

OLR-86-2-EPTU-MEM-0001	Memorandum	OLRT Project	
Revision 03	Date March 21, 2014	Owner:R.Schmidt	Technical Director

MEMORANDUM

Document No. **OLR-86-2-EPTU-MEM-0001**
Department No: **Technical Memo**
Date: **21th March 2014**
From: **Roger Schmidt, Technical Director**
To: **David Whyte, Project Director**
Subject: **Resuming Tunneling at East Portal**

This technical memo has been prepared in response to the City's request for a summary of the events of February 20-21, 2014, its root cause and the path forward from a technical perspective.

Summary of events

The sinkhole event was, as could be surmised, unexpected. Ottawa Light Rail Transit Constructors (OLRTC) had no indications of concern, and no noted deviations from practice prior to the event. Mining operations were proceeding according to approved plans and drawings. Daily records confirmed that geotechnical conditions closely matched geotechnical assumptions. Yet, at about 09:40 pm on February 20th, the mining crew noticed excessive loose and wet material start to fall, between the tunnel support pipes, from the left side area of the tunnel crown onto the tunnel floor. This material continue to ingress and, despite efforts to stabilize it from below, only stabilized after a sinkhole developed. Adjacent roadways were assessed and, at 10pm, crews closed Waller Street near Laurier to local vehicular access. At about 1:00 am on February 21st the sinkhole reached the surface in an OLRTC work zone on Waller Street.

Damage from the sinkhole was limited to the City utilities (sewer and traffic signals) that crossed its path. Extensive monitoring points OLRTC have in the area have confirmed that no building settlement of concern occurred. OLRTC via the applicable Engineers of Record provided technical guidance during the stabilization exercise and the safety report confirms that no workers or other persons were injured as a result of this event. OLRTC crews worked together with the City to manage the traffic and transit effects and by 2:00 am on February 22OLRTC had stabilized and backfilled the sinkhole.

Root cause

Since the stabilization, OLRTC has reviewed all pertinent data and prepared a root cause technical analysis report. The report confirms documented procedures were followed, appropriate materials were used, prescribed supporting measures were in place and there were no non-conformances of practice.

The report does identify that the tunnel crossed beneath a previously excavated construction pit that was deeper than the known utilities and likely extended from bedrock to the surface. The

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shape of the old pit closely matched the shape of the sinkhole that opened up; also the pit edges display features of the previous sheet piled support. The material from the pit that entered the tunnel was the type of material indicative of poor quality, un-compacted backfill. At the sinkhole it was partially saturated with water. This unexpected pit – about 7 or 8m square - was localized enough to not be identified by the investigation program yet large enough to create a problem. The root cause report concludes that the sinkhole event of 21 February 2014 was primarily caused by the presence of this previous excavation and the resulting unknown poor quality, wet and non-native ground cover above the tunnel.

Neither the presence of poor quality backfill, nor the presence of water in the soil are insurmountable tunneling problems. The problem occurs when these factors are unknown.

Moving forward

While it is true that unknown factors may arise in the future it is also important to note that the City carried out an extensive geotechnical investigation program prior to award and OLRTC augmented this with an additional, and extensive, geotechnical investigation program after award.

The investigation program and its results remain sound. The sinkhole anomaly was localized enough to not be caught by the borehole investigations. We do not expect another such incident, nevertheless we are currently reviewing our borehole logs and drawings to see where any other such an anomaly could potentially occur. In some instances we will drill additional boreholes – such those recently completed on Laurier Avenue – to confirm consistency of the overburden. We saw no fault with our processes but continue to look for ways we can, as much as possible, identify other unknown conditions early and manage them.

For immediate next steps, the tunneling program adjacent to the sinkhole is planned to continue in phases. The first phase will keep the tunnel in known and solid geotechnical conditions while additional confirmatory boreholes are drilled and analysed. It will also involve investigative probe drilling within the tunnel, and grouting to confirm stable tunnel face conditions. The second phase of tunneling works will resume after we analyze new borehole data. The graphic attached shows this in concept.

Yours truly,



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Technical Director, OLRT Constructors
 Encl. Infographic

