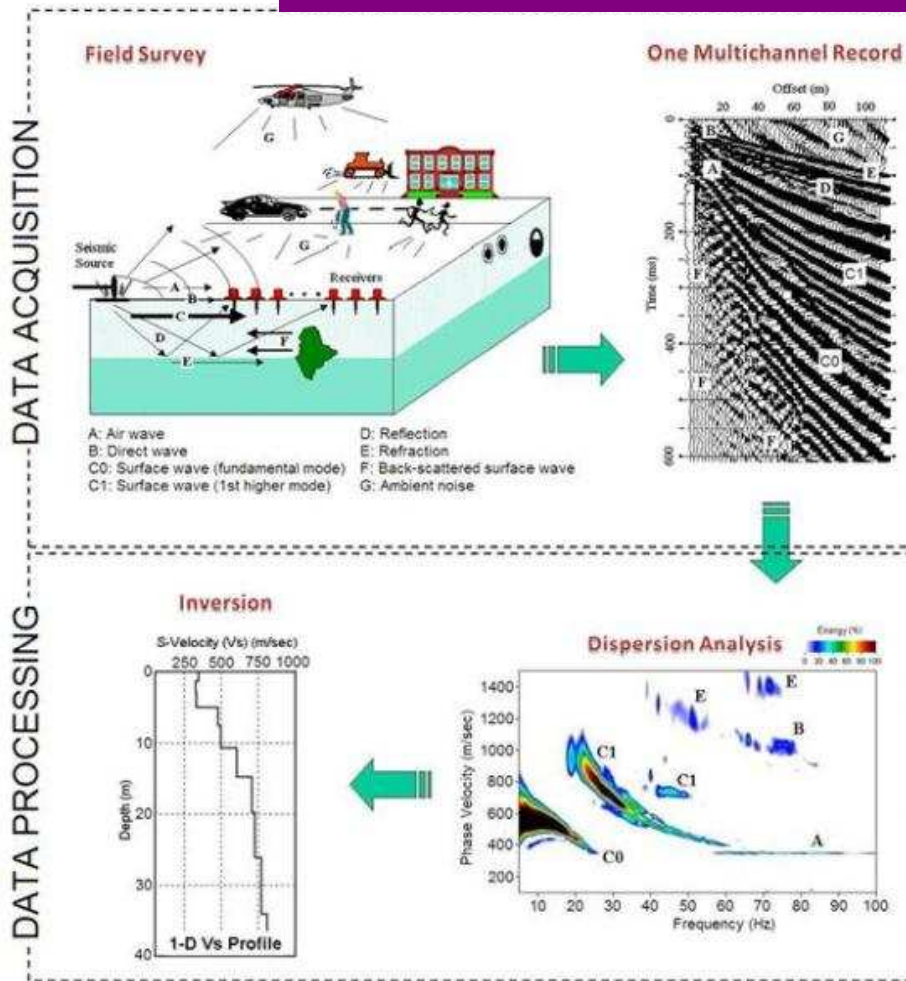
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SOIL PROPERTIES: MASW



(www.masw.com)

(Multichannel Analysis of Surface Waves)



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(www.masw.com)

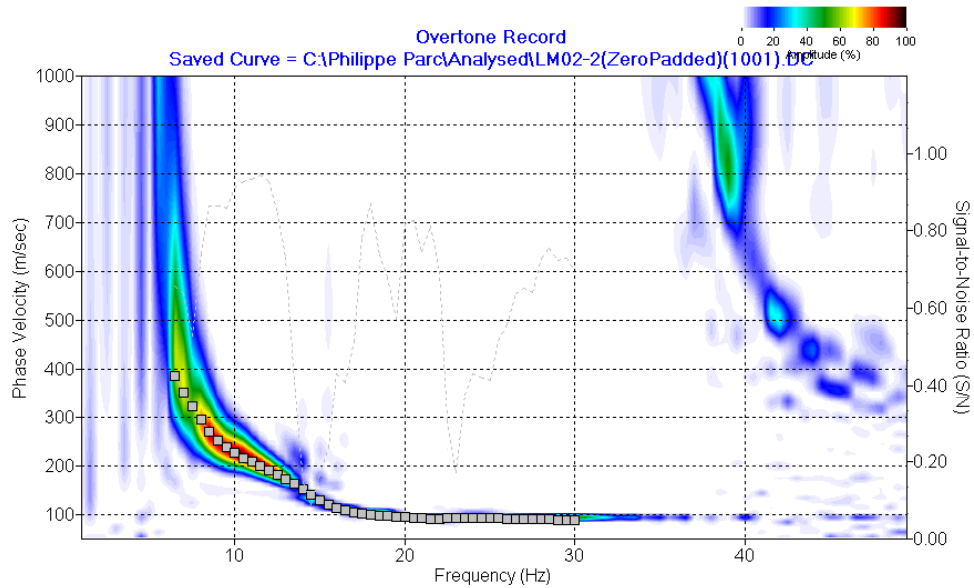
MASW in 29 parks



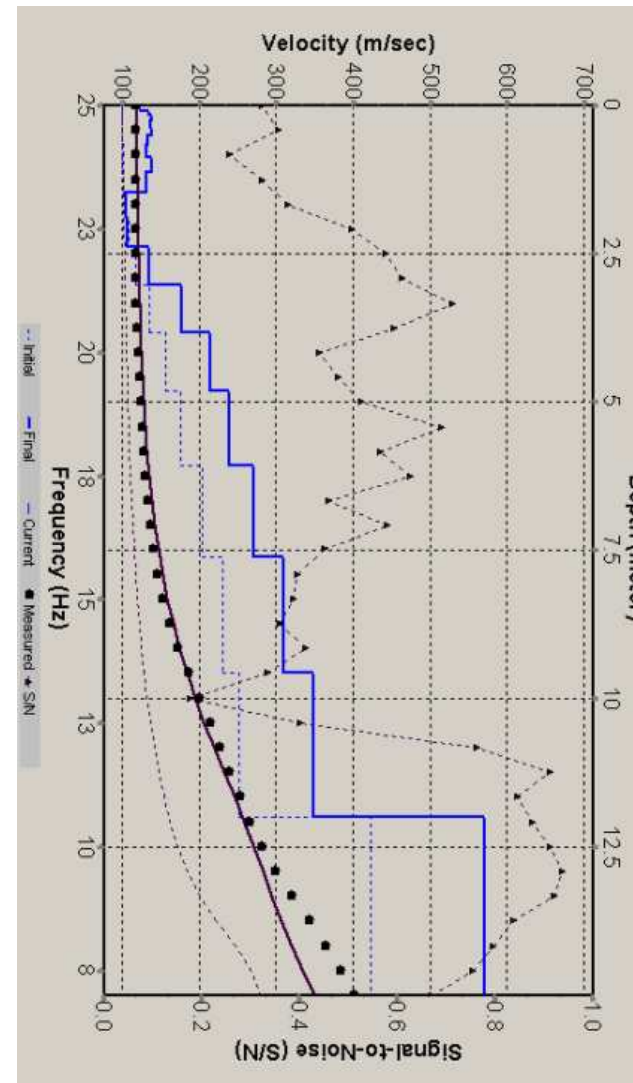
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- Number of layers selected using borehole information

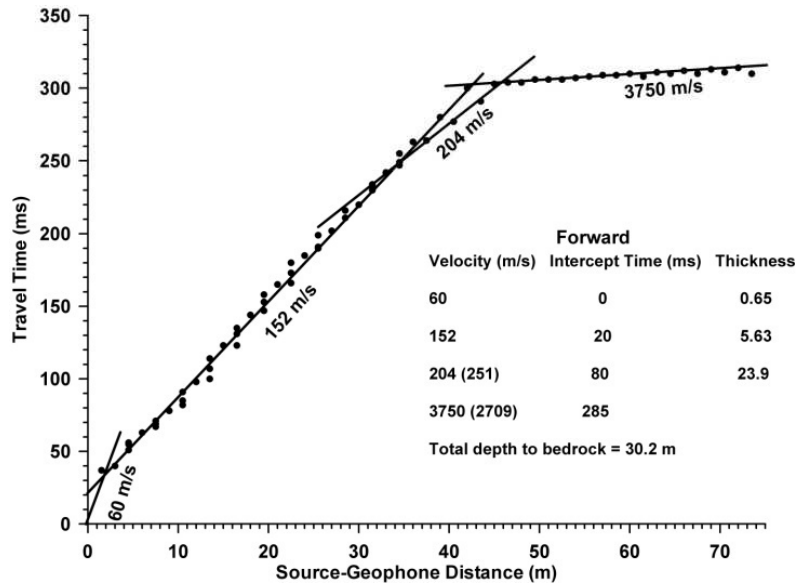


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Seismic refraction

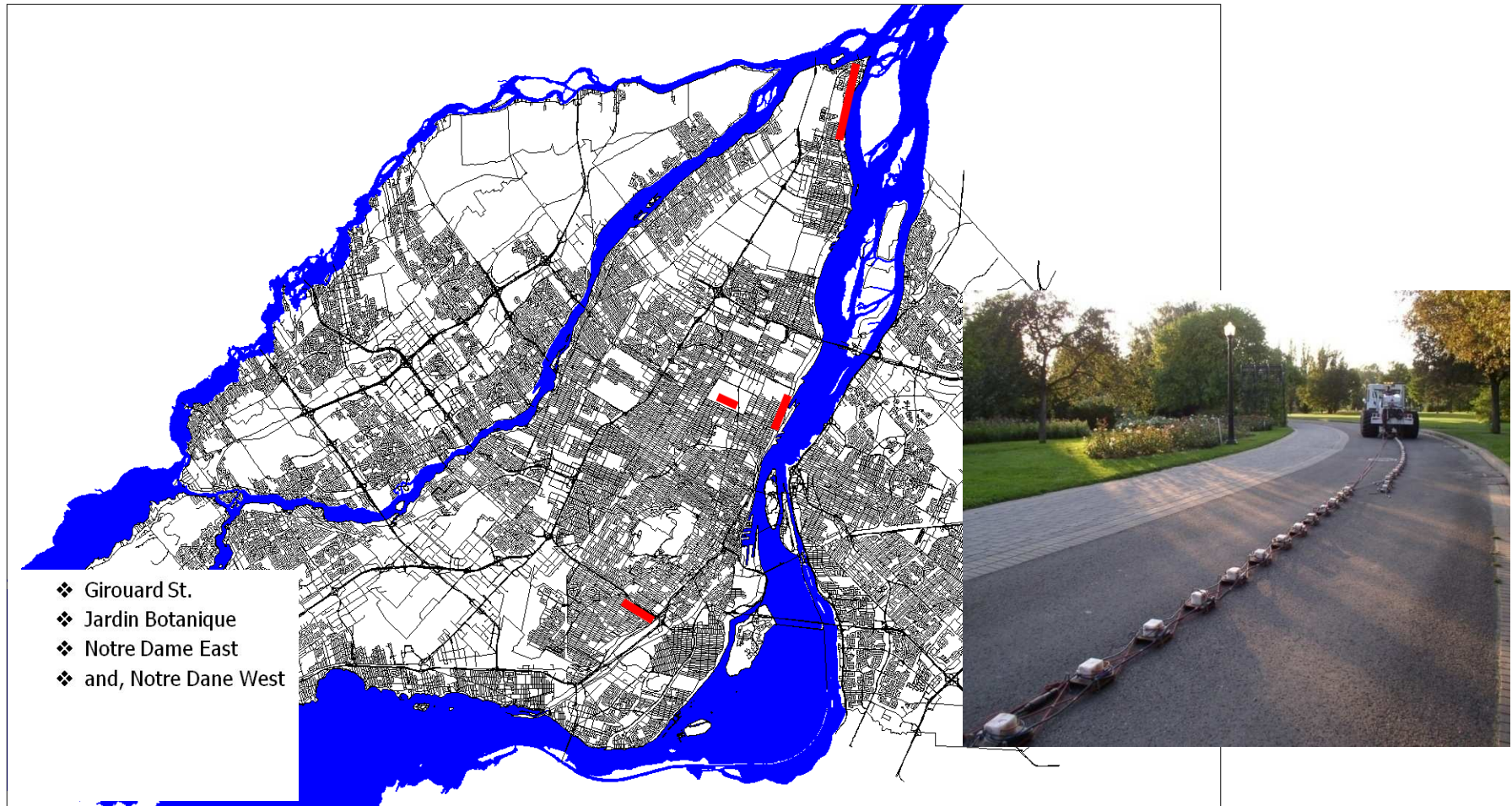


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SEISMIC REFLECTION



High resolution seismic reflection ~ 7.5 km
(GSC - Minivibe)

- Girouard
- Botanical Garden
- Notre-Dame East
- Notre-Dame West



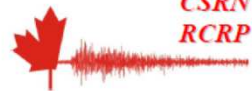
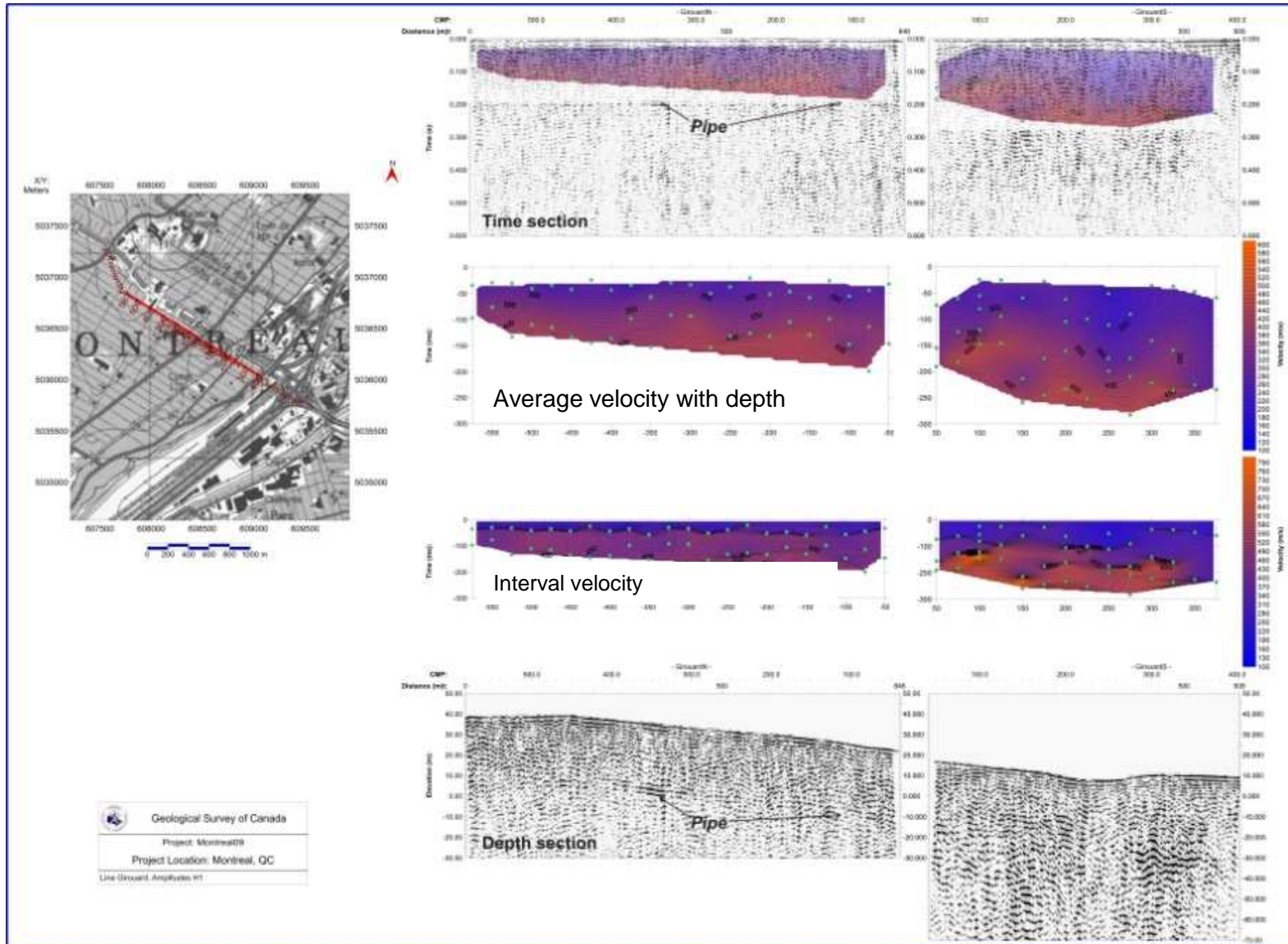
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SEISMIC REFLECTION

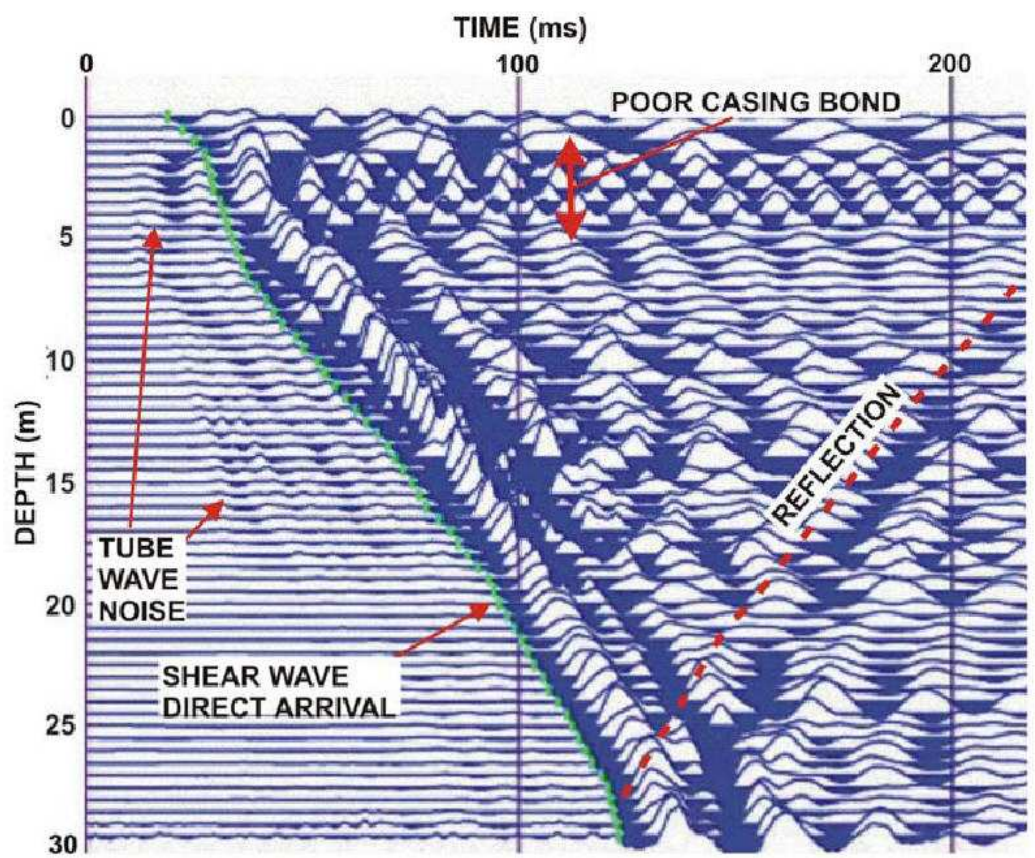
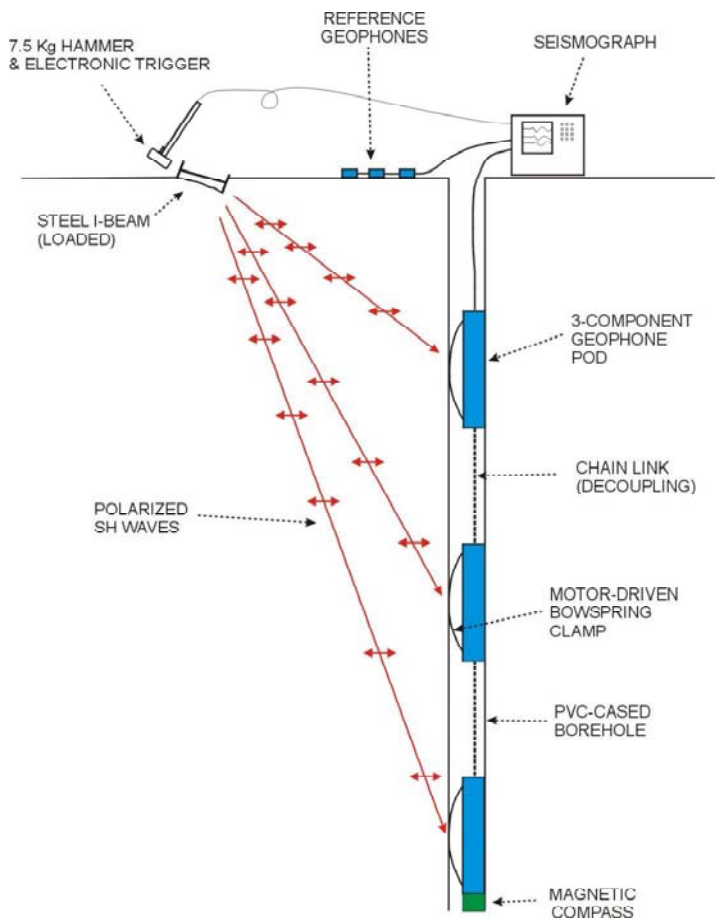


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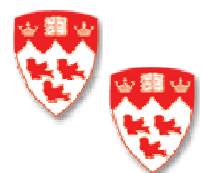
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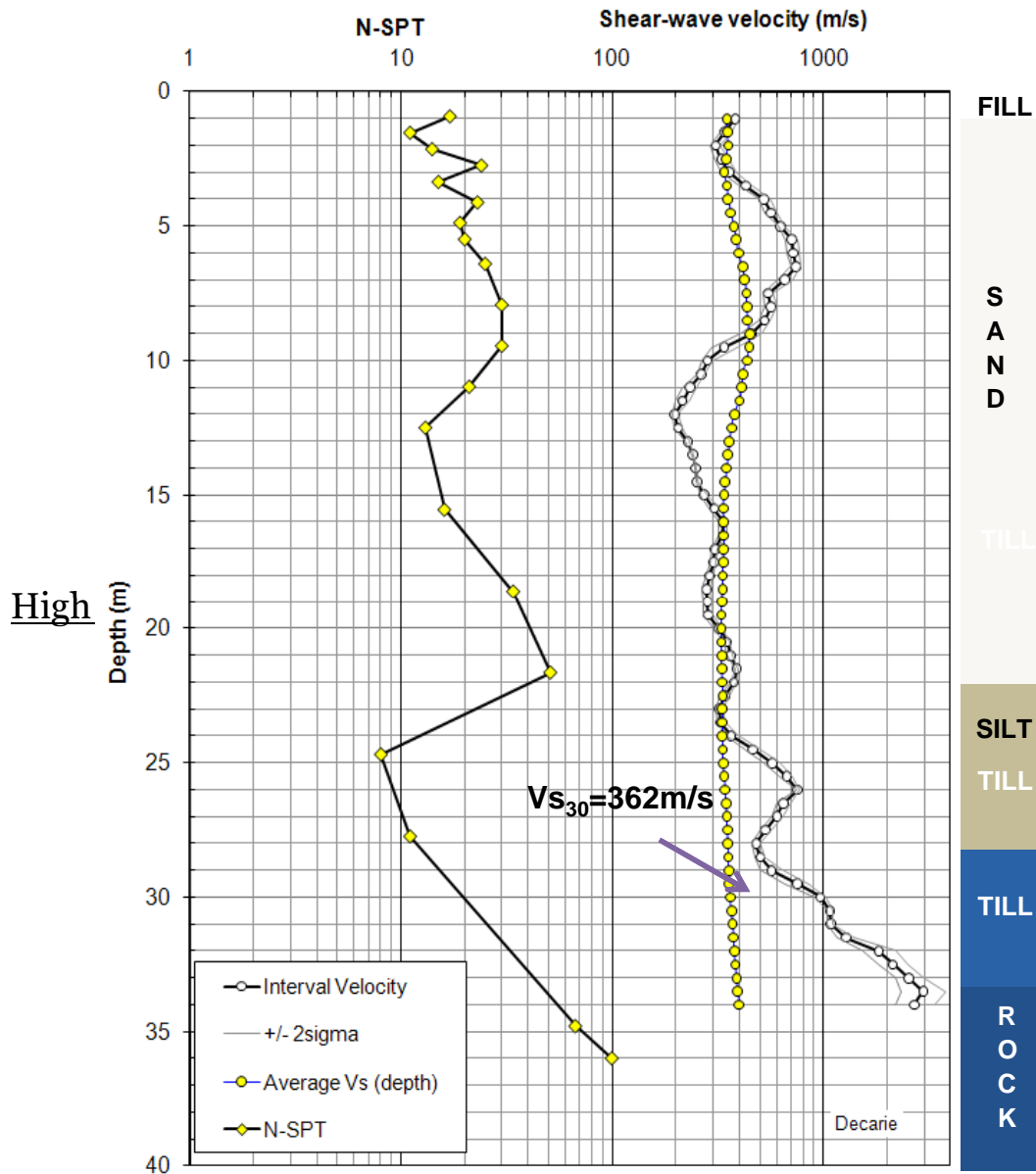
Downhole measurements



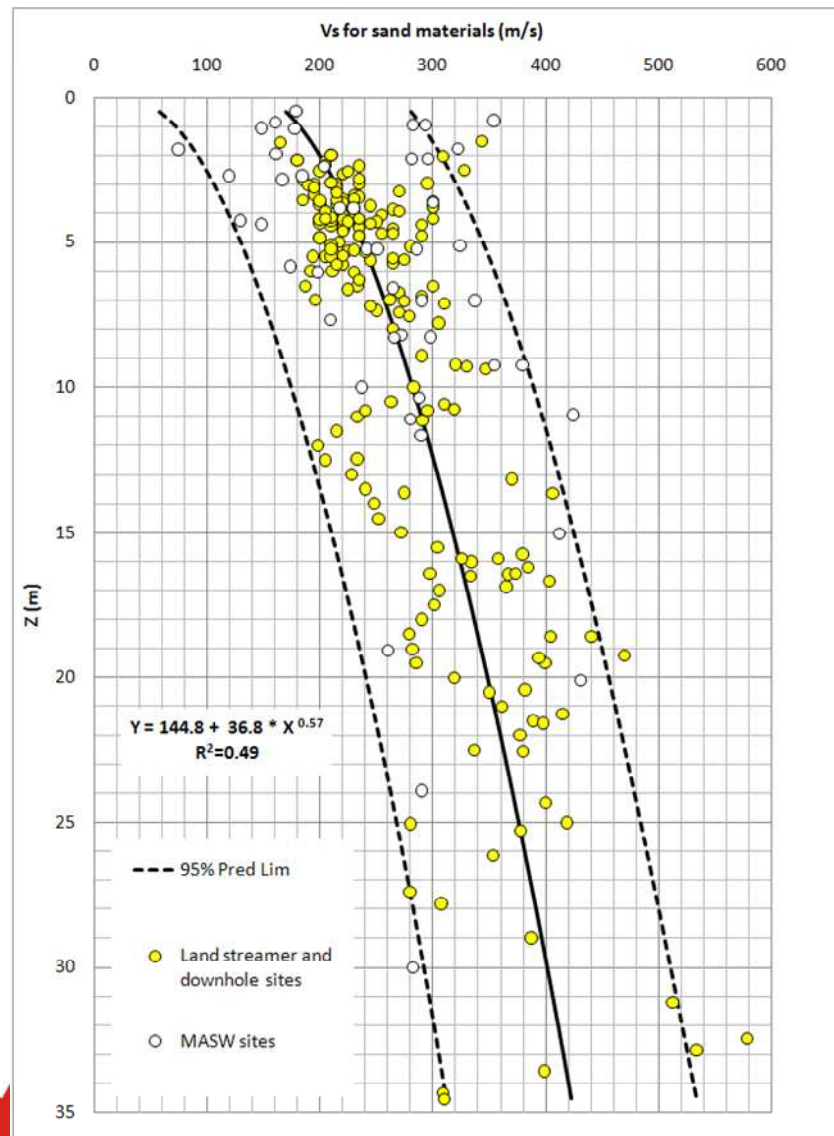
(Motazedian et al., 2009)



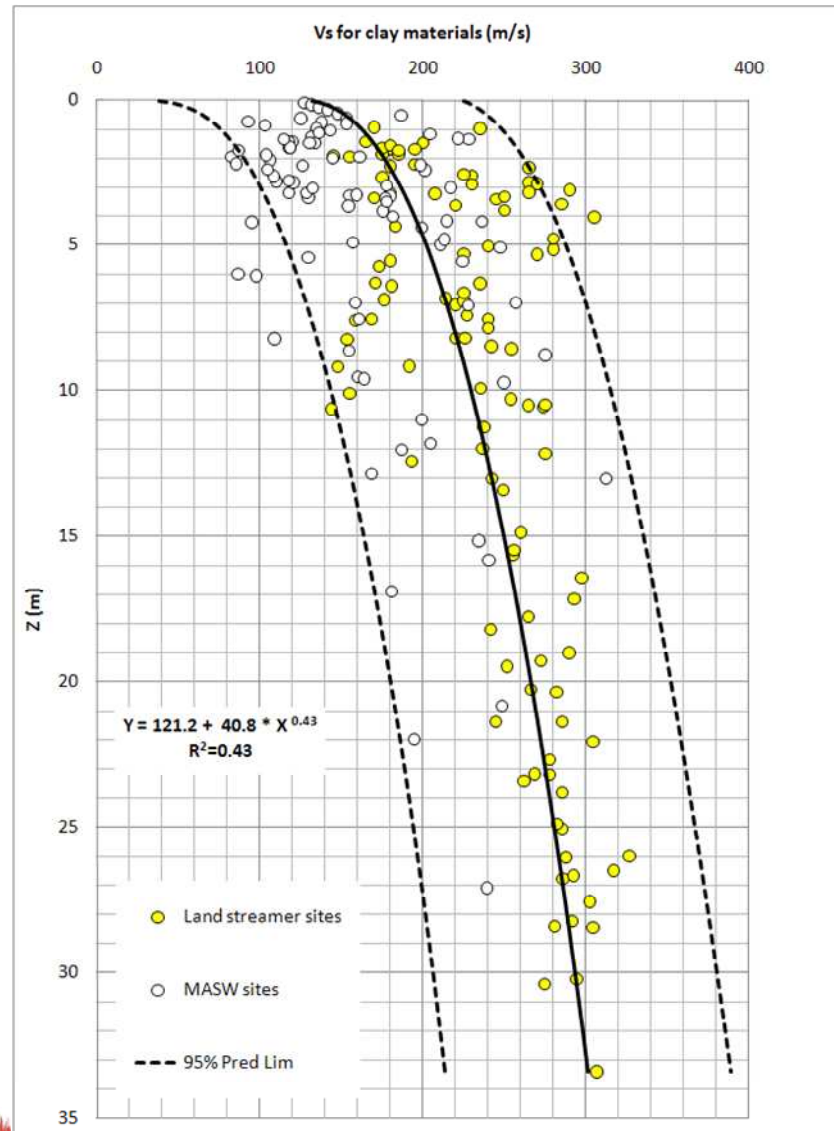
Downhole measurements



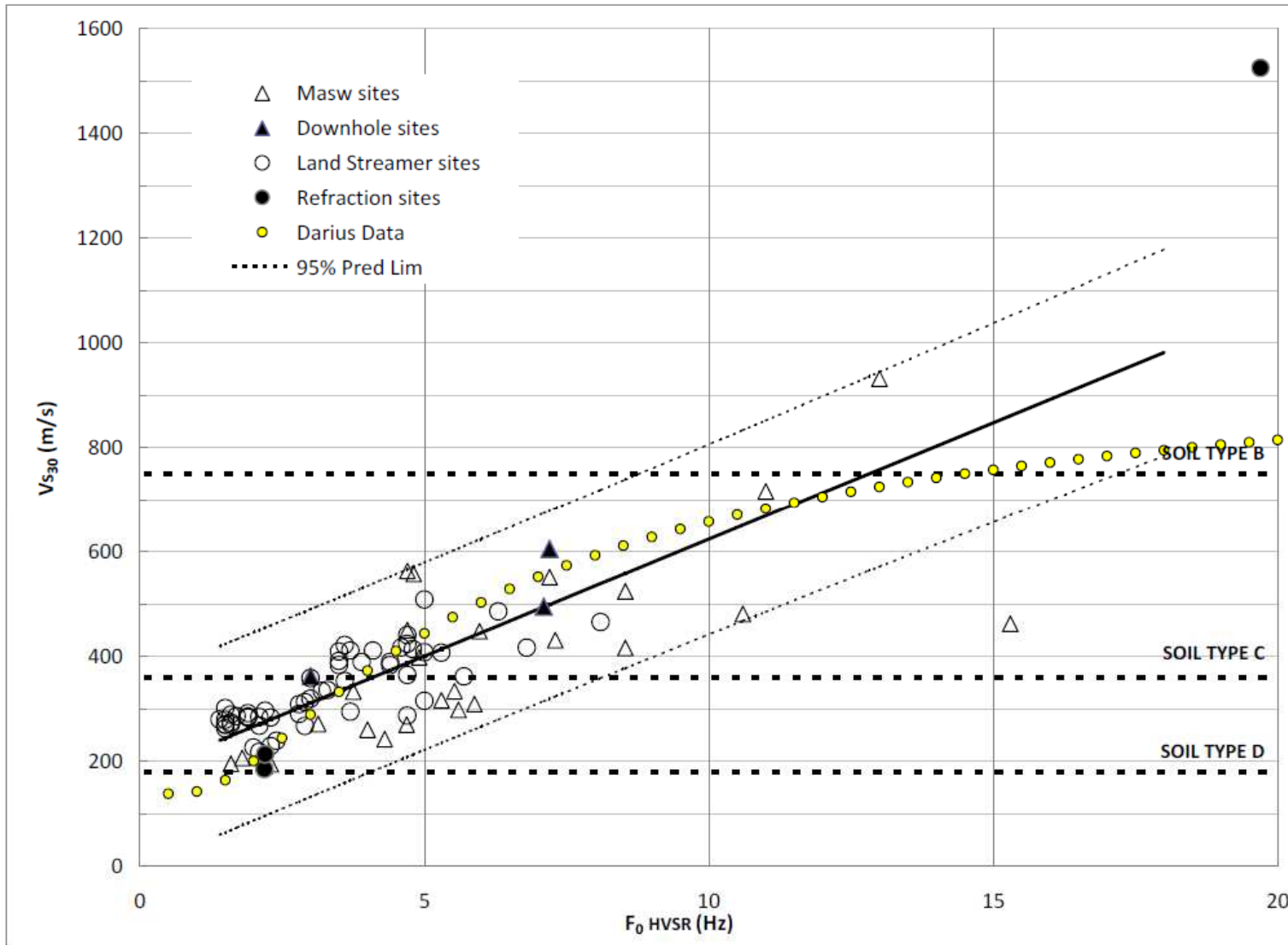
SAND



CLAY



MODEL FOR F_0

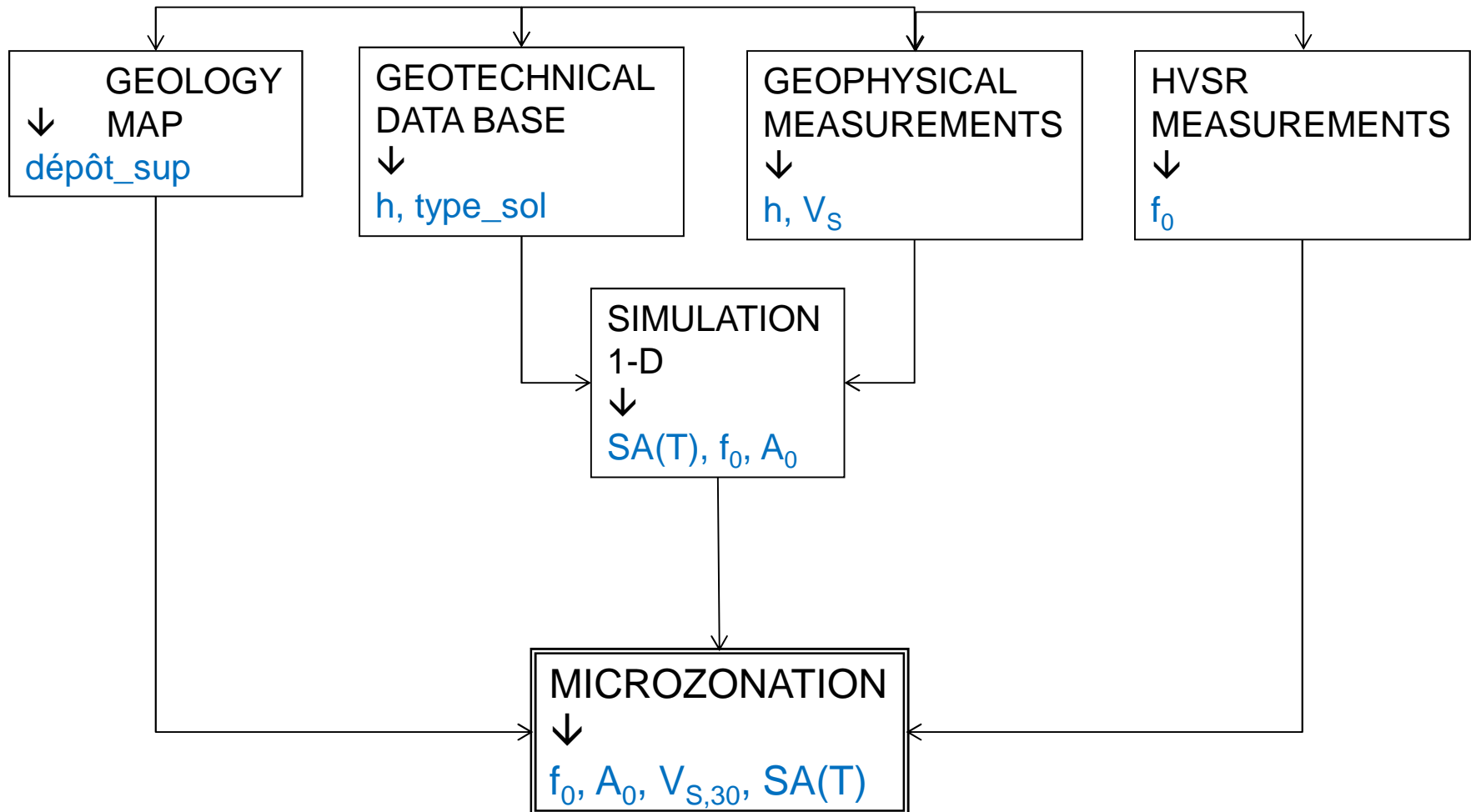


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MICROZONATION



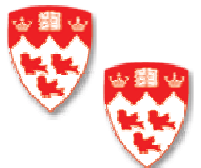
Méthodologie



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- Based on NBCC soil classification: V_{s30}
 - Différents options for defining the microzonation as a function of the level of information available
 - Based on topography (USGS)
 - Based on seismic surveys
 - Based on depth to bedrock
 - Based on borehole data
 - Based on HVSR measurements
- Based on V_{s30} and other inputs (e.g. F_0)



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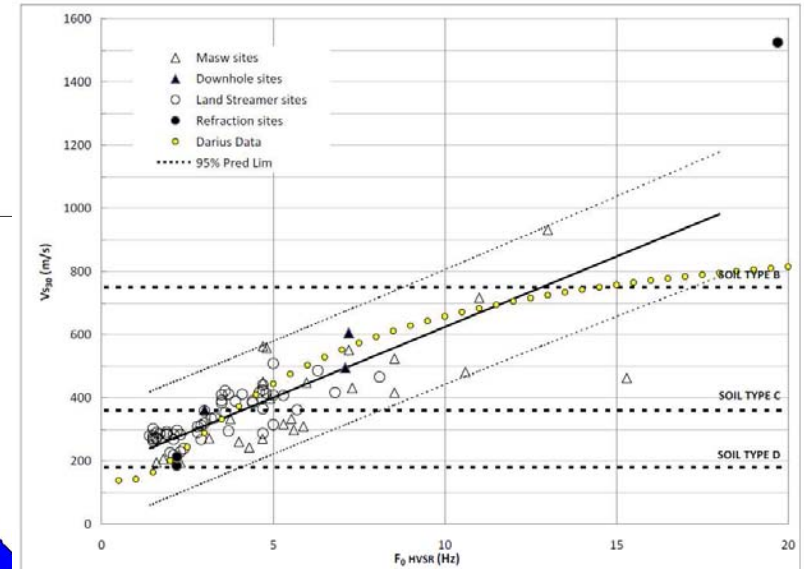
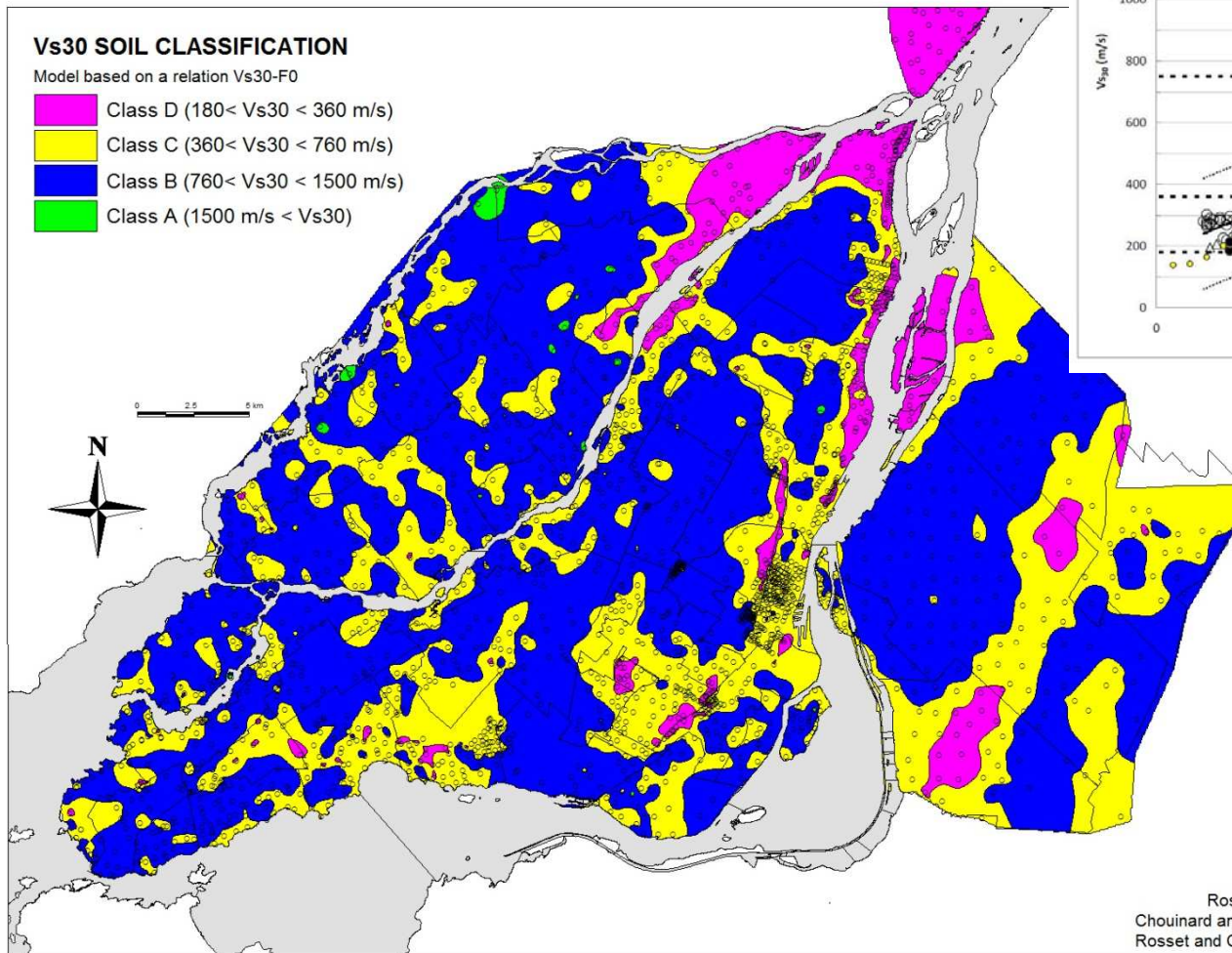
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MICROZONATION

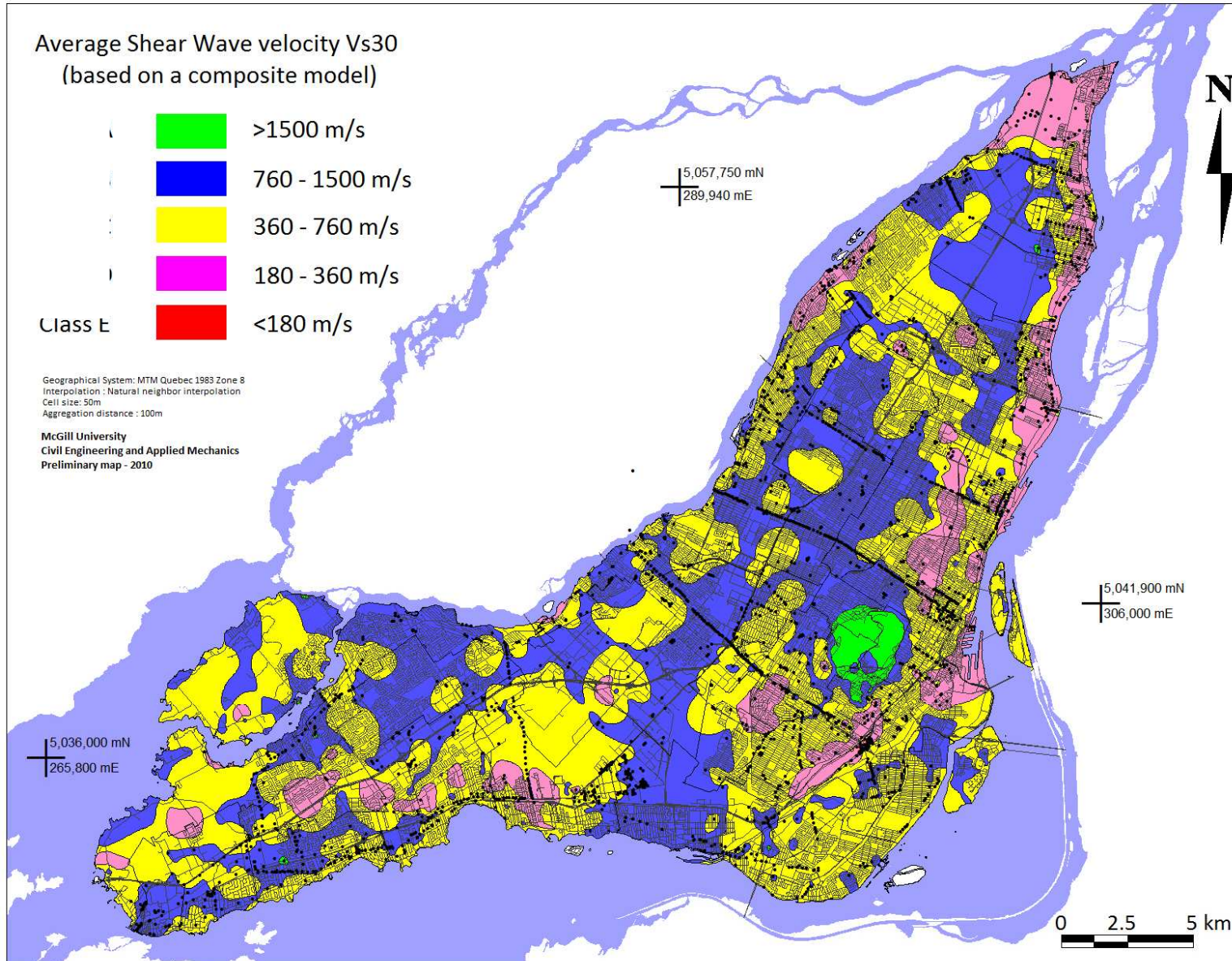
Vs₃₀ from data on HSVR (2631 sites) and Vs measurements (Chouinard and Rosset, 2011)



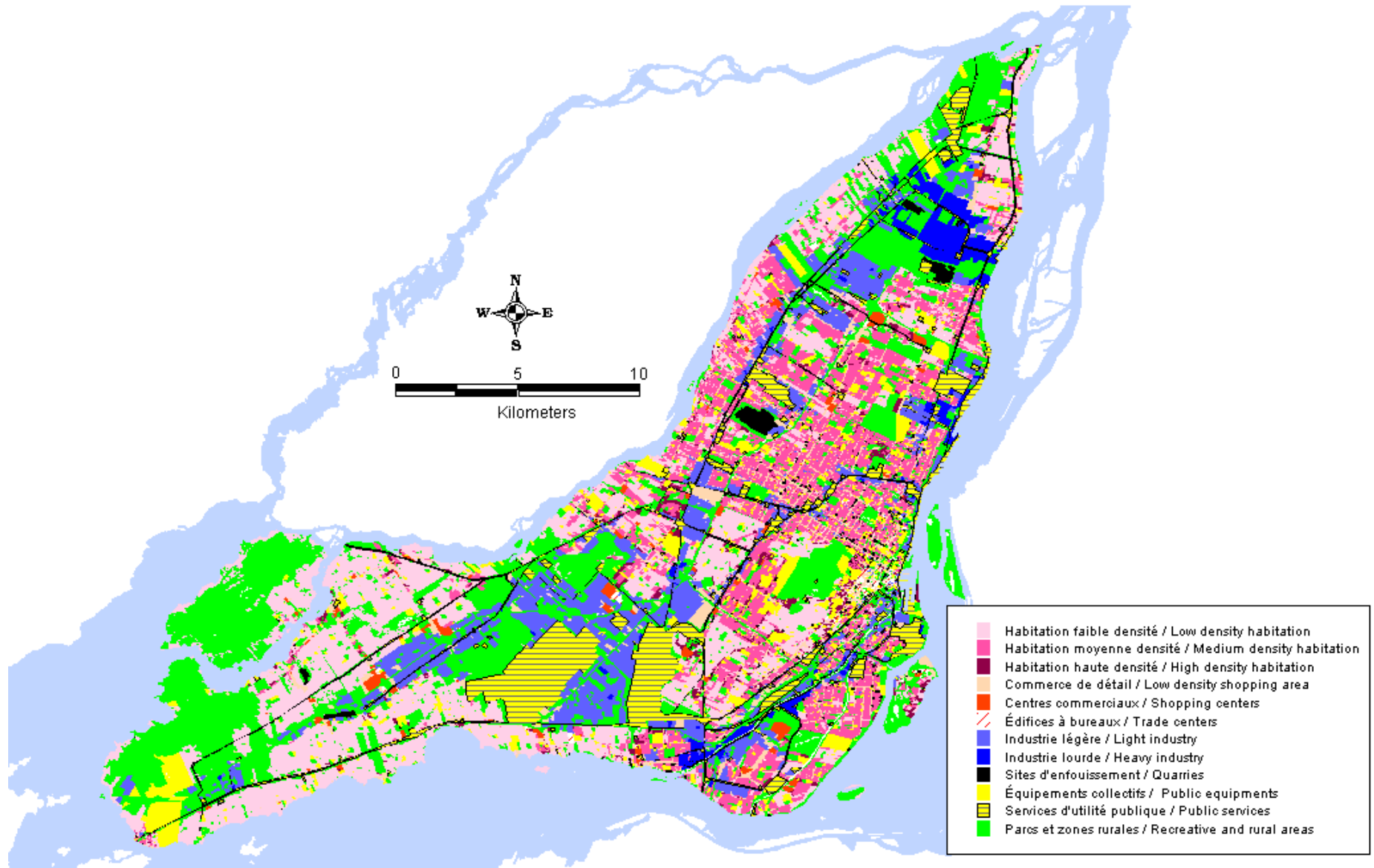
Sources:
Rosset et al. (2012)
Chouinard and Rosset (2011)
Rosset and Chouinard (2009)



COMPOSITE MODEL



INTRANTS : OCCUPATION DU SOL



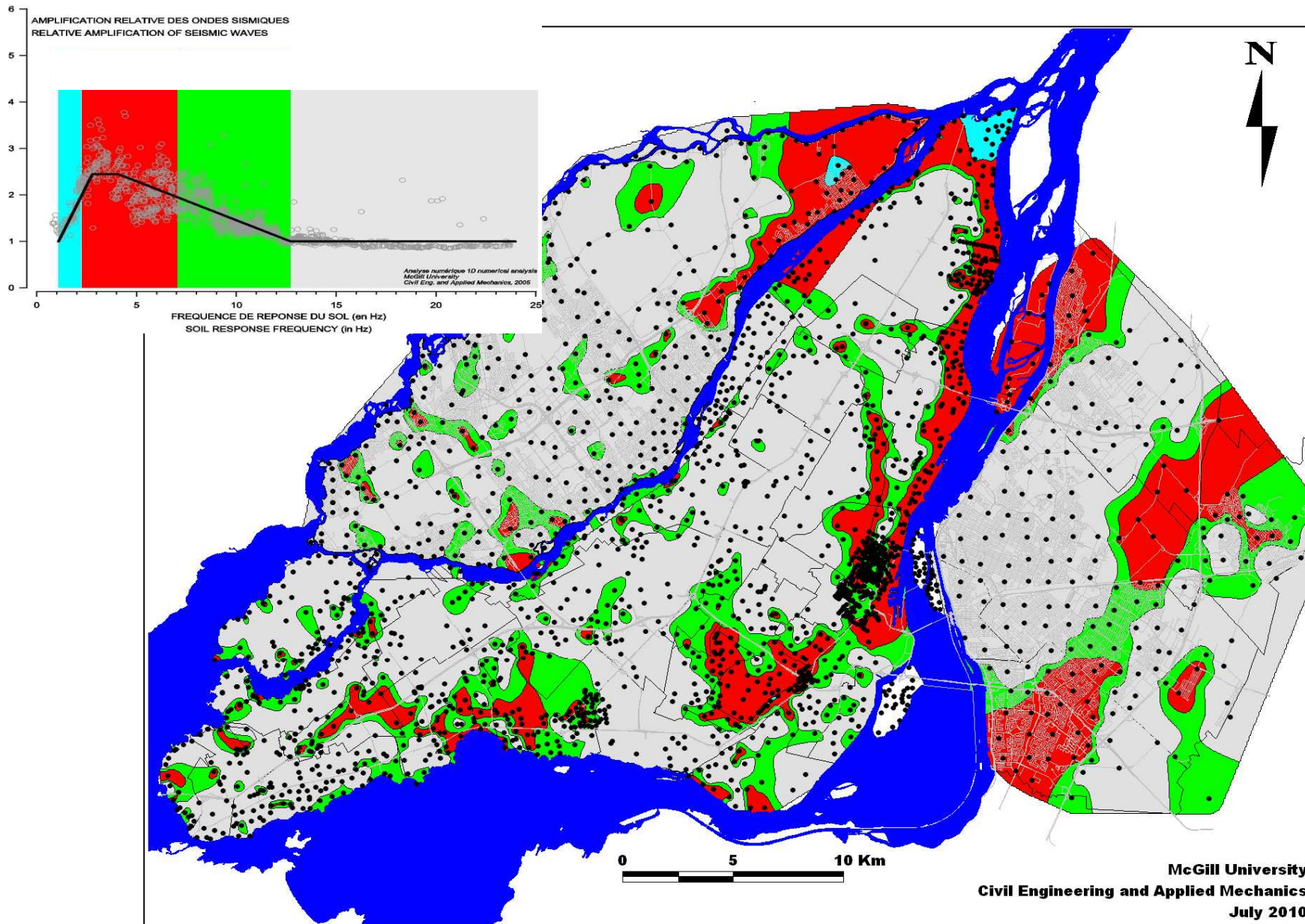
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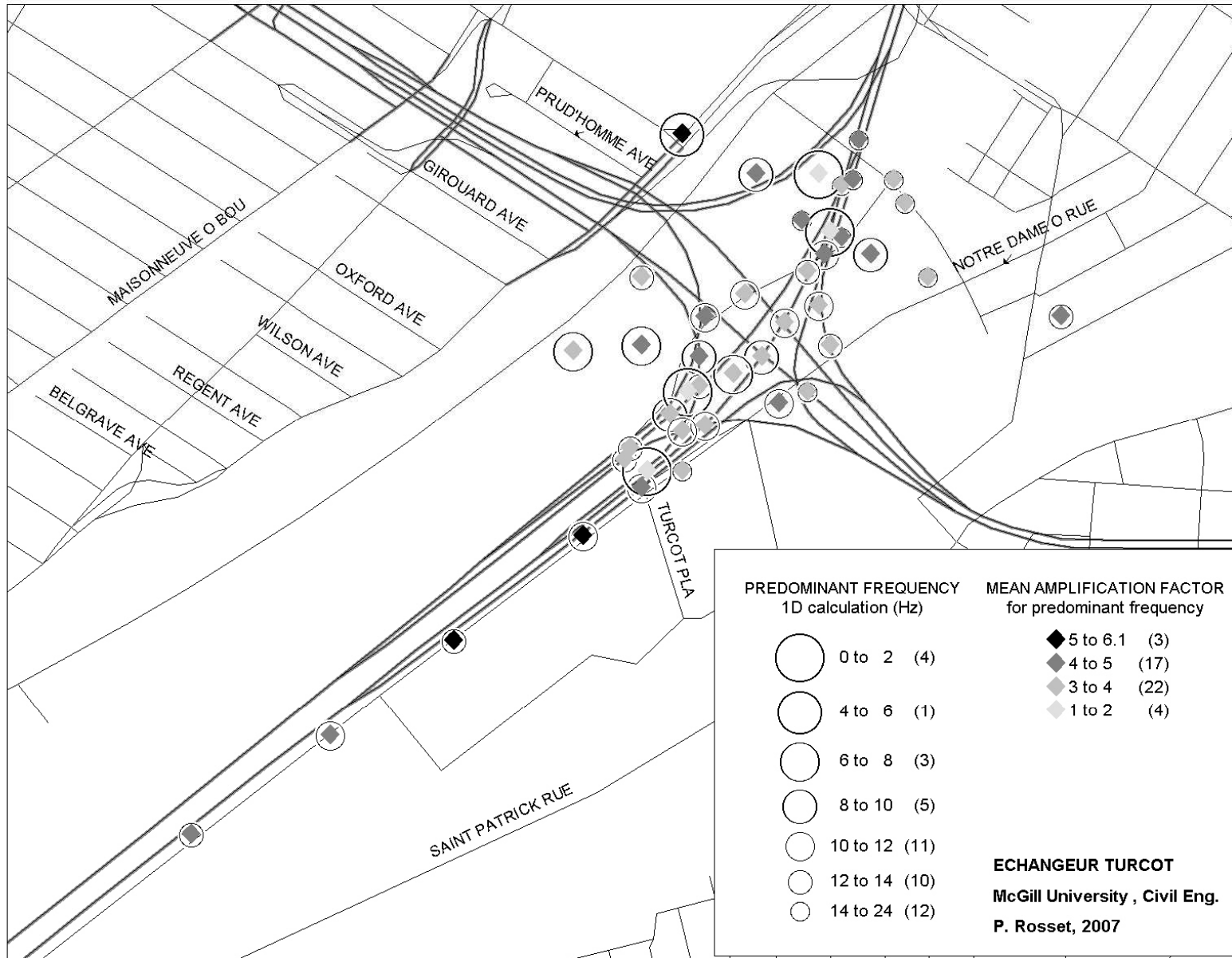
MICROZONATION

Microzonation based on F0 from HVSR and 1D wave propagation (Rosset and Chouinard, 2009)

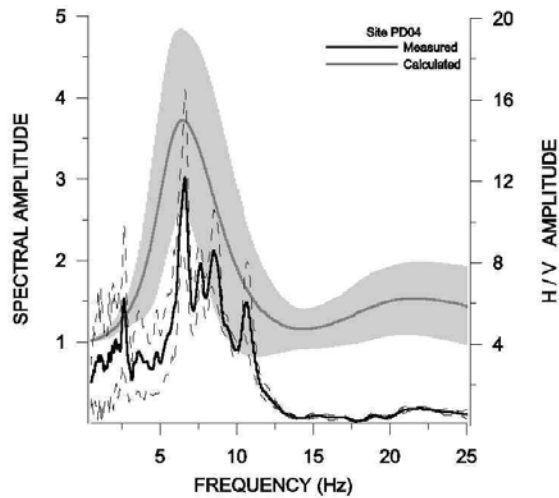


SITE SPECIFIC ANALYSIS

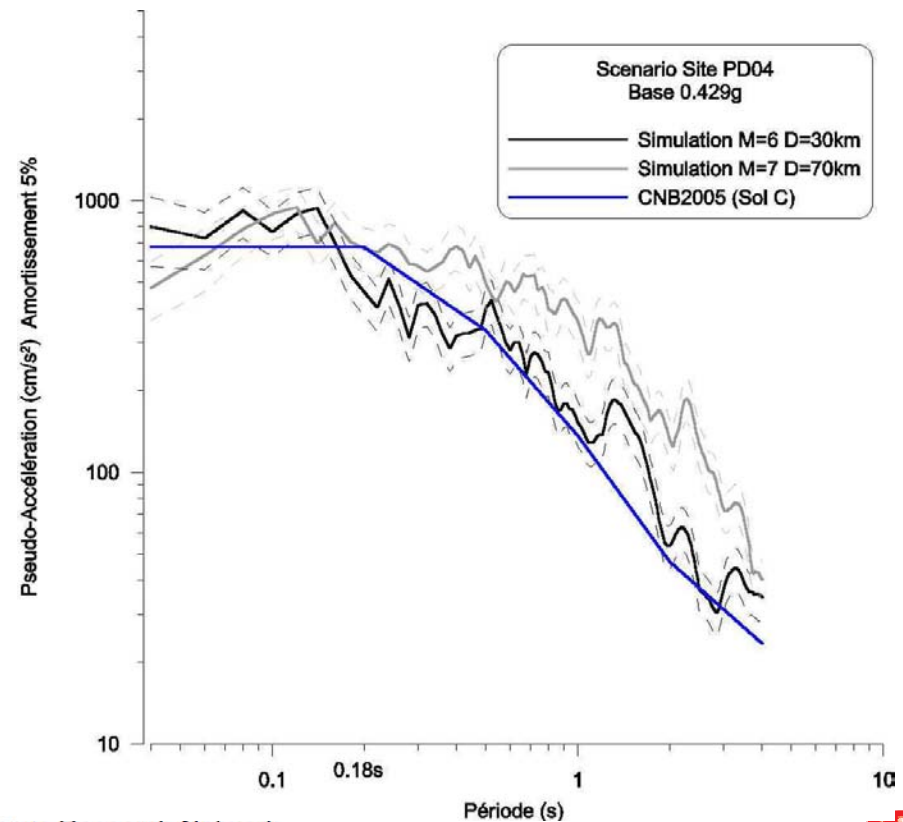
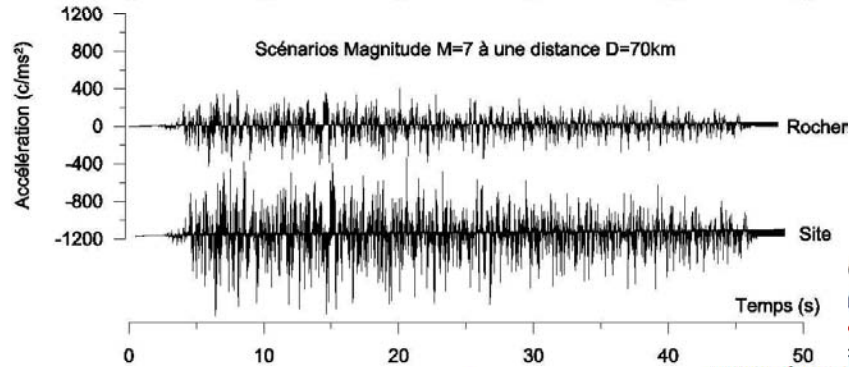
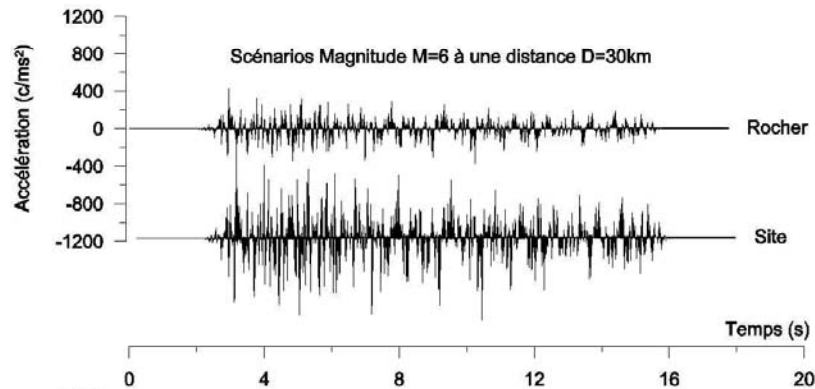
1D model for the site response – Turcot interchange (200 simulations)



SITE SPECIFIC ANALYSIS



Lithologie	Épaisseur (m)	Vitesse des ondes de cisaillement (m/s)	Densité relative	Atténuation Qs
Tourbe	0.89	150	2.0	5
Argile	5.16	150	1.72	5
Till intermédiaire	1.4	800	2.16	20
Roche		2300	2.67	100



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ACCELEROMETER NETWORK OF MONTREAL (GSC)

Station_Id	Latitude	Longitude	X	Y	Nom, adresse
MO001	45.5099	-73.5534	300580	5041000	Chaussegros-de-Léry303, Notre Dame Est
MO002	45.4962	-73.5533	300570	5039560	Louis-Charland, 801 rue Brennan
MO003	45.5403	-73.5714	297670	5043970	Direction des Immeubles, 2580 bd St-Joseph
MO004	45.5125	-73.5841	298263	5041395	Quartier Général des Incendies, 4040 av. du Parc



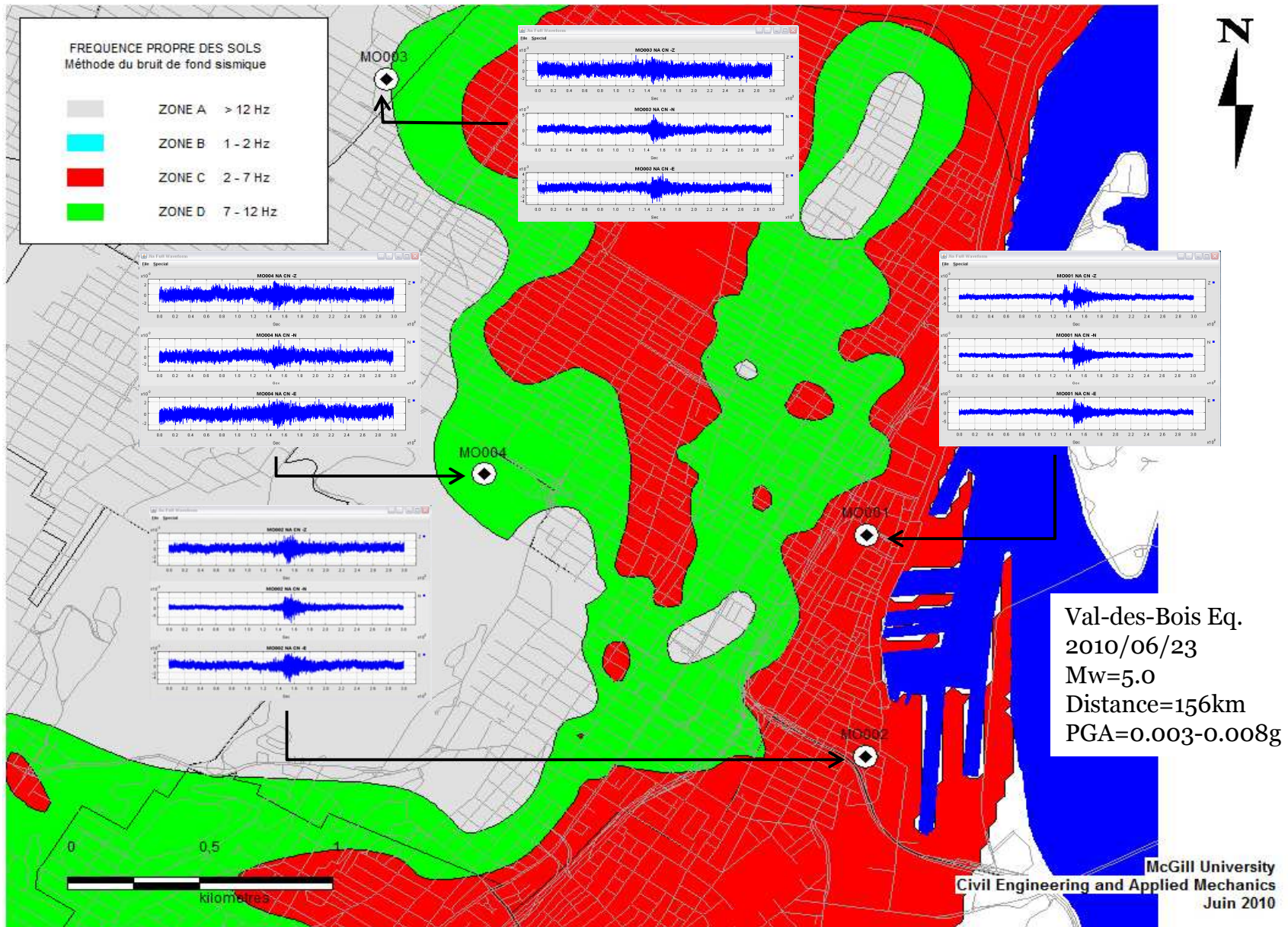
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ACCELEROMETER NETWORK OF MONTREAL (GSC)



CONCLUSIONS

Montreal is located in a moderate seismic zone with potential for significant damage.

Microzonation has been developed and is being expanded to the Greater Montreal area.

Liquefaction map has also been produced.

Microzonation has been used to perform seismic risk analysis for Montreal.

Ongoing seismic risk analysis for Laval



THANK YOU

QUESTIONS?



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