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

**Yuxuan Cui**  
Computer Science and Statistics  
Faculty of Science  
University of British Columbia

[cuiyuuxuan@gmail.com](mailto:cuiyuuxuan@gmail.com)

**Luka Vukovic**  
Computer Science and Statistics  
Faculty of Science  
University of British Columbia

[luka.vuko@outlook.com](mailto:luka.vuko@outlook.com)

**Rain Shen**  
Computer Science and Statistics  
Faculty of Science  
University of British Columbia

[rain.ya1213@gmail.com](mailto:rain.ya1213@gmail.com)

**Graham Paul Kerford**  
Computer Science and Statistics  
Faculty of Science  
University of British Columbia

[graham.kerford@gmail.com](mailto:graham.kerford@gmail.com)

June 25th, 2021

**1 INTRODUCTION**

Transportation network analysis is crucial to urban planners, researchers, and policy makers to ensure accessibility remains is a key feature of the urban landscape. This requires both a realistic and a scalable measure for accessibility, which can impact the planning and development of roads and city districts, while also helping analyze a population’s access to healthcare, schools, grocery stores, and other amenities. On a fundamental level, having proper accessibility measures allows urban resource distribution to be more equitable, optimal, and based on informed decisions.

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, being in the midst of 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 such technology within the next few decades. Instead, one might find access to electric vehicles 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 physical health, psychological health, and the environment through traffic congestion, substantial loss of time, physical inactivity, and accidents. (Martin *et al.*, 2014; Royal Society for Public Health, 2016; Sallis *et al.*, 2004; EMBARQ, 2013) As more and more people lessen their reliance on full car ownership, (*reference*) the importance of developing and improving public transit systems becomes vital for supporting urban growth.

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 project responds with a first iteration methodology for simple, scalable, and high performing network travel time computation, city block accessibility scoring, and finally visualization. A case study of Vancouver was performed measuring access to cultural amenities such as museums, libraries, art galleries, and theatres, to servr as an initial proof of concept.

**References**

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.

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.

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

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.,

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.