Centre City: Economic Analysis

Contents

Executive Summary

This report researched existing elevated, at-grade, and tunnelled transit systems in order to pinpoint the extent in which these factors become liabilities to building owners. The sources are principally professional and academic research papers as well as environmental impact analyses performed for light rail investments in Los Angeles and Minneapolis. The economics team augmented this information with interviews with commercial real estate brokers in major cities where existing transit systems travel through higher density commercial centres. Hatch's findings are the following:

- Units that experience noise and light nuisance *still* go up in price significantly from their pre-rail levels.
- Nuisance effect has a fairly small radius. Ninety five percent of all noise effects disappear within 30 meters of the source.[1]
- Affected offices immediately in front of elevated rail lines can rent between 3 – 5% lower than comparable listings. Those negative impacts from rail projects are confined to the few floors next to the elevated rail structure and the retail projects immediately below it. The rest of the building is generally unaffected by noise or shade.
- Retail listings *under* the elevated rail structure can rent 4 – 15% lower than other units in the same block or building.
- Value depreciation only occurs in older building stock. Newly built buildings are generally unaffected since they are equipped with the necessary insulation and double pane windows or necessary lighting.
- Elevated rail has no effect on vacancy rates. Indeed, rent decrease makes the corridor exhibit vacancy rates lower than the regional median, even in soft markets.
- The cumulative effect of the Green Line elevated Centre City alignment option is a loss between $100 and $160 million of the existing office, retail and condominium stock in the corridor. This is loss of 4.5% - 6.9% of the affected floors or 0.9% – 1.4% of the entire building stock of all the properties in the corridor.
- In context, a loss of 4.5% - 6.9% of property is the drop equivalent to that which occurred to the median property value in Calgary during the 2008 economic crisis.[2]

1. Overall Findings

The report summarizes the variance in property value impacts of different downtown Green Line alignment options. Specifically, the alternatives analysis evaluated how elevated, at-grade, and tunnelled alignment options would impact downtown area property values, which have corresponding impact to property tax revenue.

[1] Kilpatrick, John *The Impact of Transit Corridors on Residential Property Values* JERE Vol 29 No 3:

http://www.reconnectingamerica.org/assets/Uploads/Impact-of-Residential-Prop-Values.pdf

[2] Calgary Statistical Data: http://www.calgary.ca/CA/fs/Pages/Property-Tax/Statistical-Data/Median-Residential-Property-Tax.aspx

While significant evidence demonstrates light rail contributes positively to nearby office and retail property values, the impact is not evenly distributed and depends on the rail configuration and its interface with surrounding buildings. In other words, some buildings could be negatively impacted by the operations of a light rail line, especially under the elevated scenario. The following factors were the principal concerns to owners of buildings adjacent to elevated rail transit:

- Noise pollution caused by the operation of the LRT especially in the 2nd and 3rd levels of the building.
- Obstruction of natural light to ground level retail, especially in places with cold and prolonged winter seasons.
- Echo of car noise bouncing from the bottom of the elevated train structure.
- The noise and traffic impact during construction of the light rail line.

1.1 Aggregate Property Value Impacts by Alignment Alternative

The property value impact analysis found a marginal impact to retail and office buildings immediately facing or beneath an elevated rail system. The impact was specifically identified for the elevated alignment. However, in each case, the overall benefit of the light rail system provided a net contribution to station area property values.

At-Grade and Tunnelled Systems. The analysis could not identify any negative property value impacts or discounts to adjacent commercial properties near at-grade or tunnelled systems.

Elevated Alignment Option. Under the elevated alignment option, directly adjacent buildings on floors four and below are discounted to estimate the conservative depreciation effects associated with the additional noise and shadowing.

At a 5% depreciation effect of office space and a 15% depreciation effect of retail space, the elevated alternative would reduce the overall property value lift benefits.[3] Due to the limitations of the parcel information to date, the impact estimate cannot isolate specifically for those floors directly impacted by the elevated system. Thus, the impact estimate expressed herein is a very conservative impact estimate of the potential depreciation effects of shadowing and noise of the light rail line.

[3] Property assessor records do not have the precise floor area of each building or the assessed value for each floor. As a result, Hatch applied each floor's proportional share of the total appraised value based on the total height of the building. For example, a 10-story office building assessed $10 Million would see $4 Million of its assessed value impacted, or approximately $1 Million per floor. Note that this is a conservative estimate as typically lower floors without view premiums are worth less than higher floors.

1.2 Conclusion

Preliminary information to date indicates marginal property value impacts to those floors directly facing or under an elevated system. Based on precedent analysis, the extent of the impact is conservatively 3% to 5% for the office floors directly facing an elevated line, 4% to 15% to those retail establishments below the elevated systems and 20% for residential properties within a 30 metre radius.

In the context of Downton Calgary this can mean a loss of up to $160 million in property values along the corridor. This loss is not primarily incurred by office properties since the portion of office towers above the elevated railway remains unaffected. The main subject of this loss are the retail storefronts along the corridor. A loss of $160 million represents a net change of 1.5% on the entire building stock of the corridor, an insignificant rate given Calgary's average yearly median property value growth of 3%. However, the loss is not evenly distributed among the entire corridor.

A decrease of $160 million means that the most susceptible retail properties along the corridor can decrease by up to 10% of their value. This shift in value signifies a transformative shift in revenue and the type of tenant that currently occupies retail real estate along 2nd street. In a 30-year timeframe this means a reduction in property tax of $680 million in present value terms.

1.3 Overall Methodology

The overall positive contribution of light rail to surrounding properties make it difficult to isolate specifically for the negative externalities associated with shadowing and noise of an elevated system. Research focusing on the property values along new rail projects notes some negative impacts, but uniformly report net positive impacts. A meta-analysis that compiles 41 studies of rail projects in North America finds an average increase of 10% across all studies.[4]

However, there is some evidence from existing light and heavy rail systems which inform the potential of suppressing property value benefits, specifically in elevated rail configurations. While properties generally served by the light rail gain in value, those properties immediately adjacent to the line can be impacted negatively. Those negative externalities associated with the noise and shadowing of the systems are quickly muted outside of 50 metres of the rail line (See *Figure 1: Impact of Transit on Property Values*).

[4] Hazel, George, International Practicum on Innovative Transit Funding and Financing: https://www.apta.com/mc/internationalpracticum/previous/2014/presentations/Pres entations/George%20Hazel.pdf

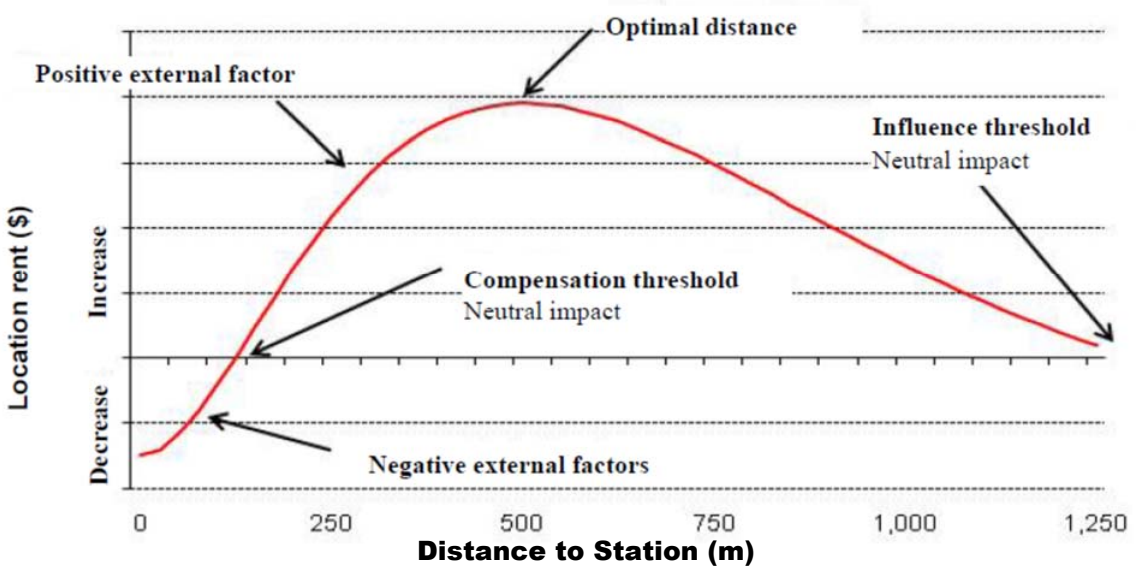

Figure 1: Impact of Transit on Property Values

Source: George Hazel Constancy

The economic analysis discussed herein applied two standard approaches to understand the potential negative effects of different light rail configurations.

1. A review of existing published reports that analyzed the negative consequences to adjacent property of existing light rail systems specific to noise and/or shadowing of the rail line. Of particular focus was how these impacts vary by configuration (i.e. elevated, at-grade, and tunnelled). In order to single out the impact on property values immediately adjacent to the Green Line, Hatch reviewed existing research performed to date that outline value capture strategies associated with the construction of rail projects. Additionally, the analysis reviewed academic articles, outlining both the economic and the acoustic impacts of elevated rail and vehicular structures.

2. A survey of available commercial buildings along existing transit systems to understand any rent or occupancy discounts associated with direct proximity to the rail line. The case study analysis evaluated impacts from Chicago, Vancouver, Seattle, and Los Angeles transit systems. The light rail lines all had elevated and tunnelled segments. The survey included speaking directly to commercial real estate brokers to ascertain their impressions of any market barriers to renting space directly adjacent or below a rail corridor. In each city, Hatch contacted multiple commercial brokers representing properties along and near the rail lines. By comparing nearby properties in the same real estate market, the analysis can isolate more for the specific condition of directly facing or below the rail line.

The analysis then applies the rent differential findings to the commercial real estate that would directly front the Green Line corridor in Downtown Calgary along 2 Street SW. This approach applies an even distribution of each building's assessed value to each floor and proportionally assigns the negative impact to those floors directly impacted.

1.4 Major Assumptions

The alternatives analysis applies a number of assumptions to arrive at its estimates.

1. The range of rent suppression found in Seattle, Vancouver, and Chicago can be applied to commercial property in Calgary. Note that this is generally conservative because the three systems are heavy rail lines which tend to be louder than a light rail system. The Chicago elevated system specifically is an older design with limited consideration for noise, vibration, and shadowing externalities. The inclusion of elevated vehicular structures was necessary given that it is a much more studied phenomenon and it would naturally create conservative projections given that literature shows that noise pollution caused by an LRT system is often dwarfed by the noise pollution by traffic congestion. Indeed there is significant data that noise pollution caused by cars can reduce property values by up to 50% more than rail.[5]

2. The assessed value of the affected buildings along 2 Street SW proportionally to estimate the potential property value suppression impacts. This is also a conservative assumption as typically higher floors command high rent premiums due to increased views and have more leasable square feet per floor.[6] It also assumes that all office buildings facing an elevated rail line have not installed mitigation measures (i.e. double pane windows) to address the noise of the Green Line.

3. The property value impact to surrounding buildings is immediate upon operation. This assumes rents immediately adjust in response to additional noise and shadowing under the elevated alignment option. Conversely, the property value lift estimates in the business case analysis assumes a gradual gain in property premiums associated with access to the Green Line.

4. Office properties are assessed based on their historic 10-year average value rather than current assessed value to account for a full economic cycle. In other words, the analysis moderates the current depressed rents with office rents realized during the economic boom.

5. The model does not assume any rebalancing of the real estate market where depreciation of assets directly affected by the line results in appreciation of buildings nearby as demand shifts towards those building receiving both the utility of the light rail line with fewer negative externalities.

2. Relevant Case Studies

The following describes the findings from the case studies for Seattle, Vancouver, Chicago, and Los Angeles. These systems were considered because they incorporate elevated lines in commercial centres. Each has their own unique characteristics that make it a useful comparison. While none directly align with Calgary's proposed Green Line alternatives but the externalities can inform different market dynamics pertinent to Calgary.

[5] Walker, Jay *Silence is Golden: Railroad Noise Pollution and Property Values* Niagara University 2016

[6] Lower floors often include lobby, security, and mechanical space which is typically non-leasable area.

2.1.1 Seattle, Washington (Downtown Monorail)

Seattle Monorail is a the most salient case study included given that it is one of the few elevated light rail systems in North America that stays above ground while moving through the densest downtown area of a major city. Additionally, given its design of only 1.5 km in length with one stop at either end, it does not serve a large part of the Seattle metropolitan area. Therefore the adjacent properties receive negative effects of an elevated rail without any significant benefits of additional transit service. This makes it a natural experiment that isolates the negative aspects of elevated rail in a downtown setting.

Figure 2: Seattle Monorail 5th Avenue Downtown Seattle Source: Wikicommons

One key difference between the Seattle Monorail and the other light rail systems utilized in this report is the relatively narrow section utilized in its construction. This section, using single narrow columns through the middle of 5th avenue and leaves open space between the two tracks. These measures slightly reduce the darkness and echo at ground level. Additionally, the single rail design of its cars makes it the quietest rail system among these case studies.

While the effects of the rail were mitigated through design of the section and the transportation equipment, interviews with local brokers showed a clear difference between their properties immediately in front of the monorail and similar properties in in the parallel streets. While none of the brokers were willing to set a monetary value to the monorails effects those leasing ground level retail suggested a 5% discount. The chief reasons for this value decrease was not lack for demand for the spaces, but rather the type of tenants attracted to the spaces immediately underneath the rail.

A cursory analysis of the monorail corridor confirms that indeed, 5th Avenue contains less restaurants and coffee shops with outdoor seating than 4th and 3rd avenue. Multiple brokers mentioned the necessity to be “creative” when it came to finding tenants for storefronts along 5th avenue. Some examples of these tenants were: galleries, cross-fit gyms, or artists’ studios. One broker attributed the slightly depreciated rents to lower vacancy in 5th avenue during market downturn.

Figure 3: 2127 5th Ave Source: EHI Real Estate Advisors

Data seems to confirm this slight permanent deflation on properties on 5th avenue. Property in front of the monorail rented for roughly 4% below comparable stock and ground level retail for 10% below their counterparts. These numbers come from a small set of observations and must consider cautiously. Additionally, the median for the small dataset gathered is the same for both uses, suggesting that depreciation due to monorail proximity happens at the margins of the market.

Two significant exceptions to the rule are the 5th and Bell building built in 2012 and Westlake Tower finished in 2002. Both buildings were completed during a market downturn and both found tenants that paid market rate prices within a year. Indeed, the monorail proximity appears prominently in marketing material for both the buildings. Neither brokers for 5th and Bell, or the Westlake Tower, find that the spaces near the monorail lease at a discount compared with either spaces in the same floor and building or in similar buildings.

Both 5th and Bell and Westlake Tower suggest that both design and construction alterations can mitigate value decrease caused by elevated rail externalities.

Figure 4: 5th and Bell Building Source: Hines Properties Properties

Figure 5: Westlake Tower Source: Hines

Figure 6: Seattle Monorail Map

	$ per sq. ft. per year									*Average*	*Median*
Comp on Rail Line	$34.00	$20.00	$35.00	$24.00	$33.00	$24.00	$28.00	$22.00	$30.00	**$ 27.78**	**$28.00**
Comp Adjacent to Rail Line	$38.00	$28.00	$35.00	$27.00	$34.00	$27.00	$30.00	$27.00	$27.00	**$ 30.33**	**$28.00**

Table 1: List of comparable properties on and off elevated rail corridor

2.1.2 Vancouver, British Colombia (Vancouver SkyTrain)

Vancouver SkyTrain is an important precedent for the Calgary Green line since the system incorporates both above ground and elevated alignment options within its network. The SkyTrain corridor goes underground once it enters the Vancouver central business district, thereby supporting the argument for a complete tunneling of the downtown Calgary portion of the Green Line. However, the pace of development in recent years has been such that areas immediately outside downtown Vancouver densified rapidly creating areas of large mixed used developments immediately adjacent to elevated portions of SkyTrain. Elevated portions of the SkyTrain directly front residential and commercial buildings.

Figure 7: Vancouver SkyTrain: Terminal Avenue Source : Transport Blog

Our analysis focuses of on these newly densified areas adjacent to the elevated portions of the SkyTrain just outside of Downtown Vancouver, specifically, the neighbourhood of False Creek bisected by the Expo and Millennium lines. Still, SkyTrain's high ridership and relative downtown density make Vancouver a useful analogue to Calgary and its transit system.

Vancouver market research suggests two opposing but parallel trends underlying the development of a light rail corridor with high ridership. On the one hand, the Terminal avenue area submarket indicates a clear a measurable decrease in the quality of retail and office stock built alongside the rail corridor. On the other hand, there numerous instances where changes in zoning allow for high-density, Class A, pedestrian-friendly development regardless of their proximity to an elevated rail line.

First, comparisons between office properties immediately on Terminal Avenue and those on the Great Northern Way (GNW) show that full 15% discount for those in front of the elevated rail. This decrease, however, is not directly attributed to either the noise or the shade caused by SkyTrain. Interviews with local brokers explain this dramatic difference in rent by emphasizing recent development of Class A office space has been limited to the areas along GNW as it offers *both* proximity to the SkyTrain *and* larger parcels that do not require land assembly.

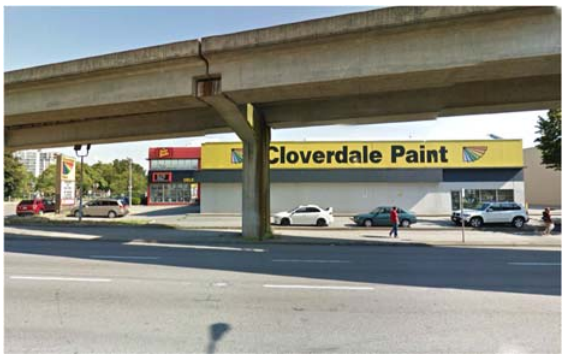

Figure 8: Retail Property on Terminal Avenue Source: Lee and Associates Commercial Real Estate

Figure 9: Office Property on Terminal Ave Source: Lee and Associates Commercial Real Estate

This confirmation of the externality curve in Figure 1 is more stark in retail properties. Both data and broker interviews show that comparable retail properties 500 meters away from the SkyTrain could rent between 20% and 40% above those immediately in front of the transit. Ground level retail rents suffer even when controlling for the width of the street and relative age of the property. Broker explanation of

this trend, however, associates this trend not to below market rents on Terminal Avenue but to above market rents on transit villages within walking distance of the SkyTrain.

There are a number of precedents that contradict the trends of price deflation directly on the rail corridor, usually due to land use regulation that promotes transit oriented development. Most prominent among these is the Gilmore Center further down the Expo Line. Due to density allotments and the size of the parcel this development will contain two levels of high-profile, pedestrian oriented retail in addition to 1 million square feet of office space, achieving a density greater than most of the potions of the Millennium Line in which the line runs underground.

Figure 10: Gilmore Centre Source: Onni Development

Figure 11: Vancouver SkyTrain Study Area Map

							Average	*Median*
Comp on Rail Line	$ 18.00	$ 25.00	$ 22.00	$ 27.00	$ 27.00	$ 26.50	**$ 24.25**	**$ 25.75**
Comp Adjacent to Rail Line	$ 22.00	$ 28.00	$ 27.00	$ 33.00	$ 33.00	$ 30.00	**$ 28.83**	**$ 29.00**

Table 2: List of Comparable Properties On and Near the Rail LIne

2.1.3 Chicago, Illinois (Chicago L)

The Chicago L is an important case study since it is perhaps the North American rail system with the most documented and studied impacts on its surrounding corridor. It is also one of the oldest systems, allowing real estate market forces to mature and express the full market dynamics of proximity to the elevated rail line. Given the density of the city and that the sections crossing downtown Chicago date back to 1892, its noise and shade imposed on surrounding residents and office tenants have an impact on property, especially older buildings which were not installed with mitigation measures.[7] Indeed, a 1974 report found that both, the noise and the vibrations in certain stations were drastic enough to cause temporary hearing loss.[8]

While maintenance and new cars have improved performance in recent years, the heavy-rail system is still louder than that of any modern light rail, and its steel section is wider and far more obtrusive than that of the future green line. Therefore, the Chicago serves as a conservative bookend of the negative property value impacts associated with an elevated rail line.

Figure 12: Chicago L: Randolph and Walsh Source: Creative Commons

[7] Hilkevitch, Jon *Thump, roar, rumble, squeal: Study maps CTA's L noise* Chicago Tribune July 29, 2002: http://articles.chicagotribune.com/2002-07-29/news/0207290167_1_rail-lines-noise-blue-line

[8] Chang, Hsing Chi *Acoustic Study of Rapid Transit System* American Industrial Hygiene Association Journal Vol 34, 1974.

Figure 13: Chicago L Train Study Area Map

Despite the considerable rail noise and shadowing of the rail line, brokers indicated only marginal differences in rents. Rather, brokers stated that some tenants were attracted to the proximity to the rail despite the noise and the shadowing impacts. Other commercial brokers stated the retail spaces under the elevated system limit the potential list of tenants, especially those in retail uses access the public right of way. Overall rents indicate no meaningful difference between those properties on the rail line versus those nearby.

	$ per sq. ft. per year					*Average*	*Median*
Comp on Rail Line	$ 25.00	$ 38.00	$ 35.00	$ 15.00	$ 25.00	**$ 30.75**	**$ 30.00**
Comp Adjacent to Rail Line	$ 25.00	$ 45.00	$ 28.00	$ 18.00	$ 18.00	**$ 29.46**	**$ 29.00**

Table 3: List of comparable properties on and off elevated rail corridor

Figure 14: 234 S Wabash: Source LoopNet

Figure 15: 205 W Randolph Source: Willard Jones Real Estate

2.2 Rail Construction

Research and broker interviews pointed out that the construction process posed a much more significant liability to retail and office space along a rail corridor since it affected operations of the buildings without offering additional service during the time of construction. Research show that the duration of construction is as important as the alignment option chosen.

Impact mitigation on existing businesses along rail corridors has been a key part of community outreach for recent rail projects including elevated systems (like the Los Angeles Expo Line) at grade systems (like the Minneapolis Green Line) or tunnelled options (like Seattle's Westlake tunnel). The of impact on existing businesses due to construction is necessary, independently of which alignment alternative is employed by the transit system. A longitudinal study of the Metro Red Line, a tunnelled portion of Los Angeles' rail network, comparing 1,600 businesses along the construction corridor to 1,200 adjacent to the corridor found the following:

- There was a 20% decrease on the survival rate of businesses along the construction corridor rate compared to the regional average.[9]
- Additionally, there was an average decrease of $57,000 in gross revenue for businesses on the corridor during the years of constructions.[10]

Technical literature shows that even conservative noise projections of both Roadheader and tunnel boring machines give a 30m radius (about as much as rail operations noise) in which noise and vibration levels are significant to residents and building owners. Additionally, office buildings were up to 25% more susceptible to noise and vibrations, even if the scheduling of tunnel boring operations during off business hours is expected.[11]

[9] Ray, Rosaline " Open for Business" Effects of Los Angeles Metro Rail Construction on Adjacent Businesses. UCLA Electronic Theses and Dissertations, 2015.
[10] Ibid.
[11] Speakman, Colin Tunneling Induced Ground-Borne Noise Modelling, Proceedings of Acoustics:

Thus, the duration and mechanics of construction may end up playing in significant role in dialogue local stakeholders and decision making when picking an alignment alternative through downtown Calgary.

3. Application to Downtown Calgary

While the impact of elevated rail is an under documented and understudied phenomenon preliminary our research shows that it is reasonable to account for 3% to 5% depreciation for the office floors directly facing an elevated line and 7% to 10% loss to those retail establishments below on the elevated systems. Additionally, there is substantial literature that shows that even at grade LRT can lower single-family-home values by up to 20% within a 30 metre radius.

Utilizing the impact coefficients (See Table 4) to the all the properties along the 2nd Street and 10th Avenue corridor and the subsequent depreciation totals (See Table 5) is likely slightly exaggerated for the following reasons:

- Majority of Downtown Calgary contains Class A office space and retail and research shows that the most susceptible properties are the ones in the low spectrum of the market.
- The positive effect of transit either elevated on tunnelled are larger far exceed the negative impacts on office and retail properties.
- New development is largely immune to negative effects of elevated rails.

	Retail	Office	Residential
Low End Impact Estimate	7%	3%	15%
High End Impact Estimate	10%	5%	20%

Table 4: Impact Coefficients Used in Overall Calculations

	Retail	Office	Residential
Low End Impact Estimate	$ 53.2 Million	$ 44.1 Million	$ 5.5 Million
High End Impact Estimate	$ 76.0 Million	$ 76.5 Million	$ 7.5 Million

Table 5: Property Value Loss Associated with Elevated LRT

Still, in order to understand a reasonable approximation of the scale of the impact caused by an elevated rail through Downton Calgary we apply these coefficients to properties currently under use. A GIS inventory show that along the 2nd Street corridor there are 74 affected properties. This analysis includes

https://www.acoustics.asn.au/conference_proceedings/AAS2009/papers/p69.pdf

properties within a 30 metre radius of the corridor and therefore properties with addresses on the intersecting streets.

A number of properties were excluded from overall impact calculations because the current use would not be affected by an elevated railway (such as parkades).Table 6 The two plots of land that make up Central Memorial Park were excluded from this analysis not because the elevated rail would not have an impacts on the park but because this analysis focuses on elevated rail's impact on private property value.

	Properties													
	2nd Street	3rd Street	4th Street	5th Street	6th Street	7th Street	8th Street	9th Street	10th Street	11th Street	12 Street	RIVERFRONT	Total	%
Properties	26	1	3	2	6	4	3	7	12	3	2	5	74	100.00%
Parkade	5	0	0	0	2	0	1	0	9	0	0	2	19	25.68%
Empty Land	3	0	0	0	1	0	0	3	1	0	0	0	8	10.81%
	18	1	3	2	3	4	2	4	2	3	2	3	47	63.51%

Table 6: Properties excluded from Rail Impact Analysis Data Set

The number of impacted properties totaled 47 with a collective value of almost $11 trillion. *Table **7*** and *Table **8*** The majority of these properties both in number and in value consisted of office properties, which historically more resilient when it came to the externalities associated with elevated rail. This drastic skew in the use dramatically reduced the overall impact of the elevated alignment option.

	Buildings													
	2nd Street	3rd Street	4th Street	5th Street	6th Street	7th Street	8th Street	9th Street	10th Street	11th Street	12 Street	RIVERFRONT	Total	%
Condo	3	0	0	0	0	0	0	0	0	1	0	2	6	12.77%
Retail	7	0	0	0	0	1	0	0	2	0	1	1	12	25.53%
Office	8	1	3	2	3	3	2	4	0	2	1	0	29	61.70%
	18	1	3	2	3	4	2	4	2	3	2	3	47	100.00%

Table 7: Properties with reduced property values by use

	Total Value of Affected Properties												Total	
	2nd Street	3rd Street	4th Street	5th Street	6th Street	7th Street	8th Street	9th Street	10th Street	11th Street	12 Street	RIVERFRONT	Total	%
Condo	$ 51,123,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,077,000	$ -	$ 37,983,000	$ 107,183,500	0.98%
Retail	$ 1,691,989,200	$ -	$ -	$ -	$ -	$ 26,350,000	$ -	$ -	$ 12,028,000	$ -	$ 15,500,000	$ 1,747,000	$ 1,747,614,200	15.93%
Office	$ 1,856,121,600	$ 606,630,000	$ 1,652,050,000	$ 960,080,000	$ 1,255,990,000	$ 1,071,280,000	$ 32,840,000	$ 1,367,350,000	$ -	$ 302,430,000	$ 14,100,000	$ -	$ 9,118,871,600	83.10%
	$ 3,599,234,300	$ 606,630,000	$ 1,652,050,000	$ 960,080,000	$ 1,255,990,000	$ 1,097,630,000	$ 32,840,000	$ 1,367,350,000	$ 12,028,000	$ 320,507,000	$ 29,600,000	$ 39,730,000	$ 10,973,669,300	100.00%

Table 8: Cumulative Value of Affected Properties

Additionally, we limited our analysis only to the portion of the buildings affected by the LRT. This required distributing the cumulative value of the corridor buildings by floors. In order to do we took inventory of the overall number of affected properties (Table 9). This layer of information additionally increased the skew of property values toward the office.

	Floor Plates													
	2nd Street	3rd Street	4th Street	5th Street	6th Street	7th Street	8th Street	9th Street	10th Street	11th Street	12 Street	RIVERFRONT	Total	%
Condo	44	0	0	0	0	0	0	0	0	6	0	28	78	13.09%
Retail	15	0	0	0	0	4	0	0	1	0	11	1	32	5.37%
Office	92	21	96	47	70	80	17	50	0	13	0	0	486	81.54%
	151	21	96	47	70	84	17	50	1	19	11	29	596	100.00%

Table 9: Number of Floor Plates along LRT Corridor

Property data and broker interviews clearly showed that whenever rail lowered rent or property value, this effect was limited only to those properties *immediately* in front of the tracks. This meant our analysis only took into account the first 4 levels of affected buildings *and* within these levels only the portion facing the tracks. Including these two caveats into the impact estimates drastically changed the makeup of the

affected properties by excluding a large portion of the towers along the corridor. Table 10 shows that office space only makes up 20% of the first 4 levels of buildings along 2nd street corridor.

As mentioned in the "Assumptions" section, this analysis distributes the value of property equally among floors. This assumption is generally conservative since rents in higher floors are not only unaffected by street or rail noise, they also rent a premium, making up a larger portion of the overall building's revenue. By giving the higher floors the same vale as the lower floors (i.e. Susceptible to the noise of the elevated LRT), the model exaggerates the impact of the elevated rail.

Thus, when looking at property value of the affected properties (*Table **11***), the cumulative value of affected condominiums becomes negligible in comparison that of the office and retail property.

	Affected Floor Plates													
	2nd Street	3rd Street	4th Street	5th Street	6th Street	7th Street	8th Street	9th Street	10th Street	11th Street	12 Street	RIVERFRONT	Total	%
Condo	8	0	0	0	0	0	0	0	0	4	0	4	16	11.43%
Retail	14	0	0	0	0	4	0	0	1	0	4	1	24	17.14%
Office	24	4	12	8	12	12	8	12	0	8	0	0	100	71.43%
	46	4	12	8	12	16	8	12	1	12	4	5	140	100%

Table 10: Affected Floor Plates Along 2nd SW Street Corridor

	Value of Floors Affected													
	2nd Street	3rd Street	4th Street	5th Street	6th Street	7th Street	8th Street	9th Street	10th Street	11th Street	12 Street	RIVERFRONT	Total	%
Condo	$ 15,895,833	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,025,667	$ -	$ 15,536,000	$ 37,457,500	1.65%
Retail	$ 737,567,850	$ -	$ -	$ -	$ -	$ 13,175,000	$ -	$ -	$ 5,975,000	$ -	$ 2,818,182	$ 873,500	$ 760,409,532	33.53%
Office	$ 494,716,170	$ 57,774,286	$ 102,272,659	$ 103,215,373	$ 132,166,765	$ 293,918,500	$ 8,755,758	$ 169,634,000	$ -	$ 107,796,000	$ -	$ -	$ 1,470,249,509	64.82%
	$ 1,248,179,853	$ 57,774,286	$ 102,272,659	$ 103,215,373	$ 132,166,765	$ 307,093,500	$ 8,755,758	$ 169,634,000	$ 5,975,000	$ 113,821,667	$ 2,818,182	$ 16,409,500	$ 2,268,116,541	100.00%

Table 11: Value of Each Floor Affected by Elevated LRT Along 2nd SW Street Corridor

Applying the value reduction depreciation coefficients in Table 4 to the cumulative property values of Table 11 yields the lost value range in Table 12 and Table 13. These tables show that bulk of the damage is, in fact, not associated with offices but with ground level retail. This is in line with the effects described by brokers in Chicago and Seattle in which the elevated rail changed the character of the affected street and the nature of the tenants that leased storefronts underneath the rail tracks.

	Lost Value (Lower End)													
	2nd Street	3rd Street	4th Street	5th Street	6th Street	7th Street	8th Street	9th Street	10th Street	11th Street	12 Street	RIVERFRONT	Total	%
Condo	$ 2,384,375	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 903,850	$ -	$ 2,330,400	$ 5,618,625	5.46%
Retail	$ 51,629,750	$ -	$ -	$ -	$ -	$ 922,250	$ -	$ -	$ 418,250	$ -	$ 197,273	$ 61,145	$ 53,228,667	51.70%
Office	$ 14,841,485	$ 1,733,229	$ 3,068,180	$ 3,096,461	$ 3,965,003	$ 8,817,555	$ 262,673	$ 5,089,020	$ -	$ 3,233,880	$ -	$ -	$ 44,107,485	42.84%
	$ 68,855,610	$ 1,733,229	$ 3,068,180	$ 3,096,461	$ 3,965,003	$ 9,739,805	$ 262,673	$ 5,089,020	$ 418,250	$ 4,137,730	$ 197,273	$ 2,391,545	$ 102,954,778	100.00%

Table 12: Low-End Estimate of Lost Value Along Corridor Associated with Elevated LRT

	Lost Value (Higher End)													
	2nd Street	3rd Street	4th Street	5th Street	6th Street	7th Street	8th Street	9th Street	10th Street	11th Street	12 Street	RIVERFRONT	Total	%
Condo	$ 3,179,166.67	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,205,133.33	$ -	$ 3,107,200.00	$ 7,491,500	4.77%
Retail	$ 73,756,785.00	$ -	$ -	$ -	$ -	$ 1,317,500.00	$ -	$ -	$ 597,500.00	$ -	$ 281,818.18	$ 87,350.00	$ 76,040,953	48.42%
Office	$ 24,735,808.49	$ 2,888,714.29	$ 5,113,632.94	$ 5,160,768.63	$ 6,608,338.24	$ 14,695,925.00	$ 437,787.88	$ 8,481,700.00	$ -	$ 5,389,800.00	$ -	$ -	$ 73,512,475	46.81%
	$ 101,671,760	$ 2,888,714	$ 5,113,633	$ 5,160,769	$ 6,608,338	$ 16,013,425	$ 437,788	$ 8,481,700	$ 597,500	$ 6,594,933	$ 281,818	$ 3,194,550	$ 157,044,929	100.00%

Table 13: High-End Estimate of Lost Value Along Corridor Associated with Elevated LRT

Thus, the cumulative effect the elevated centre city alignment option is a loss between $100 and $160 million of the existing office, retail and condominium stock in the corridor. This is loss of 4.5% - 6.9% of the affected floors or 0.9% – 1.4% of the entire building stock of all the properties in the corridor. In context, a loss of 4.5% - 6.9 % of property is the drop equivalent to the one that occurred to the median property value in Calgary during the 2008 crisis.

4. Appendix

4.1 Seattle Case Studies

Comp Number	Address	$ / SF / yr	On 5th Ave	Use	Floor	Notes
1	1601 5th Ave	$34	Y	Office	2nd	http://looplink.seattle.cbre.us/ll/17350142/1601-5th-Avenue/
	600 Stewart Ave	$38	N	Office	5th	http://www.loopnet.com/Listing/18947800/600-Stewart-St-Seattle-WA/?LinkCode=31812
2	2301 5th Ave	$20	Y	Retail	1st	http://www.loopnet.com/Listing/13685213/2301-5th-Avenue-Seattle-WA/
	2211 3rd Ave	$28	N	Retail	1st	http://www.loopnet.com/Listing/14361611/2211-Third-Avenue-Seattle-WA/
3	2301 5th Ave	$35	Y	Office	2 to 5	http://upload.officespace.com/files/Seattle/5thbell/141783347.pdf
	2300 7th Ave	$35	N	Office		http://www.loopnet.com/Listing/18987666/2300-7th-Ave-Seattle-WA/?LinkCode=31812
4	2028 5th Ave	$24	Y	Retail	1st	http://www.loopnet.com/Property-Record/2028-5th-Avenue-Seattle-WA-98121/YJe7Glt5A/Sale-Lease/
	2013 4th Ave	$27	N	Office	2nd	http://www.officespace.com/seattle-wa/building/55501-2013-fourth-avenue
5	2027 5th Ave	$33	Y	Retail	1 st	http://www.seattleretailoffice.com/retail-lease-space/
	401 East Pine	$34	N	Retail	1 st	http://www.seattleretailoffice.com/index.cfm?fuseaction=detail&startrow=5&cfid=69904967&cftoken=68576913
6	2211 5th Ave	$24	Y	Office	2nd	http://www.wallaceproperties.com/docs/3735/085a6664a926272f4e8c9c0539e002ade68f9168/22115thAvenue.pdf
	2013 4th Ave	$27	N	Office	2nd	http://www.officespace.com/seattle-wa/building/55501-2013-fourth-avenue
7	2211 5th Ave	$28	Y	Retail	1st	https://42floors.com/us/wa/seattle/2211-5th-ave
	2211 3rd Ave	$30	N	Retail	1st	http://www.loopnet.com/Listing/14361611/2211-Third-Avenue-Seattle-WA/
8	2127 5th Ave	$22	Y	Office	2nd	http://www.officespace.com/seattle-wa/building/61282-2127-fifth-avenue
	2013 4th Ave	$27	N	Office	2nd	http://www.officespace.com/seattle-wa/building/55501-2013-fourth-avenue
9	2005 5th Ave	$30	Y	Office	2nd	http://www.officespace.com/seattle-wa/building/61282-2127-fifth-avenue
	2013 4th Ave	$27	N	Office	2nd	http://www.officespace.com/seattle-wa/building/55501-2013-fourth-avenue
10	2025 5th Ave	$20	Y	Retail	1st	Fifth Avenue LLC Bainbridge Island, WA 98110 (206) 551-5155
	2211 3rd Ave	$28	N	Retail	1st	http://www.loopnet.com/Listing/14361611/2211-Third-Avenue-Seattle-WA/

4.2 Vancouver Case Studies

Comp Number	Address	$ / SF / yr	On 5th Ave	Use	Floor	Notes
1	1601 5th Ave	$34	Y	Office	2nd	http://looplink.seattle.cbre.us/ll/17350142/1601-5th-Avenue/
	600 Stewart Ave	$38	N	Office	5th	http://www.loopnet.com/Listing/18947800/600-Stewart-St-Seattle-WA/?LinkCode=31812
2	2301 5th Ave	$20	Y	Retail	1st	http://www.loopnet.com/Listing/13685213/2301-5th-Avenue-Seattle-WA/
	2211 3rd Ave	$28	N	Retail	1st	http://www.loopnet.com/Listing/14361611/2211-Third-Avenue-Seattle-WA/
3	2301 5th Ave	$35	Y	Office	2 to 5	http://upload.officespace.com/files/Seattle/5thbell/141783347.pdf
	2300 7th Ave	$35	N	Office		http://www.loopnet.com/Listing/18987666/2300-7th-Ave-Seattle-WA/?LinkCode=31812
4	2028 5th Ave	$24	Y	Retail	1st	http://www.loopnet.com/Property-Record/2028-5th-Avenue-Seattle-WA-98121/YJe7Glt5A/Sale-Lease/
	2013 4th Ave	$27	N	Office	2nd	http://www.officespace.com/seattle-wa/building/55501-2013-fourth-avenue
5	2027 5th Ave	$33	Y	Retail	1 st	http://www.seattleretailoffice.com/retail-lease-space/
	401 East Pine	$34	N	Retail	1 st	http://www.seattleretailoffice.com/index.cfm?fuseaction=detail&startrow=5&cfid=69904967&cftoken=68576913
6	2211 5th Ave	$24	Y	Office	2nd	http://www.wallaceproperties.com/docs/3735/085a6664a926272f4e8c9c0539e002ade68f9168/22115thAvenue.pdf
	2013 4th Ave	$27	N	Office	2nd	http://www.officespace.com/seattle-wa/building/55501-2013-fourth-avenue
7	2211 5th Ave	$28	Y	Retail	1st	https://42floors.com/us/wa/seattle/2211-5th-ave
	2211 3rd Ave	$30	N	Retail	1st	http://www.loopnet.com/Listing/14361611/2211-Third-Avenue-Seattle-WA/
8	2127 5th Ave	$22	Y	Office	2nd	http://www.officespace.com/seattle-wa/building/61282-2127-fifth-avenue
	2013 4th Ave	$27	N	Office	2nd	http://www.officespace.com/seattle-wa/building/55501-2013-fourth-avenue
9	2005 5th Ave	$30	Y	Office	2nd	http://www.officespace.com/seattle-wa/building/61282-2127-fifth-avenue
	2013 4th Ave	$27	N	Office	2nd	http://www.officespace.com/seattle-wa/building/55501-2013-fourth-avenue

4.3 Chicago Case Studies

Comp Number	Address	$ / SF / yr	On L	Use	Floor	Notes
1	205 W Randolph	$24.50	Y	Office	12th	http://www.loopnet.com/Listing/14008771/205-West-Randolph-Chicago-IL/
	120 W Madison St	$25.00	N	Office	12th	http://www.loopnet.com/Listing/18997315/120-W-Madison-St-Chicago-IL/
2	1204 W Lake St	$38.00	Y	Retail	1st	http://www.loopnet.com/Listing/16017282/1204-W-Lake-St-Chicago-IL/
	1146 W Randolph	$45.00	N	Retail	1st	http://www.loopnet.com/Listing/19518483/1146-W-Randolph-Chicago-IL/
3	2030 S Wabash Ave	$35.00	Y	Retail	1st	http://www.loopnet.com/Listing/19618927/2030-S-Wabash-Ave-Chicago-IL/
	2036 S Michigan Av	$28.00	N	Retail	1st	http://www.loopnet.com/Listing/19149340/2036-S-Michigan-ave-Chicago-IL/
4	180 N Wabash Ave	$25.00	Y	Office	4th	http://www.loopnet.com/Listing/15407300/180-N-Wabash-Chicago-IL/
	180 N Michigan Ave	$18.00	N	Office	4th	http://www.loopnet.com/Listing/19798570/180-N-Michigan-Avenue-Chicago-IL/
5	234 S Wabash	$15.00	Y	Office	4th	http://www.loopnet.com/Listing/16534512/234-S-Wabash-Ave-Chicago-IL/
	180 N Michigan Ave	$18.00	N	Office	4th	http://www.loopnet.com/Listing/19798570/180-N-Michigan-Avenue-Chicago-IL/

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