A High Performing and Scalable Model for   
Computing and Visualizing Urban Transit Accessibility

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**1 INTRODUCTION**

Accessibility is an essential component of the urban landscape and to achieve meaningful infrastructural development or analysis, one requires both realistic and scalable measures of urban accessibility. Such measures for accessibility play key roles in planning development of roads, city districts, amenities, as well as measuring civil access to healthcare, schools and so forth. More generally, accessibility measures are vital for supporting equitable and optimal distribution of resources across urban landscapes serving as particularly useful references for urban developers and policy makers.

Despite the importance of such measures, much of past accessibility research only considers a limited set of travel modes. These include driving, biking, and walking, but overlook the importance of public transit as a primary mode of travel. (Liu & Zhu, 2004) This may be for a few reasons such as a lack of standardized public transit data, or simply a lack of routing engines that can efficiently model complex journeys through transit networks.

Measuring transit accessibility is crucial and will be more than ever for a few major reasons. First, as society undergoes a Third Industrial Revolution, much focus will be diverted to urban and regional planning. (Roberts, 2015) Sharing economies and sustainability driven planning will undoubtedly increase our dependence on public transit and electric vehicles, although it is uncertain what fraction of society will own fully electric vehicles within the next few decades. Instead, one might find access to these through autonomous ridesharing systems, which will more than likely be useful for filling holes in current public transit networks (this *may require a reference*). Not to mention, car dependence generally has poor outcomes on human physical and psychological health and the environment through traffic congestion, loss of time, and accidents. (Martin *et al.*, 2014; Royal Society for Public Health, 2016; Sallis *et al.*, 2004; EMBARQ, 2013)

To better understand the scale of public transportation in Canada, prior to the COVID-19 pandemic, 31.4% of Canadians regularly used sustainable transportation, where public transit comprised almost 40% of those cases. When considering Canada’s largest three metropolitan areas, as much as 40.4% of the population used sustainable transportation, of which 55% was public transit. (Statistics Canada Census, 2016). To say the least, public transit will remain an imperative area for urban developers to focus on.

Secondly, we must recognize that certain population segments do not readily have access to private transportation. These populations will tend to be more vulnerable whether they be marginalized, elderly, or youth, and are likely to rely on public transit relative to other social segments (need a refence). Therefore, when considering society in its entirety, modeling transit accessibility becomes paramount in urban planning.

To address the lack of standardized methods for obtaining transit accessibility information, this research responds with a simple, scalable, and high performing methodology to accomplish such task including any form of public transit available in a city’s General Transit Feed System1. A case study of Vancouver is done on access to cultural amenities such as museums, libraries, art galleries, and theatres, to provide an initial proof of concept.

Martin, A., Y. Goryakin and M. Suhrcke. 2014. “Does active commuting improve psychological wellbeing? Longitudinal evidence from eighteen waves of the British Household Panel Survey.” Preventative Medicine. Vol. 69, p. 296–303.

Royal Society for Public Health, Vision, Voice and Practice. 2016. Health in a Hurry: The Impact of Rush Hour Commuting on Our Health and Wellbeing

Sallis, J.F., Frank, L.D., Saelens, B.E., Kraft, M.K., 2004. Active transportation and physical activity: opportunities for collaboration on transportation and public health research. Transport Res. A – Pol. 38, 249–268.,

EMBARQ. 2013. Saving Lives with Sustainable Transport. World Resources Institute

Liu, S., Zhu, X., 2004. An integrated GIS approach to accessibility analysis. Trans. GIS 8, 45–62.

Roberts, Brian. (2015). The Third Industrial Revolution: Implications for Planning Cities and Regions. Workiing Paper Urban Frontiers.

Statistics Canada. 2017. “Census of Population, 2016: Commuters using sustainable transportation in census metropolitan areas”. Minister of Industry. Catalogue no. 98-200-X2016029. ISBN 978-0-660-23763-3.