Methodology and evaluation criteria for selection of Eglinton West LRT configuration

prepared by

Eglinton West LRT Community Working Group[1]

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1. Introduction

The Eglinton West LRT (EWLRT) Community Working Group (CWG) was established "to investigate further grade separation and or tunnelling options to further develop traffic modelling and an enhanced framework that places additional consideration on local community interest." Although the CWG members have expressed strong desire for the LRT to be constructed below-grade through central Etobicoke, and have provided guidance on grade separation for the eastern and western portions of the EWLRT, many criteria, beliefs and opinions must be collectively considered to rationally compare different configuration options and guide a final choice.

This document presents CWG guidance on the criteria that should be applied when evaluating different grade separation options for the EWLRT, and on the methodology through which evaluations are performed and combined to obtain unbiased, objective ranking of alternative configurations.

We begin, in Section 2, with a quick synopsis of the evaluation framework used to support major transit project decisions in Toronto. Section 3 discusses the decision-making methodology for evaluation and ranking of alternatives, and presents arguments supporting the use of a more sophisticated process designed to rationally integrate subjective and objective inputs representing all relevant specializations, perspectives, and interests. Section 4 then lists the sub-criteria that the CWG believes are important and appropriate to consider when deciding on the best grade separation alternative for the EWLRT.

[1] See Appendix A for CWG membership.

2. Evaluation framework

At the meeting of the CWG on July 10, 2018, City staff introduced Toronto's Rapid Transit Evaluation Framework (RTEF) and its eight decision-making criteria. A backgroundfile introduces three guiding policy principles: [2]

> "Three policy principles and eight evaluation criteria are the foundation of the RTEF. These principles are:
>
> - *Serving People* - how well does the project meet the demand for travel in terms of helping passengers, drivers, goods and services get to where they need to go, and in terms of improving equity or fairness by bringing better transportation services to all parts of the city?
> - *Strengthening Places* - how well does the project strengthen and connect neighbourhoods, balance the functions of serving as a travel corridor and a place-building agent, and protect and enhance the quality of the urban environment?
> - *Supporting Prosperity* - how affordable is the project to build, operate and maintain, how well does it support the city's economic development goals, improve its competitiveness and deliver the greatest ridership/travel volumes at the least cost?"

The evaluation criteria, as described in "Update on the "Feeling Congested?" Initiative – A Consultative Approach to Transportation Planning" [3], are:

- *"Choice* – develop an integrated network that connects different modes to provide for more travel options
- *Experience* – capacity to ease crowding / congestion; reduce travel times; make travel more reliable, safe and enjoyable
- *Social Equity* – provide everyone good access to work, school and other activities
- Shaping the City – use the transportation network as a tool to shape the residential development of the City
- *Healthy Neighbourhoods* – changes in the transportation network should strengthen and enhance existing neighbourhoods; promote safe walking and cycling within and between neighbourhoods
- *Public Health & Environment* – support and enhance natural areas; encourage people to reduce how far they drive

[2] www.toronto.ca/legdocs/mmis/2015/ex/bgrd/backgroundfile-84730.pdf
[3] www.toronto.ca/legdocs/mmis/2013/pg/bgrd/backgroundfile-64359.pdf

- *Affordable* – improvements to the transportation system should be affordable to build, maintain and operate

- *Supports Growth* – investment in public transportation should support economic development; allow workers to get to jobs more easily; allow goods to get to markets more efficiently."

3. Decision-making methodology

Although, conceptually, the RTEF gives equal weighting to all criteria, the CWG believes that the notion of equal weighting has no validity in practice. The score assigned to any given criterion is highly subjective, depending on the many sub-criteria and how they are selected, scored and weighted – most of which are left to the discretion of the individual or team performing the analysis. Furthermore, there are no logical rationale for applying equal weighting to each of the eight high-level criteria. Instead, one should expect the relative significance and weighting of criteria to depend on the nature and circumstances of the decision involved. For example, the appropriate weighting for a decision on the order in which to undertake construction of several different transit lines would likely differ significantly from the appropriate weighting for a decision on the grade separation configuration of a particular transit line with a predetermined route.

The RTEF fails to acknowledge the existence of or to take into consideration the inevitable uncertainties and risks associated with the anticipated outcomes on which the scoring of different options for each of the sub-criteria and criteria are based. An alternative that scores higher than others may also be much less certain of delivering the anticipated outcome, or may involve much greater risk of undesirable outcomes or failing to meet the goals and objectives. A proper evaluation should involve estimation of uncertainties, identification of risks, and judgments regarding what is essential or unacceptable.

There exist well-established decision support systems designed to address the concerns raised above. One example, that the City should consider using, is the Analytic Hierarchy Process (AHP). [4] From the Wikipedia page:

> "the Analytic Hierarchy Process (AHP) is most useful where teams of people are working on complex problems, especially those with high stakes, involving human perceptions and judgments, whose resolutions have long-term repercussions. It has unique advantages when important elements of the decision are difficult to quantify or

[4] For details and examples, see:
Thomas L. Saaty, Decision making with the analytic hierarchy process, Int. J. Services Sciences, **1**(1):83 (2008), http://www.academia.edu/download/35403867/saaty_2008.pdf.
International Journal of the Analytic Hierarchy Process, http://ijahp.org/.
https://en.wikipedia.org/wiki/Analytic_hierarchy_process.
Danijela Baric**,** Implementation of AHP in solving transport problems, https://doi.org/10.13033/ijahp.v7i2.251

compare, or where communication among team members is impeded by their different specializations, terminologies, or perspectives."

Software, training, and consulting support is available to support adoption of AHP. A more versatile and powerful extension of AHP is the Analytic Network Process (ANP) [5], for which software and support are also available.

The CWG believes that adoption by the City of AHP or ANP (or another comparable decision support system) is essential in order to eliminate the subjective arbitrariness of the existing RTEF evaluation methodology. The decision-making process should ensure that uncertainties and risks (including worst cases) related to the criteria and sub-criteria for each of the alternatives are identified and incorporated into the analysis.

All major stakeholder groups should have the opportunity to participate in the selection of the alternatives to be compared and in the evaluation process. This includes participation in the prioritization and judgments in regard to each of the sub-criteria and criteria for each of the alternatives. CWG members represent the local community for the EWLRT segment within Toronto. But most of the LRT users will be air travelers and those who work in the Airport Employment Area. These are people who may not live in the community represented by the CWG. The GTAA and area employers are also important stakeholders. Because of the necessarily subjective nature of much of the evaluation, and the need for intimate knowledge of the stakeholder communities to anticipate likely but uncertain outcomes, we strongly recommend that all stakeholder groups be invited to directly participate in the process (e.g., AHP or ANP) of ranking of alternatives and recommendation of a preferred option.

4. Evaluation sub-criteria

Presented below are sub-criteria developed by the CWG for comparative evaluation of different EWLRT configuration options. The sub-criteria are stated in a positive manner, to express what is desirable. Evaluation based on these sub-criteria should consider all affected groups, not just transit users.

4.1. Travel experience

– capacity to ease crowding / congestion; reduce travel times; make travel more reliable, safe and enjoyable

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[5] Thomas L. Saaty, The Analytic Network Process, IJOR **1**(1):1-27 (2008), http://iors.ir/journal/article-1-27-en.pdf.

J.S. Shang, Y. Tjader, and Y. Ding, A Unified Framework for Multicriteria Evaluation of Transportation Projects, IEEE Trans. Eng. Mgmt., **51**(3):300 (2004), http://www.pitt.edu/~yotst1/Home%20Page%20of%20Youxu%20Tjader_files/TjaderIEEEpaper.pdf.

G. Mintesnot and S. Takano, Multi-criteria decision making for public transportation development projects using Analytic Network Process (ANP), J. Eastern Asia Soc. for Transportation Studies, **7**:223 (2007), https://www.jstage.jst.go.jp/article/easts/7/0/7_0_223/_article/-char/en.

Transit users:

- minimizes total trip time when using transit (LRT plus other trip components)
- provides highly reliable service - minimize disruptions from all causes
- provides highly predictable service - schedule, trip time
- ensures minimum variability, uncertainty due to time-of-day, busy days, etc.
- ensures minimum or no impacts related to roads - signals, congestion, accidents, construction, etc.
- minimizes incident impacts, frequencies, durations - weather, construction, road events
- achieves minimum frequency, duration of service outages
- increases options to use alternate transit service(s) during prolonged disruptions within the transit network
- minimizes walking distance from/to stop or to transfer
- minimizes the need/potential for interaction with traffic to access LRT platforms
- provides comfortable access and waiting - all seasons and weather, not exposed to vehicle noise or exhaust
- minimizes acceleration and jerkiness in all three dimensions - makes standing easy
- minimizes number of transfers needed, wait times for complete trip
- enhances transfer capability and facility
- optimizes transit system capacity, minimizes crowding
- enhances enjoyment of surroundings and ambient environment

Others:

- minimizes traffic congestion, intersection delays
- enables many options for route selection
- minimizes vehicle travel distance, trip time
- helps make trip times predictable, less uncertain
- minimizes impacts of weather, construction, road events
- reduces time-of-day variability, uncertainty
- Improves diversity and safety of walking and bicycle routes; minimizes route lengths and intersection delays
- enhances enjoyment of surroundings and the ambient environment

4.2. Travel Choice

– develop an integrated network that connects different modes to provide for more travel options

- enables riders to choose alternate routes in the case of service outages
- reduces the need to transfer
- makes transfers efficient, when required
- enables riders to choose different routes to destination according to personal priorities - comfort, walking, time, etc.

- improves riders' ability to choose time of travel, services with different access, comfort, performance, aesthetic characteristics

4.3. Social equity

– provide everyone good access to work, school and other activities

- produces equitable benefits and impacts for all applicable communities, demographic groups, genders, races, residence types (e.g., apartment, townhouse, detached)
- balances the combination of benefits and impacts for the local community and the extended region
- equitable benefits and impacts for local users and pass-thru users (airport, commuters; LRT users, drivers)
- balances benefits and impacts for those who own / don't own cars
- ensures accessibility by all - seniors, baby strollers, cyclists, people with mobility challenges
- improves ease of movement, goods transport for non-transit users - pedestrians, cyclists, private vehicles, commercial vehicles
- ensures that walking distances to LRT stops or to connecting buses are reasonable for all users
- provides a safe environment and experience that considers LRT users and all others in a balanced manner
- ensures that the service is available, with reasonable frequency, when needed - e.g., shift workers
- creates an environment conducive to increased, safe travel by walking and cycling within, across and through the community - all ages, including people with mobility challenges.

4.4. Shaping the City

– use the transportation network as a tool to shape the residential development of the City

- creates conditions conducive to increased density, diversity (of people, built form, uses), and vitality (all times of day) of communities passed through and served
- improves informal connectivity of communities through which Eglinton Ave. passes – short drives, walking, cycling by residents of all ages to visit friends and relatives and to access schools, parks, library, churches and local commercial and health services
- enhances transit-based connectivity within the Eglinton West corridor
- fosters increased use of transit for commuting to work and travel to Pearson Airport
- maintains flexibility for future transportation uses, land uses, development, community transformation
- supports strategic vision for future transportation, while allowing for uncertainties
- protects and enhances existing greenbelt and green spaces
- minimizes the land area dedicated to transit – concrete, structures, etc.

4.5. Healthy Neighbourhoods

– changes in the transportation network should strengthen and enhance existing neighbourhoods; promote safe walking and cycling within and between neighbourhoods

- minimizes all forms of disruption to existing neighbourhoods
- helps to unify the community, minimizing the disruptive boundary effects of arterial roads
- improves connections by all users to "third spaces" - churches, cafes, clubs, public libraries, parks, etc.
- enhances the visual appeal of the community
- minimizes air pollution, noise, heat island effects
- facilitates drainage, winter plowing, snow and ice removal
- improves the appeal and safety of walking, cycling and driving within, along and across the LRT corridor using the shortest natural routes
- minimizes drivers' use of local roads as an alternative to arterials
- avoids causing drivers to choose longer routes in order to lessen stress and trip times
- facilitates safe access to transit by bicycle – e.g., bicycle lanes where travel on arterials cannot be avoided, bicycle parking at stations
- minimizes the potential for LRT interactions with traffic or for integration of flow controls (turning, signals, etc.) for LRT vehicles and traffic
- minimizes disruption during construction, both local and on the wider transportation network
- minimizes the need for periodic at-grade renovation with corresponding community and traffic disruption
- enhances safety for pedestrians, cyclists, children, students (2 major schools at major intersections), seniors, and users of mobility devices
- enhances street-level conditions during all seasons, all weather
- minimizes weather-related impacts on service and the community - heat, cold, rain, ice, snow, wind, aging, major refurbishment

4.6. Public Health & Environment

– support and enhance natural areas; encourage people to reduce how far they drive

- minimizes noise - LRT vehicles, traffic
- improves air quality
- maintains greenbelt, trees, woodlots, green corridors
- minimizes summer, road-level heat
- no detrimental effects on water absorption, runoff
- preserves / enhances quality of natural areas - Humber River between Jane and Scarlett
- increases use of transit instead of cars, reduces both long and short drives
- reduces production of green-houses gases (GHGs)
- reduces stress of travel for transit users and all users of the roads

4.7. Supports Growth

– investment in public transportation should support economic development; allow workers to get to jobs more easily; allow goods to get to markets more efficiently.

- improves transit utilization through reliability, predictability, speed
- contributes to development of a comprehensive multi-tiered transit network - high-speed rail, commuter rail, subway, LRT, streetcar, busway, bus, community bus, wheel trans
- reduces congestion and improves traffic flow - trucks (goods movement), autos
- makes use of transit viable and attractive for travel to work between Toronto and Mississauga
- ensures flexibility for future growth of transit system and its use
- supports development of and access to Humber, Centennial parks for recreational uses
- supports regional economic development, including in the Airport Employment Area and along the Eglinton West corridor

4.8. Affordable

– improvements to the transportation system should be affordable to build, maintain and operate

- business case analysis examines total societal costs, benefits and risks, including
    - long term implications for all forms of transportation
    - opportunity cost of any reduction of land and flexibility for future development or other changes
    - impacts on the development and value of local communities, consistent with 60 year strategic development expectations, and associated impacts on revenue (taxes) and public expenses
- reduces the risk that major disruptive upgrade or replacement will be required (e.g., Scarborough RT, track replacement due to ravages of freeze-thaw, going underground after first building at-grade)

Appendix A - CWG Members

The CWG members were selected by Councillors Stephen Holyday (Ward 3) and John Campbell (Ward 4) following an open request for participants from within the local community. The selection was guided by transit use, being other-abled, specific skills appropriate to the subject matter, and representation of residents' associations. The CWG members are:

Jim Chapman	
Don Charles	
Janice Charles	
John Disalvo	
Jurij Fedyk	
Martin Green	(Chair, after July 10, 2018)
Joseph Lorincz	
Frank Pallotta	
Phil Poulos	
Margareta Shpir	
Christopher Solecki	
Laila Strazds	(Chair, until July 10, 2018)
Steven Tufts	

One additional person was selected, but attended only one meeting and did not respond when invited to participate in preparation of CWG reports.