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*Moving Forward with Light Rail Transit?
An Analysis of Factors for Success of Light Rail Transit and Implications for Hamilton, Ontario*

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Introduction

Since the 1970s, cities throughout North America have seen a significant increase in urban rail investment (Babilak-Sutcliffe, 2002). The impetus for the investment in hard and soft rail infrastructure is based on the belief that an attractive, efficient alternative to the private automobile must be made available to citizens in order to reverse the negative effects of increased automobile use, such as pollution and congestion, on the urban landscape and urban environment (Kuby et al., 2004; Mackett & Edwards, 1998). More recently, policy documents throughout North America have stated that rail-based transit solutions, light rail transit (LRT) in particular, are the most effective public transportation alternative to reduce the negative effects of private automobile usage (Babilak-Sutcliffe, 2000). As a result of this statement, many local cities and municipalities have begun to consider the implications of introducing an LRT into their existing transportation network (City of Hamilton, 2010; De Bruijn & Veeneman, 2009; Topalovic, 2008).

This paper will begin by describing what constitutes and defines an LRT system. Following this initial definition, the various arguments made in favour of LRT systems and their critiques will be explored. In order to provide a better understanding of what constitutes a “successful” LRT system, this paper will then examine how LRT systems are measured in terms of their success in a particular city.

Based on criteria for measuring the success of an LRT system, this paper will conclude by examining the case of a proposed LRT development in Hamilton, Ontario: the “B-L-A-S-T”

Line (City of Hamilton, 2010 & 2009). After an in-depth analysis of this project, this paper takes the position that while the proposal for an LRT system in Hamilton is justifiable on paper, the maximum benefits associated with LRT developments, and associated success, are not likely to be seen when measured using various LRT planning frameworks.

What is Light Rail Transit (LRT)?

The term “light rail transit” became part of the common vernacular in transportation circles throughout North America around the 1970s and was taken to mean “*any form of urban rail transit that is less costly than the other rail modes being developed*” (Boorse, 2000). While the term was used as early as 1970, a formal definition of LRT was not adopted and placed in the Transportation Research Board’s (TRB) Urban Public Glossary until 1989 (De Bruijn & Veeneman, 2009; Boorse, 2000). The generally accepted definition of LRT today, as outlined in the TRB’s glossary, is:

“A metropolitan electric railway system characterized by its ability to operate single cars or short trains along exclusive rights-of-way at ground level, on aerial structures, in subways or, occasionally, in streets, and to board and discharge passengers at track or car-floor level”

(De Bruijn & Veeneman, 2009; Boorse, 2000).

Characteristically, all LRT systems are composed of three basic elements; however, variability in these elements exists from system to system (Boorse, 2000). All LRT systems have a fleet of cars, or a *rolling stock*, that can be altered to make longer or shorter trains as needed to carry passengers along the route (Boorse, 2000). Next, LRT systems consist of *infrastructure* that allows the train to travel on the street to board and de-board passengers including track ways, stations, maintenance or storage yards, and subsurface infrastructure (Boorse, 2000).

Finally, LRT systems must consist of *fixed equipment* such as an operations centre, power supply infrastructure centre, communications facilities and technological infrastructure such as the internet, for passengers to obtain scheduling information and, finally, road-side infrastructure (Boorse, 2000).

One of the primary reasons for the rise of prominence of LRTs within cities and their subsequent popularity as a preferred transportation option today can be considered to be a result of their flexibility compared to other modes of rapid transportation (Topalovic et al., 2009). This flexibility lies in the fact that LRT can be operated as a traditional tram with a shared right-of-way in outer parts of the city and also as a tram on a separate railroad with segregated or exclusive right-of-way in the city centre (Topalovic et al., 2009). The following section will examine additional reasons for support, aside from their flexibility, for LRT developments in North America.

Arguments in Support of LRT Developments

Historically, planners and politicians have given support for LRT developments over other transit infrastructure development options (Kuby et al., 2004; Babilak-Sutcliffe, 2002; Mackett & Edwards, 1998). Arguments in support of LRT developments can be considered to fall into the following thematic areas: environmental benefits, health benefits, economic benefits, and mobility benefits.

In terms of environmental and health benefits, it is believed that because rapid transit is perceived to be more attractive than bus transit to middle and upper-class commuters, congestion on highways will be reduced and an increased modal share in public transit would be achieved, thereby reducing emissions and providing an overall environmental and health benefit to the

community (Hodgson & Potter, 2010; Lane 2010 & 2008; Litman, 2007; Hansen, 2007). The reduction in emissions resulting from increased transit ridership on LRT lines within a city would provide citizens with improved health (Mackett & Edwards, 1998).

In addition to the reduction in emissions resulting in improved quality of life and lower incidence of respiratory illness, citizens living in a community with an LRT line would see health benefits due to the increased walkability of their neighbourhood (Litman, 2007; Mackett & Edwards, 1998). Research from the public health field suggests that people who live closer to rail transit lines walk more, participate in active transportation more frequently and may enjoy better health than those who live in more suburban, sprawling, style neighbourhoods as a result (Brown & Werner, 2007).

In terms of economic and mobility benefits, those in favour of rapid transit suggest that its implementation would give medium-sized urban centres the chance to create direct links between the inner city, the outlying districts and surrounding population centres thereby improving overall mobility of residents (De Bruijn & Veeneman, 2009; Hansen, 2007; Litman, 2007; Kim et al., 2007). Additionally, because of its permanence, rail transit is believed to increase regional employment, business activity and productivity resulting in an overall revitalization of a city or city centre (Lane, 2008; Litman, 2007; Mackett & Edwards, 1998; Gomez-ibanez, 1985). In other words, business owners tend to place value on the permanence of LRT lines, which entices them to establish retail and other outlets near rail transit stations resulting in an overall economic benefit to the community and possible revitalization of declining downtown business and economic centres (Lane, 2008). Finally, when compared to heavy rail transit systems, LRT is more cost effective, thereby making it an appealing system to implement in a city that only has bus transit (Kim et al., 2007).

Criticisms of LRT Developments

For each of the advantages and reasons given for support of LRT developments, a counterargument can be made (Gomez-ibanez, 1985). Critics of LRT developments suggest that planners and politicians may be acting or thinking irrationally in deciding to choose to build rail transit due to the perceived, and not actual, benefits associated with the permanence of rail transit systems (Lane, 2008). Often, critics of LRT maintain that because of the spatially diverse nature of today's cities, traditional buses and BRT can serve cities better, and more cost-effectively (Pickrell, 1992). Moreover, critics argue that in our current economic downturn, the substantial capital investment associated with LRT developments is difficult to justify (Kim et al., 2007).

One of the most prominent criticisms of LRT developments is that of inaccuracy in projections (Winston & Maheshri, 2007; Pickrell, 1992). Critics argue that ridership forecasting often falls far below projections in actuality and that costs for construction are generally underestimated (Hensher & Golob, 2008; Winston & Maheshri, 2007; Mackett & Edwards, 1998; Pickrell, 1992).

Critics of LRT further argue that there are not enough jobs downtown and residents living along rail corridors to generate substantial ridership (Kuby et al., 2004). Additionally, when LRT systems report ridership gains, critics argue that these are a result of bus route downsizing and not a result of an increase in transit's overall modal share (Pickrell, 1992; Gomez-ibanez, 1985). A resulting conclusion that can be drawn from these criticisms is that LRT developments would not actually do much to curb congestion or automobile emissions because it is not influencing enough automobile users to switch transit modes (Winston & Maheshri, 2007).

A final counterargument against the environmental benefits of LRT is also made by critics. Critics suggest that LRT systems would impart their own negative environmental effects on a community by way of noise pollution and visual intrusion from overhead wires (Mackett & Edwards, 1998). Further, critics point out that supporters of LRT initiatives argue that the systems would improve the environment based on the assumption that car drivers will shift to the new rail system; however, this may not be the case in actuality (Mackett & Edwards, 1998). After considering the various arguments for and against LRT developments, it is important to consider what would make a successful LRT system. The factors for achieving a successful LRT system within a city will now be discussed.

What Makes an LRT System “Good”? Measuring the Success of LRT Systems

It is important for planners and politicians to know what makes LRT systems successful and what hinders their success (Babalik-Sutcliffe, 2002). Given the high costs associated with any rail transit infrastructure project, it should be imperative to ensure that the systems being developed are made to be as successful as possible (Mackett & Babalik-Sutcliffe, 2003).

Babalik-Sutcliffe (2000; 2002) and Mackett and Babalik-Sutcliffe (2003) developed and tested a planning framework that has been proven to accurately predict and analyze the success of urban rail systems in developed and developing countries. This framework analyzes urban rail projects based on a checklist that is divided into six categories: urban factors, transport policies, socioeconomic factors, urban planning policies, planning factors and operating policies (Babalik-Sutcliffe 2000; 2002). One point is awarded for meeting specific criteria described in each category if the factor is present, for up to a total of 32 points (Babalik-Sutcliffe, 2000 & 2002; Mackett & Babalik-Sutcliffe, 2003). Ultimately, LRT systems with higher scores can be

considered to be more successful (Babalik-Sutcliffe, 2000 & 2002; Mackett & Babalik-Sutcliffe, 2003). This framework is limited in that it has a high degree of subjectivity; however, if the process of analyzing the LRT system remains transparent and structured, the results can be considered to hold validity in the community under which they are applied (Mackett & Babalik-Sutcliffe, 2003).

In addition to the planning framework developed by Babalik-Sutcliffe (2000 & 2002), Giuliano and Agarwal (2010) present criteria necessary for public transit systems to have positive impacts and influence on local land use within a city. These factors are as follows: the public transit system must offer a substantial improvement in accessibility, the existing transit network is heavily congested, the area is experiencing growth, and supportive land use and transport policies exist within the corridor (Giuliano & Agarwal, 2010).

Arguably, if too many of these criteria outlined by Babalik-Sutcliffe (2000 & 2002) and Giuliano & Agarwal (2010) are missing, then the transit system may not enjoy the desired levels of success within the city. The next section examines these “success frameworks” in a case study for a proposed LRT development in Hamilton, Ontario.

Hamilton, Ontario: Case Study

Hamilton, Ontario has historical roots as an electric, industrial and transportation-oriented city (Topalovic et al., 2008). The City believes that, as a result of this history, it is a region that is well suited for the implementation of rapid transit technology (Topalovic et al., 2008). The idea of such a major transportation infrastructure project in the City of Hamilton began in June 2007, when the Province of Ontario released their MoveOntario Plan (Topalovic et al., 2008). This plan outlines two corridors within the City of Hamilton as areas that should be seriously

considered for the implementation of an LRT system within the next 15 years (Topalovic et al., 2008).

Development of light rail transit in Hamilton, Ontario is seen by some as the “*key to fulfilling the city’s vision of being the best place to raise a child, promote innovation, engage citizens and provide diverse economic opportunities*” (City of Hamilton, 2010). The proposed project, with a price tag of around \$800 million (2008 dollars), has the potential to be the largest capital project the City has ever constructed (City of Hamilton, 2009). Additionally, the LRT project is presently viewed as a catalyst for shaping and revitalizing the City in general as well as particular “priority” communities within the City (City of Hamilton, 2010).

The provision of rapid transit is seen as a key component to meeting the City’s long-term goals, including Hamilton’s vision statement, corporate strategic plan, public works business plan, and planning’s new official plan (City of Hamilton, 2010). Additionally, with an anticipated population growth of 660,000 by the year 2031, the City feels that an LRT system would be the *only* means of transportation that could support the population growth on an already strained and out-dated road network and alleviate the associated congestion (City of Hamilton, 2009).

The City of Hamilton currently envisions the LRT initiative as a cure all for the City’s many perceived and real problems, maintaining that the introduction of LRT to the community will undoubtedly, and without argument, improve any and all aspects of life in Hamilton from decreasing congestion, improving the overall health of citizens, stimulating the economy, spurring economic growth and revitalization in the downtown, and increasing the quality of life of the most vulnerable members of the population (City of Hamilton, 2010; Topalovic et al.,

2008). In this regard, the justification for the project goes well beyond the scope of transportation planning. Further, the project is currently justified under the notion that implementation of an LRT line will meet the City's Vision 2020 standards as well as the Transportation Master Plan goals (City of Hamilton, 2010). However, it remains to be seen if, and how, the other intended synergistic results of the system will be realized and, as such, the justifications for the project seem unrealistic.

In applying Babalik-Sutcliffe's (2000 & 2002) framework for measuring the success of LRT systems and Giuliano & Agarwal's (2010) criteria for rail transit to influence land use, it becomes evident that the implementation of an LRT system within the City of Hamilton may not be a wise investment and therefore would not likely be the catalyst for change the developers intend for it to be. After analyzing and tabulating the scores for the various indicators (**See Appendix 1, Tables 1-7**), the results show that only 17 out of the 32 indicators for success are present within the city, giving it a 53% "success rating". Further, only two of Giuliano & Agarwal's (2010) five criteria appear to be present within the Hamilton LRT context (**See Appendix 2, Table 8**). These results imply that the City is currently lacking the basic criteria necessary to influence any substantial change through an investment in an LRT line. Based on this analysis, it would not be advisable for the City to move forward with an LRT development. Following, some of the more interesting findings related to the analysis and subsequent decision to advise against the LRT development in Hamilton are presented (See tables in Appendix 1 & 2 for a complete list of the findings).

Of particular interest in this analysis is the finding that the proposed corridors for Hamilton's LRT initiative exist within an area of relatively high social need (City of Hamilton, 2010; Topalovic et al., 2008). If the aim of the project is to reduce congestion and increase

transit's modal share within the community, targeting the new LRT system at people of lower socioeconomic status, who likely already use the bus transit system, will not achieve this goal (Lane, 2008; Winston & Maheshri, 2007; Kuby et al., 2004; Denat-Boemont & Mills, 1999).

In addition, the literature implies that an increase or improvement in accessibility is a necessary prerequisite for the success of an LRT system (Giuliano & Agarwal, 2010; Babalik-Sutcliffe, 2000 & 2002; Mackett & Babalik-Sutcliffe, 2003). Upon closer examination of the Hamilton case, it becomes apparent that the LRT system would not be improving accessibility beyond that which already exists. This is due to the fact that the proposed LRT network will be replacing several regular public transit lines, in addition to the BRT service that already runs through the corridor. As such, it could be concluded that undertaking this development would be a fiscal waste as it would not be adding any more value than currently exists.

Finally, in examining current bus transit usage in the city, results show that only 7% of Hamiltonians use the existing bus system on a daily basis (IBI Group, 2010). The literature indicates that cities that choose to build LRT systems and see subsequent success of these systems already have high ridership on traditional bus transit (Lane, 2008). Given that such a small portion of the population is currently using the bus transit, and that the development of the LRT system is proposed along a corridor comprised of citizens with high social need and low socioeconomic status, it is unlikely that the LRT system would garner any additional riders (Giuliano & Agarwal, 2010; Lane, 2008; Kuby et al., 2004). Instead, it would be competing with bus transit for the same pool of riders, or would be achieving an increase in riders on the LRT line due to a reduction in traditional bus transit routes (Lane, 2008). In this regard, the success of the LRT system based on ridership estimates may only be perceived and not actual.

Conclusion

This paper has examined the various arguments in support for, and criticisms of, LRT developments within North American cities and found that LRT systems have the possibility to reduce congestion and provide environmental, economic, and health benefits to a community when they are successful (Lane, 2008; Hansen, 2007; Kim et al., 2007; Litman, 2007; Mackett & Edwards, 1998). However, each of the benefits and reasons for support of an LRT system must contend against a myriad of criticisms based on the notion that primary benefits will not be seen unless, or until, a majority of the population gives up dependence on the private automobile in favour of attractive and efficient public transit options (Hensher & Golob, 2008; Winston & Maheshri, 2007; Pickrell, 1992; Gomez-ibanez, 1985).

Factors and indicators for the success of an LRT system have been outlined throughout this paper and examined to reveal that the maximum benefits of an LRT project may not be realized if cities and municipalities act too hastily and invest too much confidence in the potential success of the project (Lane, 2008; Kuby et al., 2004). Ultimately, investment in rail transit can be seen as worthwhile if the initiative reflects the will of the citizens, the decision to move forward with the development is made in a rationally way, and if the municipality is willing to bear the cost (Lane, 2008; Kuby et al., 2004).

Overall, based on the analysis presented for the case of an LRT development in Hamilton, Ontario, it is a recommendation of this report that the City refrain from investing in LRT. Instead, the City should continue with its current traditional bus and BRT routes, as the LRT line would not provide any additional accessibility within the city or increase transit's overall modal share beyond that which the current transit system is capturing.

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from Babalik-Sutcliffe (2000)

Table 1: Analysis of Urban Factors that Determine LRT Success

URBAN FACTORS			Comments
	Present	Absent	
The CBD is economically vital		X	<ul style="list-style-type: none"> • At present, the city's CBD is not economically vital. It is believed that the LRT system will "revitalize" the city (City of Hamilton, 2009 & 2010; Topalovic et al., 2008) • Revitalization of the CBD is one of the reasons the City is advocating for an LRT system
Office/ retail located at CBD or at other centres which the system serves	X		<ul style="list-style-type: none"> • Although offices and retail outlets are present in the CBD, the CBD is not currently economically vital (Topalovic et al., 2008) • Many office buildings are closed, or not at full capacity (Topalovic et al., 2008)
Residential Density in the city is high		X	<ul style="list-style-type: none"> • Research suggests that the city is experiencing growth in the suburban neighbourhoods (City of Hamilton, 2010; Topalovic et al., 2008) • Higher density neighbourhoods exist near the city centre (e.g. Corktown, Durand, and Riverdale) and are well connected to transit; however, the expected growth for the city is not anticipated to occur in these areas (Social Planning and Research Council of Hamilton (SPRCH), 2011; Topalovic et al., 2008) • Overall density is currently ~450 persons per km² (City of Hamilton, 2010) • Population is currently ~520,000, while the projected population by 2031 is ~660,000 (City of Hamilton, 2010; Topalovic et al., 2008)
City has developed along radial corridors	X		<ul style="list-style-type: none"> • Although the city has developed along radial corridors, the LRT proposal calls for changes from a radial transportation pattern to a more grid-like pattern that would be compatible to contemporary automobile patterns (Topalovic et al., 2009)
SUBTOTAL	2	2	

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from Babalik-Sutcliffe (2000)

Table 2: Analysis of Transport Policies that Determine LRT Success

TRANSPORT POLICIES			
	Present	Absent	Comments
Buses are integrated into the rail system	X		<ul style="list-style-type: none"> • Reports indicate that integration between the current HSR system and the proposed "B-L-A-S-T" LRT system will occur (City of Hamilton, 2010; Topalovic et al., 2008)
Car parking facilities are provided at stations	-	-	<ul style="list-style-type: none"> • N/A • A report has recommended that parking facilities be provided at stations if the project moves forward; however, it is unknown at this time if it will be implemented (IBI Group, 2010)
Car parking in city centre is restricted	X		<ul style="list-style-type: none"> • Parking in the city is expensive, limited and restricted (City of Hamilton, 2010; Topalovic et al., 2008)
SUBTOTAL	2	0	

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from Babalik-Sutcliffe (2000)

Table 3: Analysis of Socioeconomic Factors that Determine LRT Success

SOCIOECONOMIC FACTORS			Present	Absent	Comments
Project has high local support	X			<ul style="list-style-type: none"> • There has been vast stakeholder involvement and consultation in the planning process to date (Stephen et al., 2011; Topalovic et al., 2008) 	
Public transport modes are considered safe	X			<ul style="list-style-type: none"> • In general, the current bus system (the Hamilton Street Railway, or HSR) is operated in a "safe and efficient manner consistent with similar cities" (IBI Group, 2010) 	
Public transport usage is high		X		<ul style="list-style-type: none"> • Approximately 7% of Hamilton's population currently uses the HSR bus system daily (IBI Group, 2010) • The HSR currently has a significantly lower ridership per capita than would be expected of a system servicing an area with Hamilton's population density (IBI Group, 2010) 	
System serves high-income AND is on a corridor with high public transport usage				<ul style="list-style-type: none"> • The proposed corridors, particularly the B-Line, cover areas of relatively high social need within the city (City of Hamilton, 2010; Topalovic, 2008) • Fares will be "comparable to the cost to ride transit" (City of Hamilton, 2009) • Seamless transfer from LRT to regular bus system is guaranteed (City of Hamilton, 2009) 	
OR: System serves low-income areas AND bus fares can be controlled	X				
SUBTOTAL	3		1		

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from *Babalik-Sutcliffe (2000)*

Table 4: Analysis of Urban Planning Policies that Determine LRT Success

URBAN PLANNING POLICIES		Present	Absent	Comments
Municipalities adapted their plans to the system	X			<ul style="list-style-type: none"> City of Hamilton plans currently are calling for LRT (Stephen et al., 2011)
TOD incentives are offered at station areas	X			<ul style="list-style-type: none"> Development charges, density bonuses, and exemptions are proposed (Stephen et al., 2011) City is working on amending their zoning regulations to allow for mixed use (Stephen et al., 2011)
Joint development projects are introduced	-		-	<ul style="list-style-type: none"> N/A
New public buildings are located at stations	-		-	<ul style="list-style-type: none"> N/A New buildings are proposed and consultations with businesses to relocate along the proposed corridors have been held (City of Hamilton, 2010)
City centre streets are pedestrianized			X	<ul style="list-style-type: none"> Currently the city centre streets are not pedestrian-friendly (Stephen et al., 2011) There is a proposal for the city to improve the pedestrian realm in the city centre along with LRT implementation, but not until it is implemented (Stephen et al., 2011)
There are redevelopment projects in the city centre	X			<ul style="list-style-type: none"> The City is doing some work on downtown revitalization projects (City of Hamilton, 2010)
There are renewal projects in declining sites	X			<ul style="list-style-type: none"> The City is working on renewal of some areas of the downtown (City of Hamilton, 2010)
SUBTOTAL	4		1	

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from Babalik-Sutcliffe (2000)

Table 5: Analysis of Planning Factors for Determining LRT Success

PLANNING FACTORS			Comments
	Present	Absent	
Planning of the system is integrated into regional plans	X		<ul style="list-style-type: none"> The system has been integrated into, and considered a major component of, the City's transportation master plan, official plan, and vision 2020 statement (City of Hamilton, 2010) Additionally, the creation of the system has been integrated into the province's long-term transportation plan as well as the surrounding municipal transportation plans (City of Hamilton, 2010 Topalovic et al., 2008)
Planning of the system is integrated with other urban projects		X	<ul style="list-style-type: none"> Other urban projects depend on the system (City of Hamilton, 2010; Topalovic et al., 2008)
Stations are integrated with activity centres	-	-	<ul style="list-style-type: none"> N/A Currently, this item cannot be measured because the system has not yet been built The current HSR system has stations integrated with activity centres, such as the Limeridge Mall, Eastgate Square, the Meadowlands Power Centre, and Hamilton Downtown (IBI Group, 2010; City of Hamilton, 2009)
System creates a significant improvement in accessibility		X	<ul style="list-style-type: none"> The LRT system will be replacing existing bus stations and therefore will not be making any improvements on accessibility The proposed "B-L-A-S-T" LRT network will be replacing several regular public transit lines, in addition to express bus services and BRT. Giuliano & Agarwal (2010) indicate that this type of system would therefore not increase accessibility

Appendix 1

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from Babalik-Sutcliffe (2000)

System is located along a developed corridor	X		<ul style="list-style-type: none"> B-line is located along a developed corridor, serving the university population as well as those living in outer suburbs (City of Hamilton, 2010; Topalovic et al., 2008)
Corridor does not serve declining areas	-		<ul style="list-style-type: none"> N/A Unknown
Corridor is compatible with growth trends	X		<ul style="list-style-type: none"> Approximately 17% of Hamilton's population and 20% of Hamilton's employment are located within 800 metres of the proposed LRT lines (City of Hamilton, 2010 & 2009)
System is inexpensive		X	<ul style="list-style-type: none"> The anticipated cost for the project is estimated to be around \$800 Million (in 2008 dollars) (Stephen et al., 2011; Topalovic et al., 2008)
OR: Expensive but area is very suitable			<ul style="list-style-type: none"> Reports indicate that the area may not be suitable for LRT given that the escarpment (aka "Hamilton Mountain") is steeper than traditional LRT trams would be able to climb (Topalovic et al., 2009)
SUBTOTAL	3	3	

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from Babalik-Sutcliffe (2000)

Table 6: Analysis of Operating Policies for Determining LRT Success

OPERATING POLICIES			Comments
	Present	Absent	
The urban rail services is very frequent	X		<ul style="list-style-type: none"> The current bus system in the city runs on 15 minute headways and is generally considered to have frequent service (IBI Group, 2010)
There are travel cards	-	-	<ul style="list-style-type: none"> N/A
There are free transfers between buses and rail	X		<ul style="list-style-type: none"> If the project is realized, free and seamless transfers between buses and rail transit are guaranteed (City of Hamilton, 2010; Topalovic et al., 2008)
There are offers for free travel	X		<ul style="list-style-type: none"> The city currently offers a U-Pass system for students at McMaster University and Mohawk College allowing them free use of the bus (IBI Group, 2010) Senior and Low Income passes are also offered (IBI Group, 2010) It is assumed that these will be carried forward if the LRT is implemented in the City
There are marketing and advertising	-	-	<ul style="list-style-type: none"> N/A Current buses use advertising The HSR itself as a company lacks a marketing/ branding scheme (IBI Group, 2010)
There are security staff on board and at stations	-	-	<ul style="list-style-type: none"> N/A
SUBTOTAL	3	0	

OPERATING POLICIES

Note: at present, some of these categories are not applicable because the project has not yet begun or is in its infancy. As such, scores cannot be given for all. Where possible, comparisons have been made between the current HSR bus system and applied to the proposed LRT system

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from Babalik-Sutcliffe (2000)

Table 7: Hamilton, Ontario- LRT Success Evaluation Tabulations

	Present	Absent	N/A
Urban Factors	2	2	0
Transport Policies	2	0	1
Socioeconomic Factors	3	1	0
Urban Planning Policies	4	1	2
Planning Factors	3	3	2
Operating Policies	3	0	3
TOTAL	17	7	8
% Success	53%		

EVALUATING THE SUCCESS OF HAMILTON, ONTARIO'S PROPOSED LRT PROJECT
Adapted from Giuliano & Agarwal (2010)

Table 8: Evaluating Potential for LRT to Have Positive Impacts in Hamilton, Ontario

	YES	NO	COMMENTS
Existing transportation network is heavily congested		X	<ul style="list-style-type: none"> Currently, there is not an immense problem of congestion within the City; however, the City anticipates congestion to become a problem in the future as the population grows (City of Hamilton, 2009; Topalovic et al., 2008)
Offers improvement in accessibility		X	<ul style="list-style-type: none"> The LRT system will be replacing existing bus stations and therefore will not be making any improvements on accessibility The proposed "B-L-A-S-T" LRT network will be replacing several regular public transit lines, in addition to express bus services and BRT
Area is experiencing growth	X		<ul style="list-style-type: none"> Current population: ~520,000; projected population by 2031: ~660,000 (City of Hamilton, 2010 & 2009; Topalovic et al., 2008) Growth is primarily occurring in suburban neighbourhoods (City of Hamilton, 2010; Topalovic et al., 2008)
Area has significant growth and development potential		X	<ul style="list-style-type: none"> The City is currently facing economic and employment issues due to the closing of manufacturing plants (City of Hamilton, 2010; Topalovic et al., 2008) Businesses are leaving the City Centre (City of Hamilton, 2010; Topalovic, 2008) In terms of employment and development, the City has plans to renovate the Hamilton Tiger Cats Football stadium and is hosting a portion of the 2015 PanAm Games (City of Hamilton, 2010)
Supportive land use and transport policies exist	X		<ul style="list-style-type: none"> Development charges, density bonuses, and exemptions are proposed (Stephen et al., 2011) City is working on amending their zoning regulations to allow for mixed use (Stephen et al., 2011)
TOTAL	2	3	

WORKS CITED

- Babalik Sutcliffe, E. (2000). Urban Rail Systems: A Planning Framework to Increase their Success. *Doctoral Thesis, University of London* .
- Babalik-Sutcliffe, E. (2002). Urban Rail Systems: Analysis of the Factors Behind Success. *Transport Reviews* , 22 (4), 415-447.
- Boorse, Jack W. (2000). This is Light Rail Transit. *Transportation Research Board* .
- Brown, Barbara B. and Werner, Carol M. (2007). A New Rail Stop: Tracking Moderate Physical Activity Bouts and Ridership. *American Journal of Preventive Medicine* .
- City of Hamilton. (2009). *LRT Functional Planning Analysis: B-Line Corridor*. Hamilton: City of Hamilton.
- City of Hamilton. (2010). *Moving Hamilton Forward with LRT: Funding Proposal*. Hamilton.
- De Bruijn, Hans, and Veeneman, Wijnand. (2009). Decision-making for Light Rail. *Transportation Research Part A* , 43, 349-359.
- Denant-Boemont, Laurent and Mills, Gordon. (1999). Urban Light Rail: Intermodal Competition or Coordination? *Transport Reviews* , 19 (3), 241-253.
- Giuliano, Genevieve and Agarwal, Ajay. (2010). Public Transit as a Metropolitan Growth and Development Strategy. In N. Pindus, & H. a. Wial, *Urban and Regional Policy and its Effects, Vol 3* (pp. 205-253). Washington, D.C.: The Brookings Institution.
- Gomez-ibanez, Jose A. (1985). A Dark Side to Light Rail? The Experience of Three New Transit Systems. *Journal of the American Planning Association* , 51 (3), 337-351.

- Hansen, Brett. (2007). Light-Rail Projects Provide Options, Help Manage Growth. *Civil Engineering* , 20-22.
- Hensher, David A. and Golob, Thomas F. (2008). Bus Rapid Transit Systems: A Comparative Assessment. *Transportation* , 35, 501-518.
- Hodgson, Paul and Potter, Stephen. (2010). Refining Light Rapid Transit Typology: A UK Perspective. *Transportation Planning and Technology* , 33 (4), 367-384.
- IBI Group. (2010). *Hamilton Street Railway Operational Review*. Hamilton: City of Hamilton.
- Kim, Sungyop; Ulfarsson, Gudmundur F. and Hennessey, Todd J. (2007). Analysis of Light Rail Rider Travel Behavior: Impacts of Individual, Built Environment, and Crime Characteristics on Transit Access. *Transportation Research Part A* , 41, 511-522.
- Kuby, Michael; Barranda, Anthony, and Upchurch, Christopher. (2004). Factors Influencing Light-Rail Station Boardings in the United States. *Transportation Research Part A* , 38, 223-247.
- Lane, Bradley W. (2008). Significant Characteristics of the Urban Rail Renaissance in the United States: A Discriminant Analysis. *Transportation Research Part A* , 42, 279-295.
- Lane, Bradley W. (2010). The Relationship Between Recent Gasoline Price Fluctuations and Transit Ridership in Major US Cities. *Journal of Transport Geography* , 18, 214-225.
- Litman, T. (2007). Evaluating Rail Transit Benefits: A Comment. *Transport Policy* , 14, 94-97.
- Mackett, Roger and Babalik-Sutcliffe Ela. (2003). New Urban Rail Systems: A Policy-Based Technique to Make them More Successful. *Journal of Transport Geography* , 11, 151-164.

- Mackett, Roger L. and Edwards, Marion. (1998). The Impact of New Urban Public Transportation Systems: Will the Expectations be Met? *Transportation Research A: Policy and Practice* , 32 (4), 231-245.
- Pickrell, Don H. (1992). A Desire Named Streetcar. *Journal of the American Planning Association* , 58 (2), 158-171.
- Social Planning and Research Council of Hamilton (SPRCH). (2011). *Hamilton's Social Landscape*. Hamilton: Social Planning and Research Council of Hamilton.
- Stephen, Jillian; Readman, Justin; Lee-Morrison, Christine and Curtis, Ashley. (2011). *City Shaping Light Rail Transit: The Hamilton, Ontario Project and Lessons for Other North American Cities*. Edmonton: Paper Presented at the Success in Integrating Sustainable Transportation and Land Use Session at the Conference of the Transportation Association of Canada.
- Topalovic, P.; Tobey, D. and Lotimer, L. (2008). *Community Impact and Economic Analysis of Light Rail Transit*. Hamilton: City of Hamilton.
- Topalovic, Peter.; Lottimer, Leslea. and Pepito, Mary-Kaye. (2009). *Light Rail Technology Analysis*. Hamilton: City of Hamilton Public Works.
- Winston, Clifford and Maheshri, Vikram. (2007). On the Social Desirability of Urban Rail Transit systems. *Journal of Urban Economics* , 62, 362-382.

