West Island Line / South Island Line (WIL/SIL):

DIRECT EXTERNAL BENEFITS

Centre of Urban Planning & Environmental Management (CUPEM)
The University of Hong Kong

THE CENTRE OF URBAN PLANNING & ENVIRONMENTAL MANAGEMENT
城市規劃及環境管理研究中心

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Research carried-out under funding from the Mass Transit Railway Corporation Ltd., Hong Kong

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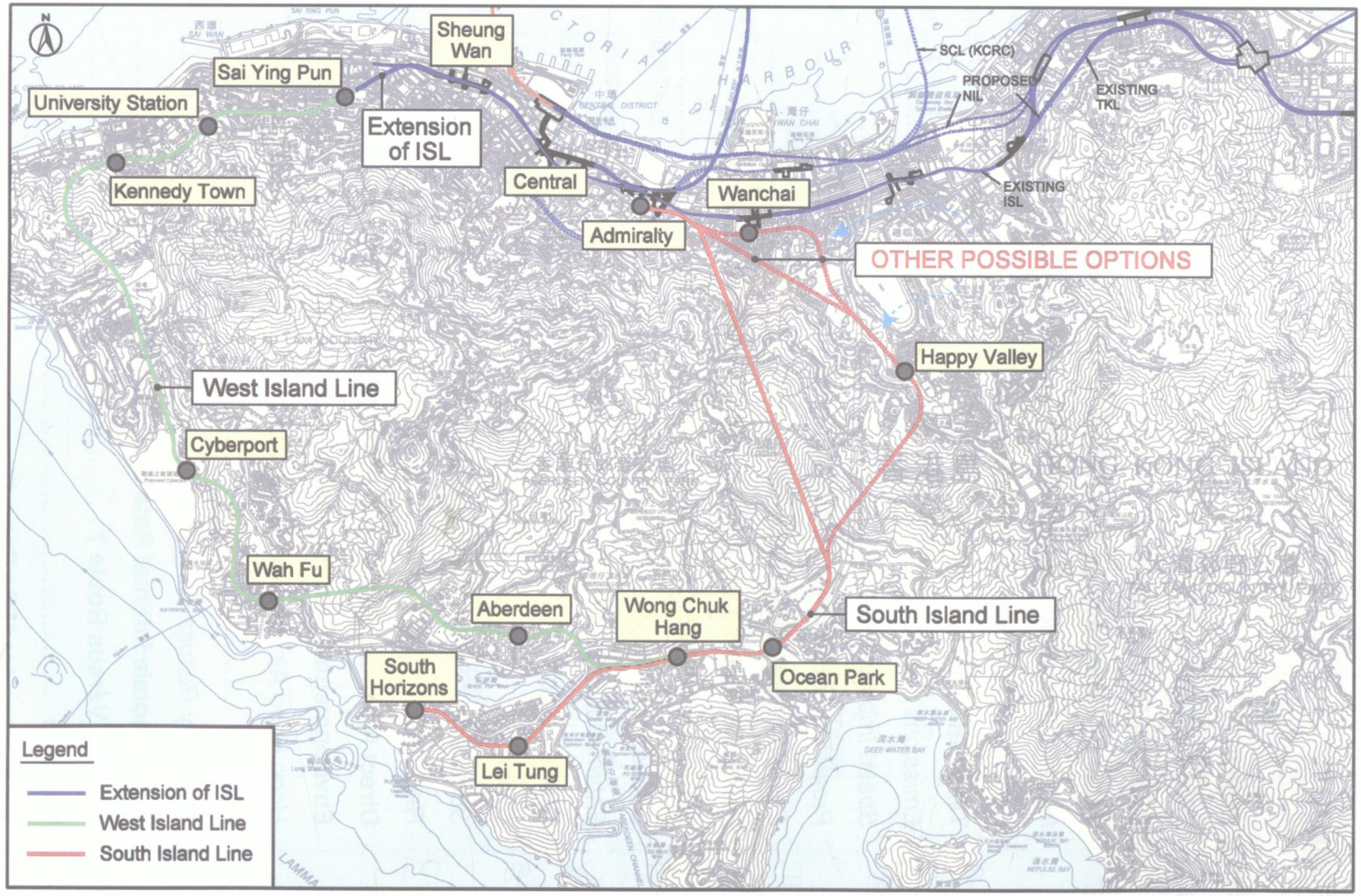
Study Responsibilities

The Mass Transit Railway Corporation Limited (MTRCL) provided funding to the Centre of Urban Planning and Environmental Management (CUPEM) of the University of Hong Kong, and to Civic Exchange to carry out research on the direct external benefits associated with the proposed West Island and South Island Lines (WIL/SIL). Funding was also provided for CUPEM to publish this report on the study's methodology and findings.

PlanArch served as sub-consultant to CUPEM and Civic Exchange for the property valuation part of this work and had lead responsibility for Appendix B. The Hong Kong University Department of Community Medicine collaborated on the environmental health assessment and had lead responsibility on Appendix C. As noted in the acknowledgments, other persons and organizations also made important contributions to this research.

While the authors worked closely with the MTRCL and its consultants on parts of the data analysis (especially transport modeling), responsibility for methodology, data sources, and findings rest with the authors.

West Island Line and South Island Line



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Summary

Table S.1
Summary of Direct External Benefits

Type of External benefit	Annual Benefits *(HK $ MILLION)*	Present Value in 2004 of future returns *(HK$ BILLION)*[a]
ECONOMIC VALUE OF TIME SAVINGS/SAFETY[b]	**$ 1,016**	**$ 18.5**
Time Savings	$ 985	$ 17.9
Safety Benefits	$ 31	$ 0.6
PROPERTY VALUE INCREASES	**$1,594 – 1,978**	**$ 18.7– 22.7**
Private Property Owners (w/o Happy Valley)[c]	$1,266 – 1,543	$ 14.4 – 17.6
Financial Returns to Government[d]	$ 328 – 435	$ 4.3 – 5.1
Rates	*($ 84 – 103)*	*($1 7 – 2.0)*
Property Tax	*($ 76 – 84)*	*($ 1.5 – 1.7)*
Land Premium[e]	*($ 150 – 230)*[e]	*($ 0.7 – 1.0)*
Cyberport Rent	*($ 18)*	*($ 0.4)*
ENVIRONMENTAL HEALTH BENEFITS[f]	**$ 23**	**$ 0.4**
Direct PRIVATE Health Care Savings	$ 12	$ 0.3
Direct PUBLIC Health Care Savings	$ 6	$ 0.045
Avoided Productivity Losses	$ 5	$ 0.1
TOTAL DIRECT EXTERNAL BENEFITS	**$2.6 – 3.0 billion/ yr.**	**≈ $ 38 – 42 billion**
EIRR[g]	**NA**	**24% to 26%**
If Route 7 is canceled, net financial benefits to government go up by an additional		**≈ $ 12 billion**

Notes to Table S.1

[a] This column represents annual values summed in perpetuity and discounted at a real rate of 4% for government income, and discounted to 2004. The stream of benefits begins in 2010. For private property, the increase in value is assumed to generate a rental income equal to 7% of value. If the rate were to be lower, owners would find it more profitable to sell their property and invest the assets elsewhere. In effect, this approach raises the real discount rate for the private property owner to 7%.

[b] At first glance these time savings benefits may appear to be rather low. However, in contrast to many other studies of external benefits of major transport infrastructure, we have separately identified expected property value increases. Since the value of time savings is one of the features likely to drive up property values in the WIL/SIL catchments, we avoided double-counting by including only the time savings of Southern and Western residents who live in public housing (and hence do not participate in the property value changes).

[c] Net of rates to government. Happy Valley would add $1.3 to $1.5 million/year in net external benefits to private property owners. The 'annual' value is based on the estimated increase in value for properties using 'let' properties as the guide. Research carried out as part of this study confirms that this assumption is a realistic one.

[d] Conservatively estimated to offset likelihood of value transfer from elsewhere in Hong Kong.

[e] To reflect the likelihood that not all of the land premium would come to government in 2010 (the projected start of WIL/SIL operation), we spread the premium out over 5 years. Hence, while the other figures in the annual benefit column are in perpetuity, this one is only for 5 years (2010-2014).

[f] We estimated effects of a 10% reduction in PM and NO_2. Effects of other transport pollutants such as SO_2, CO, and hydrocarbons are not assessed here. The values are also exclusive of an estimated $3.0 billion in associated *willingness to pay* (WTP). In other words the values shown here are only a sub-set of actual values.

[g] From the perspective of a 1/3 government capital contribution to WIL/SIL (i.e., $ 5 billion of $15 billion). If the full capital cost ($15 billion) is applied, the EIRR is 12% to 13%.

S.1 EXTERNAL BENEFITS are those stemming from a project but not accruing to the organization undertaking the project. They do, however, accrue to the community at large (and some of this is reflected in revenues back to government). Hence, estimating external benefits for major infrastructure projects is an essential step in assessing the appropriateness of possible public support for the undertaking.

S.2 In 2003 the MTRCL approached CUPEM of the University of Hong Kong with a request to undertake a study of the major external benefits associated with its proposed West Island Line and South Island Line (WIL/SIL). An agreement was reached whereby CUPEM would take the lead in an assessment of major direct external benefits. It was agreed that other, less direct, benefits, such as the rejuvenation of older areas and employment would be examined separately.

S.3 The CUPEM - led part of the analysis examined in detail a number of direct external benefits:

- economic value of travel time savings and safety benefits;
- impacts on property values in WIL/SIL catchments;
- associated returns to private property owners and government; and
- environmental health benefits.

S.4 Methodology and data sources are outlined in the report and in more detail in the three appendices. In this summary, we simply note a few basic points on methodology and sources of data.

- The assessment of property values involved a building-by-building review using data from the Valuation and Rating Department and by examination of the impacts of access to nearby rail on property values elsewhere in Hong Kong.

- The analysis of time savings and safety benefits drew heavily on specially formulated runs of MVA's transport model (MVCTS).

- Our estimates of the health care benefits of the WIL/SIL were developed by firstly drawing on the MVA transport model to estimate changes in travel by various classes of vehicles (and associated speed changes), and secondly coupling this with information on current emissions data (by vehicle class) from the Motor Vehicle Emissions Group of EPD. The third step was to pass these results to the University of Hong Kong's Department of Community Medicine which applied this information to their recent modeling of the impacts of pollution on the level of required health care in Hong Kong.

S.5 *Throughout this assessment we have been careful to avoid double-counting of benefits and to address issues of shifts in values as distinct from net increases.*

S.6 For example, the private property values shown in Table S.1 are net of associated revenues to government. Likewise, our estimates of the value of time savings for residents of Southern and Western are only for residents of *public rental housing*, since the value of time savings for those in private housing is presumably captured in our estimated increased willingness to pay for property in the two districts.

S.7 A less straightforward issue is that of determining how much of the estimated increase in value in WIL/SIL catchments represents a transfer of value from other parts of the Territory. To do such an assessment with much precision would be quite complex, time-consuming and, in the end, still subject to considerable uncertainty. Hence, we addressed this issue indirectly. For example, we credited only one half of the estimated property value increase for certain types of commercial property values to a net increase for Hong Kong.

S.8 More broadly, we consistently used conservative assumptions when considering what types and level of external benefits to count as part of

our assessment (e.g. *whose* time savings are counted; *level* of projected increases in property value; and for pollution reduction, the *types* of pollutants considered). Thus, while no one can say just how much of our estimated property value increases in WIL/SIL catchments would result in lower demand elsewhere in Hong Kong, we are confident that, on balance, our estimates broadly reflects net gains to Hong Kong as a whole.

S.9 *Indeed, if one were to assume that mere transfers of value account for much of the estimated increase in value for areas benefiting from a major new transport infrastructure project, what would be the rationale for government building roads or supporting any type of infrastructure development?*

S.10 In terms of monetary (and monetized) direct external benefits, the WIL/SIL yields a present value for time savings of more than $18 billion. In addition, it yields about $20 billion in direct financial returns to private property owners and government. It also yields nearly a half billion in direct environmental health benefits.

S. 11 As elaborated in Table 7.1 the WIL/SIL is far superior to a Route 7 extension as a means of relieving traffic congestion in Southern, as well as Central/Wan Chai. The rail option is better with respect to:

(i) costs to government ($5 billion compared to roughly $12 billion);

(ii) carrying capacity (20,000/hr/direction compared to less than 10,000),

(iii) travel time and reliability of travel time to Central and beyond,

(iv) up-lifts to local property values, and

(v) environmental health impacts.

S.12 The WIL/SIL provides a substantial Economic Internal Rate of Return (EIRR). Using an assumed one third of the WIL/SIL capital cost as an investment by government, the EIRR is roughly 25%.

S.13 In conclusion, we can say that the direct external benefits associated with the WIL/SIL (in both financial and imputed economic terms) are substantial. A significant portion of these benefits come in the form of enhanced government revenues.

S.14 This assessment has considered only the relatively direct external benefits of the proposed WIL/SIL. It is expected that, in addition to the benefits addressed here, there will be INDIRECT EXTERNAL BENEFITS in the form of an impetus for desirable forms of REJUVENATION OF SOME OLDER AREAS, and an overall INCREASE IN EMPLOYMENT. The potential scale of such impacts will be considered separately in a forthcoming assessment lead by Civic Exchange.

S.15 Considering the various assumptions and, in some cases complexities of measurement, the direct external benefits shown here should be viewed as broadly '*indicative*', rather than as precise. While there may be reasonable differences of view about particular values shown here, we are confident that each *approximate* value is broadly robust. For example,

> *The TOTAL OF TIME SAVINGS AND SAFETY on the one hand and RETURNS TO PRIVATE PROPERTY OWNERS AND GOVERNMENT REVENUES on the other hand is each close to $20 billion (i.e. about $40 billion overall).*
>
> *Likewise, while the health care savings are of a much lower order of value, they are sufficient to be clearly reflected in lower expenditures (public and private) for pollution-related health care.*

Report

1. Introduction

1.1 This study examines selected external benefits associated with the Mass Transit Railway Corporation Limited's (MTRCL's) proposed West Island Line and South Island Line (WIL/SIL) for Southwestern Hong Kong Island. *EXTERNAL BENEFITS* are those stemming from a project, but not accruing to the organization undertaking the project. External benefits are, however, captured by the community as a whole (and some are directly reflected in revenues back to government). Hence, estimating external benefits for major infrastructure projects is an essential step in assessing the appropriateness of possible public support for the undertaking.

1.2 Major transport infrastructure improvements tend to enhance the development potential of the areas they service. Where new transit provides noticeably better connectivity to other areas, willingness to pay on the part of residents and business to be located in the transit system's catchments tends to go up, resulting in an overall stimulus to economic development within (and to a lesser extent between) catchments.[1] With this said, issues remain about double-counting and transfers (as distinct from net additions to economic activity). These points are considered below.

1.3 Four general types of external benefits are estimated here[2]:

1. Imputed economic value to society of:
   (a) TIME SAVINGS to travelers; and

[1] ECONorthwest and Parsons Brinckerhoof Quade & Douglas, Inc., 2002.
[2] Other, less tangible or indirect impacts, such as the potential for a new rail station to stimulate rejuvenation of an older area and to create employment opportunities are being evaluated in a separate assessment lead by Civic Exchange. Hence, the values reported here should be viewed as a subset of the full range of external benefits associated with the WIL/SIL.

(b) REDUCED TRANSPORT ACCIDENTS.

2. ADDITIONAL REVENUES ACCRUING TO GOVERNMENT from higher property values (residential, non-residential) within WIL/SIL catchments[3] from:
   (a) increased rates;
   (b) tax on rental income;
   (c) enhanced land premium potential; and
   (d) added rents coming from Cyberport's non-domestic property owned by government.

3. FINANCIAL RETURNS TO PRIVATE PROPERTY OWNERS in the catchments.[4]

4. BENEFITS OF REDUCED ROADSIDE POLLUTANT EMISSIONS in the form of:
   (a) estimated DIRECT COST SAVINGS IN HEALTH CARE[5]; and
   (b) imputed costs savings of AVOIDED LOSSES IN PRODUCTIVITY.

Issues of Double Counting

1.4 It has long been recognized that the potential exists for double-counting of different types of external benefits.[6] For example, the value of time savings presumably is reflected in the increased willingness to pay for property (owned or rented) where travel is more reliable and convenient. Hence, it would be double-counting to credit both enhanced property values and the value of time savings for local residents who live in housing affected by the property value changes. Likewise, it is obvious that we should not take credit for gross increases in property values plus increases in government revenue due to taxes on such enhancements.

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[3] A catchment is defined here as the area within 400 meters of a rail station entrance or less where terrain is steep.
[4] *Net* of rates paid to government (to avoid double counting).
[5] We have not attempted to estimate the health benefits of reductions in such pollutants as CO, SO_2, and hydrocarbons. Hence, estimates shown later are a subset of the actual health benefits.

1.5 We do estimate benefits for private property increases plus time savings plus associated impacts on government revenue, but *we do not double count*. We exclude the value of time savings accruing to those impacted by our estimates of higher property values.[7] Likewise, benefits to private property owners are shown *net of* property-related revenues to government.

1.6 A less straightforward issue with respect to double-counting is that of *shifts* in economic activity, from one place within the Territory to another, versus *net* increases in willingness to pay. In other words, when assessing the project from the standpoint of the Territory as a whole, the challenge is to separate *net* increase from *shifts* in economic activity.

1.7 *Transport infrastructure improvements have long been recognized as fundamental enablers, though not a guarantee, of overall economic growth.*[8]

It is for this reason, for example, that the Hong Kong government continues to subsidize the construction of highways and roads.

By improving connectivity between areas, transport infrastructure allows the Territory to incorporate more areas when weaving the economic and social fabric.

1.8 Yet, not all areas offer the same potential for growth when transport is improved. Areas with good pre-existing infrastructure (e.g. water, electric systems, schools and other infrastructure-intensive services) will tend to generate a higher willingness to pay compared to the provision of greater connectivity in areas where such systems are not fully developed.

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[6] Such issues have been raised for example, for over 30 years in such works as Gittenger 1972, Mishan 1974, Dixon 1986, Cambridge Systematics, Inc., 1988, ECONorthwest and Parsons Brinckerhoof Quade & Douglas, Inc., 2002.

[7] We exclude trips by all non-public housing residents of the two districts, but estimate property value increases only for non-public housing residents within 400 meters of a station entrance (our 'catchments'). This leaves out perhaps 15-20% of the population of Southern and Western. We have throughout this analysis adopted such purposely conservative estimates so as to offset the potential for transfers rather than net additions to economic activity.

[8] See, for example, Adler 1987.

Likewise, the lifting of a transport constraint in areas possessing exceptional environmental features (views, air quality, environmental amenities) tends to generate a greater willingness to pay compared to areas less endowed. Finally, even with the same type of transport infrastructure improvements and all other factors being equal, areas close to centres of economic or social activity will tend to benefit more than those located much farther away.

1.9 To actually measure the differences in willingness to pay among areas (and hence be able to separate out the marginal increase in value associated with a particular area) would be quite complex.

1.10 However, we feel that in the case of the WIL/SIL, the basic premise that there *is additional value added* compared to similar improvements elsewhere in the Territory can be put forward rather simply. First, Southern and Western Hong Kong have well-developed services. Second, Southern has perhaps the best environmental quality of any relatively urban place in the Territory.[9] Third, both districts have the intrinsic value of very close proximity to Hong Kong's core urban area. Yet while distances are short, local roads today are often congested and travel times sometimes long and unpredictable.

1.11 *We feel that there is really no doubt that the willingness to pay following the lifting of a transport constraint in Southern and Western is greater than elsewhere in Hong Kong.*

1.12 Transport in Southern is hampered by the twin bottlenecks of the Aberdeen Tunnel and the area where Pokfulam Road delivers its traffic into Sai Ying Pun and Sheung Wan. Transport between Kennedy Town, Sai Ying Pun and Central is congested at peak. With the provision of rail transport, these constraints vanish and with the short distances travel time becomes almost inconsequential, and more importantly, far more reliable.

[9] And overall, with the exception of the Outlying Islands and Eastern New Territories.

While provision of rail to places like the northwestern New Territories (West Rail) enhanced local property values, such impacts are likely to be considerably less than those in Southern and Western since, even with rail, travel times from the Northwest New Territories to the core urban area remain many times longer.

1.13 *This leaves the question of 'how much of the values we estimate represent a shift in values from elsewhere in the Territory?' For this we have no definitive answer.*[10]

Yet, as noted above with respect to the potential for property value enhancements in Southern and Western, it may be that a simple common sense approach is most appropriate.

Unless we believe that with the coming of a major infrastructure project much (though not necessarily all) of the associated increase in economic value represents a net addition to the well-being of society, we need to ask:

'what is the justification for anything that government does with respect to facilitating expansion of such infrastructure?'

*'Why **EVER** build a public road?'*

1.14 The answer is, of course, that while we recognize that some of the value added to the area most immediately benefiting from the new infrastructure is drawn away from other parts of the territory, in the end, we believe that a substantial part reflects a net increase to the well-being of society.[11]

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[10] In principle, such an assessment could be carried out as an econometric exercise designed to isolate the impact of a major transport infrastructure improvement on the level of overall economic activity from other factors (e.g., changes in the *structure* of economic activity, the level of technology, in the terms of trade, and 'softer' changes such as the build-up of human capital through a better educational system). Yet, such an assessment would be far more time-consuming and complex than we had the resources for. Further, it is the nature of such exercises that questions remain about the comprehensiveness of the model employed (perhaps because of the lack of data, or because new, as yet unidentified, factors are at work).

[11] In this regard, it would be quite useful if government would provide detailed information on how it estimates the overall development impacts from major infrastructure projects it funds in whole or part.

1.15 Since we were unable to undertake an econometric assessment of sufficient scale, and wishing to go beyond a simple assertion that major transport infrastructure projects bring with them benefits to the whole of Hong Kong, we have attempted to address the point indirectly.

1.16 *Throughout this assessment, we have been conservative with respect to the way we estimated benefits.*

In other words, by purposely under-estimating gross benefits, we seek to develop estimates that are robust, even if they partly reflect shifts in value from elsewhere in the Territory.

1.17 In part, we do this by taking credit for only a portion of the estimated benefits (e.g. for ground floor commercial properties). Here, we felt this sub-sector was especially prone to *local* value enhancement that includes a significant shift from some other areas. To account for this, we *credited only one half* of the estimated increase in the value of such properties as a net benefit associated with the coming of the WIL/SIL.

1.18 More broadly (and less directly), we consistently estimated value enhancement conservatively. For example, about 80% of the population of Southern and Western live within the WIL/SIL's walk-in catchments (400 meters) and it is only within these narrowly defined catchments that we considered property value impacts. To be conservative, we excluded the value of time savings for all persons living in private housing in the two districts (i.e. those inside and outside the 400 meter catchments). To the extent that the uncounted population lives in private housing (and most do) we have failed to count their benefits.

1.19 In estimating expected property value increases in the WIL/SIL catchments, we have used a set of eight pair wise comparisons from *elsewhere* in Hong Kong (i.e., matching comparable sites with and without

a nearby rail station). In other words, we did not credit the *exceptional* increase in value in the WIL/SIL due to the areas' special features noted above. Indeed, as reflected in various footnotes and text comments, throughout this assessment we have been conservative in *what* and *how* we count external benefits. *If there are challenges to our claim that our estimates represent net values, we welcome further discussion on this point.*

1.20 To facilitate future policy analysis, we separately identify: direct *financial* returns to specific parts of society (i.e., government revenues, government and private expenditure for pollution-related health care; value increases for owners of private property within the catchments); and the imputed *economic* returns (e.g., time savings, safety and avoided costs with respect to a loss in productivity) accruing broadly to the larger community.[12]

1.21 The remainder of this report consists of short sections outlining our estimates for the external benefits listed above. Descriptions of the calculation procedures, assumptions and other elements of the methodology are detailed only to the point where the reader may have a general idea of what our estimates represent and how they were developed. For more detailed documentation of the methodology please refer to the Appendices.

[12] As used here, *financial* benefits are ones that are reflected in market prices, while *economic* benefits refer to *imputed* values, some of which may be assigned surrogate monetary values (shadow prices) and others which are left non-monetized, but have clear value to society.

2. Value of Time Savings and Reduced Transport Accidents

Imputed Economic Value of Travel Time Savings

2.1 Imputing an economic value to the time travel saving following improvements in transport infrastructure is a standard part of external benefit assessments for such investments.[13] Basically, the idea is that time spent travelling is *'down time'* for those who do it, and so reduces time available for productive activities or leisure.[14] Hence, time saved in such travel has a value, and an imputed dollar value per hour saved may be developed to reflect local conditions.

2.2 We used the MVA transport model [MVCTS][15] to estimate travel time savings associated with the coming of the WIL/SIL. For public transport users, we used a series of *evaluative values of time* (VOT) for the estimation[16]. We also considered private vehicles and goods transport[17], each with its own set of time values[18]. For example, the 2010 time values (HK$/hour) for public transport users, private vehicle users and goods vehicles at 2002 prices are $53.9, $95 and $240, respectively. These

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[13] ECONorthwest and Parsons Brinckerhoof Quade & Douglas, Inc., 2002.
[14] Hoyle et al, 1998.
[15] MVCTS is an HKSAR-wide multi-modal forecasting model developed and updated by MVA over 20 years. It is compatible with the CTS model used by government. MVCTS estimates trip generation, trip destination, modal choice, and assignment of travel routes between pairs of origins and destinations. (MVA Working Paper 3: Validation of Domestic Transport Model, 3/03).
[16] Our value estimates are based on VOT calculations carried out in 1997 during the *Third Comprehensive Transport Study* (Wilbur Smith Associates) and reviewed during the *Second Railway Development Study* (MVA/Maunsell). VOT is assumed to increase over time in line with the forecast growth of real GDP per capita. All values shown here have been converted into constant 2002 dollar values.
[17] With the WIL/SIL not only do the passengers on the rail itself enjoy time savings but, with less traffic remaining road users (including goods vehicles) enjoy faster travel times as well. A portion of these benefits associated with reduced road congestion accrue in Central.
[18] For private vehicles, vehicular value of time was derived from behavioural values of time and occupancy rates, both of which were estimated during the *1992 Travel Characteristics Survey* (MVA). 'Evaluative' value of time is a measure of economic benefit to the community arising from time saved. 'Behavioural' value of time reflects willingness to pay on the part of travelers in a trade-off between money cost and time saved.

values were then applied to the results from the model in such a way as to avoid double-counting of benefits.

2.3 Since the value of time would presumably be an important component in our estimated property value increases, in Southern and Western we applied the time savings value only to the proportion of residents living in public rental housing in those areas. (Since for public housing residents, the benefits of time savings with the coming of the WIL/SIL is not reflected in the rent they pay). Based on the 2001 Census, the percentages of public housing residents are 38 and 3.4 respectively for Southern and Western. However, we could not distinguish in the model between travelers within and outside the catchments (20% of the population [virtually all of whom are in private housing] in Southern and Western live outside WIL/SIL catchments as narrowly defined). So we excluded all persons living in private housing in these districts as an additional means of underestimating the external benefits of the WIL/SIL so as to counterbalance the possibility of transfers of value from elsewhere in the Territory.

2.4 *In effect, we have transferred a portion of external value that would normally be counted as 'time savings' and identified it separately under property value increases. The advantage of this is that it distinguishes between market (financial) values and imputed economic values.*

2.5 The annual value of the reduced travel time for public transport users, private transport users and goods vehicles was then calculated, summed in perpetuity, and discounted at 4% back to 2004.

2.6 With this approach the estimated relevant portion of the total imputed economic value of travel time savings is $17.9 billion.[19]

[19] This result is robust with respect to the real discount rate assumed. Even at a 7% discount rate the value is still about $13 billion.

Benefits of Improved Road Safety

2.7 The WIL/SIL would reduce the volume of road-based traffic. Reducing road traffic has the added advantage of reducing the expected number of traffic accidents. We compared the estimated annual vehicle kilometers traveled (VKT) territory-wide with and without the WIL/SIL and then applied a set of accident rates[20] by major vehicle types per million VKT to determine the reduced number of accident cases. We estimate that with WIL/SIL the resulting reduction in road traffic will mean that about 150 fewer traffic accidents occur each year. By applying an average accident cost of $115,500 (at 1998 prices),[21] we estimate the present value[22] of the avoided accidents total to be $0.6 billion.

Time Savings + Safety Benefits

2.8 The annual imputed economic value of time savings and safety benefits for the WIL/SIL (exclusive of Happy Valley and Wan Chai) is $1,016 million. The 2004 present value of this benefit from 2010 onwards is $18.5 billion.

Emissions Reductions

2.9 We estimate reductions in vehicular emissions both as a function of reduction in VKT and of speed improvement for Southern and Central/Western Districts. Model runs were made for 2011 and 2016, with and without the WIL/SIL, to show the marginal impact of the WIL/SIL on traffic as measured in passenger car units per kilometer (pcu/kms) and in vehicle speed during morning peak, evening peak and off-peak periods. Daily pcu/kms for each broad class of vehicle types (public transport,

[20] These were determined by Transport Department based on accident analyses.
[21] We used the GDP deflator to revalue the average accident cost at 2002 prices. The value per accident in any future year was then adjusted to account for projected growth in gross domestic product (GDP) per capita.

private vehicles and goods vehicles) during morning peak, evening peak and off-peak periods were converted into daily VKT by a set of conversion factors (see Table A.11 in Appendix A). Reductions in VKT due to WIL/SIL in different time periods of the day were then obtained for both 2011 and 2016.

2.10 We then employed the latest fleet average emission factors (in gram/VKT by vehicle class) to estimate the scale of emissions reduction as a result of reduced daily VKT for particulate matter (PM) and nitrogen oxides (NO_x). Emission factors for the years from 1991 to 2011 were provided by the Environment Protection Department (EPD) of the Hong Kong Special Administrative Region Government, and they are grouped under ten vehicle classes.

2.11 Here is an illustration to show our calculations: the model run estimated daily VKT savings of 960, 90 and 1468 vehicle kilometres for public transport, goods vehicles and private transport, respectively, in Central/Western District during evening peak in 2011. We broke those numbers into 10 vehicle types. For example, public transport VKT savings (960) was disaggregated into VKT savings for public light buses (960 x 46.3% = 444), single-decker franchised buses (960 x 4.1% = 39) and double-decker franchised buses (960 x 49.6% = 476).

2.12 We then estimated, for example, PM reduction as a result of VKT savings and applied the PM fleet average emission factors for 2011 to the VKT numbers to determine PM reduction by vehicle types (e.g. given a 444 VKT savings for public light buses, there will be a PM reduction of 31 gram (444 x 0.07) during each evening peak hour).

2.13 Finally, we re-grouped the PM reduction figures into broad vehicle categories. Based on the calculation, we estimated a total PM reduction of 335 gram during each evening peak hour in Central/Western District in 2011 as a result of VKT savings due to WIL/SIL. We could then compare

[22] At a 4% real discount rate.

this with the corresponding figure in the base case (that is, no WIL/SIL) and obtain a percentage reduction.

Speed Improvement

2.14 WIL/SIL will lead to VKT savings that directly reduce emissions from road traffic. In addition, for remaining traffic, the reduced number of vehicles will lessen congestion and result in better speed. Therefore, we also estimated the impact of speed improvement on additional emission reductions.

2.15 Model runs show that without SIL, average road speed (in kilometers per hour) for Southern and Central/Western will fall within the range of 22.7 to 32 kph in 2011 and within the range of 20.9 to 31.7 kph in 2016. With WIL/SIL, the range is projected to become 23.6 to 32 kph in 2011 and 22.2 to 31.7 kph in 2016. In this range, which is typical for traffic in Hong Kong's urban area, increases in average speed have the benefit of reducing pollutant emissions for *each kilometer traveled.* For this study, we assumed roughly a 10% reduction in emissions for every 5 kph change in average speed[23].

2.16 We then applied the speed correction factor to speed improvement with WIL/SIL in place and obtained an extra percentage of emission reduction for the remaining road traffic.

Projected Reduction in Roadside Emissions

2.17 As a result of reduced VKT and speed improvement with WIL/SIL, we estimate roughly a 13% reduction of PM and a 7% reduction of NO_x during each morning/evening peak hour in Southern and Central/Western, respectively.

[23] Estimates derived from information in *Manual of Environmental Appraisal.* (Department of Transport, 1983)

Environmental Health Benefits

2.18 Our estimates of vehicular emissions reduction as a result of WIL/SIL were passed on to the Department of Community Medicine of the University of Hong Kong for their estimation of the associated environmental health benefits. Please see Section 5 and Appendix C for an outline of their work on environmental health benefits associated with WIL/SIL.

2.19 For more details on the methodology and calculations used for the time savings value, safety, and emission reduction estimates in this study, please refer to Appendix A.

3. Financial Returns to Government from Enhanced Property Values in WIL/SIL Catchments

Government Revenue from Rates and Property Taxes with Enhanced Property Values due to the Coming of the WIL/SIL

3. 1 Fast, safe, reliable and affordable transport increases the value of properties within catchments, reflecting an increased willingness to pay in response to improved accessibility. [24] We first looked at Rates and Property Taxes [25] and conducted separate assessments for non-residential and residential properties. We obtained plans [1:1000] and identified *each* building within a 400 meter radius of a station. The resulting list of buildings (4,000 in all) was then sent to the Government's Rating and Valuation Department (RVD) with a request to retrieve information on their specific characteristics (e.g., age, net floor area, and use [commercial, residential, industrial], and prevailing aggregate rateable values by type of use). Information on land status was obtained through land searches on the Government leases of selected lots. For this purpose, a clustering sampling of government leases was carried out. Since residential and non-residential users have different characteristics in property value, two different methodologies were adopted.

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[24] In this assessment we conservatively considered only residential and commercial properties within a 400 meter radius of a WIL/SIL station entrance. Convenient and low cost Park & Ride facilities or frequent feeder bus service considerably extends the common designation of a 'catchment' (Barron, Ng, and Kwok, 2001). However, the impact on the value of properties farther afield through good Park & Ride facilities or feeder bus services was not considered in this phase of the work.

[25] Rates are indirect taxes levied on properties and charged as a percentage of Rateable Value (5% currently). The 'Property Tax' applies to owners of leased properties and this tax is charged at 15% of rental value. However, as a practice, the tax office allows up to 20% for the owner's out-goings.

Residential

3.2 First, we sought to identify comparable estates *with and without* a nearby rail station (MTR or KCR). We developed eight pair comparisons (e.g., Tai Koo Shing & Chi Fu Fa Yuen, Kornhill & Whampoa Garden) and found that the average price differential with nearby rail for the years 2000 to 2002 was roughly 18% – 19%. In light of this, we conservatively chose 12% to represent our lower bound and 17% our upper bound. This allows for the likelihood that *some* of the higher property values in the WIL/SIL catchments may result in *value reductions* elsewhere.

3.3 We then applied these percentage increases in value (12% and 17%) to the rateable values supplied by the RVD to calculate the *rateable value enhancement to government revenue* (at 5%). For property taxes on rented and leased properties we used a level of 15%. The resulting income streams to government from rates and property taxes were then capitalized in perpetuity at a 4% real discount rate and the present value brought back to 2004.

Non-residential

3.4 We divided our non-residential value assessments into two groups: one for ground floor Gross Floor Area (GFA) and a second for upper floor GFA. We then compared values for similar developments within 400 meters (m) of an existing rail station entrance with those in each of our WIL/SIL catchments (e.g., Sheung Wan compared to Sai Ying Pun) to estimate the likely 'value enhancement'. For other WIL/SIL catchments we did similar, but separate exercises. Because ground floor commercial activities are potentially quite liable to move from one location to another, we credited only one half of our estimated effect in WIL/SIL catchments as a *net value increase for the Territory as a whole*. We then applied the standard percentages for Rates and Property Taxes to the non-residential properties within each of the WIL/SIL catchments.

Assumed Split of Owner Occupied/Let Premises

3.5 We took 10% of properties in the residential category as the *'let'* portion of residential properties and treated the remainder as owner-occupied (and hence subject to the lower level of tax, i.e. 5% per annum versus 15%). For non-residential properties (commercial/industrial) we assumed that 40% were let.[26]

Findings

3.6 As detailed in Appendix B, estimated annual revenue enhancement to government from rates is between $84 million and $103 million. The annual return from property tax is $76 million to $84 million. Capitalizing the sum from 2010 in perpetuity at a 4% real discount rate back to 2004 gives a present value as of 2004 of between $3.2 billion and $3.7 billion.

Land Premium

3.7 In addition to a rise in property values, we believe there will be potential for enhanced lease value due to selective increases in the plot ratio and new types of development (e.g., hotels) in various catchments of the WIL/SIL. To assess this, we identified those sites within our catchments where, a) the Town Planning Board has given approval for changes in land use, and b) those buildings that will be 40 years or older by 2010 as potential land for re-development. We then conducted representative searches for land leases on these sites.[27]

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[26] Overall, about 38% of property in Hong Kong is let (Inland Revenue – Schedule 7 of the 2001-02 Annual Report, Inland Revenue Department). This represents a mix of residential and non-residential properties and the share of let properties is much higher for non-residential uses. Further, corporate owners may not be liable for the property tax if their rental income is regarded as income to the company. To reflect the lack of adequate data on this matter and to take a conservative approach in estimating the relevant government revenues we adopted the assumptions that only 10% of residential and 40% of non-residential properties are leased.

[27] We consulted the Hong Kong District Planning Office which advised us that they did not anticipate a lifting of the *Pokfulam Moratorium*, nor would they, at this stage, propose any change in land use due to the WIL/SIL. In light of this we were especially conservative in estimating re-development potential in the relevant catchments (personal communication, K.K. Ling, District Planning Officer/Hong Kong District Planning Office, Planning Department, December 2, 2003).

3.8 Land searches were conducted to review the lease conditions of the land lots to determine whether there is a restriction on plot ratio or use. Where lease modifications are required, there might be premium implications for government revenue. However, our review found that most lots in relevant areas are quite old and do not have restrictions on use or development intensity. Hence, the premium accruable to government was lower than we had expected.[28] In other cases, such as the industrial lots in Wong Chuk Hang and the Hong Kong Electric Company Operations Headquarters in Ap Lei Chau, their uses are restricted and would require a land exchange or payment of premium, if they were to be redeveloped for different uses (e.g. hotels). It was such examples that accounted for most of our estimate of government revenue enhancement due to premiums.

3.9 Those sites for which there has already been an interest shown in land use changes (e.g. where a change in Town Planning Board approval has been sought or granted) formed the lower bound for our estimate for added premiums (i.e. with re-development comes the potential for increased land premiums). To form an upper bound, we added to this a few additional sites (e.g. the police station and residence at Sai Ying Pun) that we felt would be ripe for re-development with the coming of rail service.

3.10 To account for the normal problems in Hong Kong in re-development due to fragmentation of ownership, difficulty in site assembly and technical problems, we assumed that only 40% of the sites for which specific re-development interest has already been shown, and 25% of the additional sites we identified as likely to, in fact, be redeveloped within 5 years of the arrival of a WIL/SIL station.

3.11 Under these assumptions the Land Premium component of the enhancement of government revenue is between $150 and $230 million

[28] In effect the lease conditions mean that it would be private owners rather than government that would stand to profit financially from new uses.

for each of five years (2010 – 2014). At a 4% real discount rate, the 2004 present value of these returns amount to $0.7 and $1.0 billion.

With and Without A Station at Happy Valley

3.12 If an SIL station were to be added at Happy Valley the present value of estimated rates to government increase by between $0.2 billion to $0.3 billion, while the present value of the stream of property tax revenue would increase by roughly $0.1 billion. There would be no obvious case in which premiums would go up.

Cyberport

3.13 Government contributed the land at Cyberport through a joint venture with PCCW, acting as developer. Under this arrangement, government owns the non-domestic portion of the development. We examined the likely effect on rental income to government with the coming of a rail station there. Here, we adopted the same model for non-residential property value up-lift as described above.

3.14 To account for a likely *shifting effect in value* (i.e., some of the increased willingness to pay for government-owned commercial space at Cyberport being reflected in lower willingness to pay elsewhere), we credited only half of the projected increase in value of the ground floor commercial property as a net impact on government's rental income territory-wide. This gives us a present value for additional revenues to government from Cyberport (at a 4% real discount rate) of $0.4 billion.

Summary of Property Value Enhancement Impacts on Government Revenues

3.15 Combining the results from the above calculations, we obtain an estimated total of $4.3 to $5.1 billion as the direct (net) financial return to government arising from property value enhancement due to the WIL/SIL.

4. Direct Financial Returns to Private Property Owners

4.1 The methodology outlined in Section 3 for estimating private property value enhancements obviously applies here and is not repeated. Nevertheless, we should note that a private owner of property within our catchments would benefit from WIL/SIL through a general appreciation of the capital value of his/her property in response to increased willingness to pay for the improved connectivity. If the owner leased or rented that property, he or she would benefit from a commensurate increase in income. Because we are dealing here with returns to the private sector, we assumed that the private property owner requires a 7% real return of his property. (Hence we take 7% of value as the potential for annual rent). In effect, this is like applying a 7% real discount rate for the private investor.[29]

4.2 The estimated present value of the property value increases to private owners (without Happy Valley) ranges from $14.4 billion to $17.6 billion net of government rates.

4.3 For a fuller description of the methodology and calculations used for estimation of the enhancement to the property values within WIL/SIL catchments, please refer to Appendix B.

[29] Arguably private investors would tend to have a higher time value of time preference or, because of their vastly smaller portfolio, would want to apply risk premium to their discount rate.

5. Environmental Health Benefits with WIL/SIL

(This section was prepared with the collaboration of Dr. Wong Chit-Ming, Dr. Sarah McGhee, Ms Patsy Chau, Dr. Thuan Quoc Thach, and Prof. A. J. Hedley of The Department of Community Medicine, The University of Hong Kong).

Hong Kong Air Pollution-health Context

5.1 At the roadside, air quality in Hong Kong is often quite unhealthy, particularly with respect to Nitrogen Dioxide (NO_2) and Particulate Matter (PM).[30] While pollution blowing in from the Mainland contributes to the Territory's background air pollution (particularly the winter months and times of stagnant or dry air) a significant part of the responsibility for the dangerously high levels of *roadside* air pollution on *an average annual basis* must be placed on Hong Kong's own road transport, especially in areas such as Central where the street canyon effect slows its dispersal and large numbers of pedestrians are directly exposed to relatively high emission concentrations.

5.2 Urban air pollution is a major environmental risk to health.[31] It is responsible for cardiovascular and respiratory morbidity and mortality. While vulnerable groups such as children and the elderly are especially susceptible to the effects of roadside air pollution, all age groups are affected. Arguably, Hong Kong's Air Quality Objectives (AQO), are – at least in some cases – not strict enough to adequately protect health.[32]

5.3 Hong Kong has a strong record in examining the health impacts of air pollution over the last 15 years with many internationally published papers

[30] EPD, 2003
[31] WHO, 2000.
[32] For example, the Hong Kong AQO for annual average concentrations of NO_2 is 80 μ/m^3. However the WHO Europe has proposed a level of 40 as the air quality guideline. Similarly, the Hong Kong AQO for annual average PM_{10} is 80, while WHO Europe has proposed the far lower level of 30 μ/m^3 [and for $PM_{2.5}$ it proposes 20 μ/m^3] (WHO Europe, Copenhagen, 2000).

describing excess risks for respiratory symptoms, primary care use, public hospital admissions and mortality. Health benefits of air pollution reductions are seen in both younger and older members of the population.

Methods

5.4 In this costing, we used existing evidence on health risks and population mortality and morbidity to show the direct cost of illness due to air pollution (specifically, NO_2 and PM in this assessment) and the associated productivity losses. [33] To this, we apply the projected reduction in emissions expected to result from implementation of the WIL/SIL. Drawing on the estimates shown in Table 5.1, we assumed for simplicity that there is a 10% reduction across the board for both NO_2 and PM in the two districts.[34]

Table 5.1
Projected Reduction in Roadside Emissions due to the WIL/SIL

District	Time Period	Estimated Local NO_2 Reduction	Estimated Local PM Reduction
Southern	Weekly average	12%	12%
	Peak	13%	13%
Central/Western	Weekly average	6%	6%
	Peak	7%	7%

Estimates developed by this project using VKT and speed changes from MVCTS model with emissions data from EPD (Motor Vehicle Emissions Group, 2003)

5.5 We varied the estimates used to test the sensitivity of the final results. Because this costing captures only a part of the full cost of ill health due to air pollution, we also note a valuation based on local information on

[33] See, for example, Katsouyanni et al 1997, LeTertre et al 2002, Wong, CM et al 2003; and Wong, T.W. et al 2002

[34] As described in Appendix C, we used NO_x as a proxy for NO_2 (see Figure C.1). Further, we were unable to obtain up-to-date vehicular emission estimates from EPD on SO_2.

willingness to pay to avoid other effects related to these air pollutants. All methods used are in line with international recommendations and practice.

Summary Results

5.6 The annual direct benefit arising from avoided cost of illness (including productivity losses) of the WIL/SIL is about $23 million. Of this, 79% ($18 million) is reflected in direct health care expenditure. Of the health care costs, 34% are *public* health care costs falling on Government.

5.7 Hence, the present value of the combined financial impact on EXPENDITURE FOR HEALTH CARE with the levels of reduction in roadside levels of nitrogen dioxide and particulate matter estimated here is $0.35 billion [of which $0.045 billion is savings by government].

5.8 An indirect but potentially important external cost of excessive air pollution is the productivity loss associated with sick days. We estimated this value associated with productivity losses per 'event' (e.g. going to a hospital, visiting a general practitioner, or the loss of a year of life among those under 65). The estimated annual value of avoided pollution-related productivity losses associated with reduction in NO_2 and PM with the coming of the WIL/SIL is about $5 million. Over time, the present value of the continuing stream of benefits associated with avoiding roadside pollution-related productive losses is about $0.1 billion.

5.9 The value of an episode of illness goes beyond the money and time spent on health care. Feeling sick is unpleasant and something people generally would be willing to pay (WTP) to avoid. Here we looked at two sets of values not captured in the above assessments. One is the willingness to pay to avoid symptoms for which professional medical help may not be sought (e.g. coughing). The other is the willingness to pay to avoid shortening of life among adults. Based on surveys in Hong Kong, the annual willingness to pay to avoid both the symptoms and premature

death among adults is a $128 million.[35] Over time and at a 4% real discount rate this yields a 2004 present value for WTP of $3 billion.

5.10 Unfortunately, this value is spread among those persons within our catchments (where they tend to be greatest) and those outside. For those within the catchments living in private housing, at least part of their WTP is presumably captured in our property value increases. Being unable to separate out this component and given the quite different nature of the valuation techniques used in estimating WTP (i.e., contingent valuation compared to estimates of direct costs and benefits and hedonic property value pricing), we decided to not incorporate the WTP into our summary values. By doing so, we increase once again, the highly conservative nature of our estimates of the external benefits.

5.11 We should note that the values shown here are only a modest fraction of what recent findings indicate are likely to be the true benefits of reduced exposure to vehicular pollution of the scale modeled here. Not only have we been able to consider here only some of the dangerous vehicular pollutants, we have consistently applied highly conservative estimates with regard to the likely health effects. In other words we have estimated what is likely to be only a subset of the true environmental health values associated with the WIL/SIL.

5.12 Please refer to Appendix A for more information on our estimation of emissions reduction and to Appendix C for more information on the methodology used in calculating environmental health care benefits.

[35] This willingness to pay (WTP) estimate was derived by extracting data from a random sample telephone survey conducted in 2001 (1,387 observations [a 71% response rate]). The values here are WTP to avoid 1 day of symptoms (relevant to excessive exposure of nitrogen dioxide and particulate matter along the lines of what would be expected from projected reductions in roadside pollution emissions. Separately, findings from a local study to validate European data on the value of a life lost or saved were also applied to the modeling on the effects of such pollutant reduction on mortality.

6. An Economic Internal Rate of Return (EIRR)

6.1 This study has estimated a range of external economic (and financial) benefits stemming from the WIL/SIL.[36] It is such a stream of benefits that might form a major part of the comparison with government support for the WIL/SIL.

6.2 The Internal Rate of Return (IRR) is a commonly used measure to compare cost and benefit streams from a project. *The IRR is the discount rate that equalizes the present value of the benefit and cost streams.* If the calculated IRR is greater than the relevant discount rate (e.g., based on the opportunity cost of capital), then the project is attractive, since it yields more than the normal return. For assessments involving external benefits, some of which are imputed economic values, then the process is termed an Economic Internal Rate of Return (EIRR).

6.3 This study focuses on external *benefits* only. Hence, in order to calculate an EIRR for the benefit stream, we need a cost stream. For the purposes of calculating an EIRR, we make the assumption that the MTRCL's shortfall to make undertaking the WIL/SIL financially viable to the Corporation[37] is 1/3 of an assumed $15 billion capital cost of the WIL/SIL.[38] For the purposes of this analysis we assumed that half of the

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[36] As noted above financial benefits are those with market prices. Economic benefits include both benefits with market prices and those for which a monetary value must be imputed (i.e., an estimate of what the market price would likely prevail if the market existed – often referred to as a *'shadow price'*).

[37] Financial viability (i.e., without consideration of any benefits external to the Corporation's financial balance sheet) is needed to satisfy the requirement of the Corporation's private shareholders.

[38] Such a level of support is far below the levels commonly provided worldwide to urban mass transit system where 2/3 is more common. In addition, other governments also typically provide support to rail providers for the purchase of rolling stock and in some cases operating costs (Barron, Ng, and Kwok, 2001). In Hong Kong our densities mean that load factors are high enough to make consideration of support for anything other than a modest portion of the capital costs unnecessary.

$5 billion would come from government in 2005 and the remainder in 2006, while the external benefits would start in 2010.[39]

6.4 With these working assumptions, the calculated EIRR for the MONETIZED EXTERNAL BENEFITS is about 25%.

[39] Varying this assumption does not have much of an effect. For example moving the assumed timing of support to 2004 only slightly lowers the EIRR.

7. WIL/SIL Versus Route 7

7.1 As shown in Figure 7.1 below, the WIL/SIL overcomes key bottlenecks in the transport system (e.g. at the Aberdeen Tunnel and Pokfulam Road at Sai Ying Pun) for Southwestern Hong Kong Island (stretching from Kennedy Town to Ocean Park) by transferring a substantial portion of vehicular traffic from road to rail. Yet, it has been suggested that a four or six lane extension of Route 7 from Kennedy Town to Wah Kwai (via a tunnel under Mt. Davis then along the shoreline) could provide adequate traffic relief for the same general area.

7.2 While some have suggested that both the WIL/SIL and Route 7 be built, this would involve substantial oversupply of transport infrastructure and would be highly inefficient and impractical in this time of budget deficits.

7.3 The *meaningful choice* is EITHER WIL/SIL *OR* Route 7.

7.4 While the rail and road options might arguably each serve the basic purpose of helping alleviate the traffic constraints in Southwestern Hong Kong Island, they do so at quite different levels of effectiveness, financial cost to government, and in their external benefits and costs.

7.5 The WIL/SIL would be a medium capacity (mostly underground) system. Route 7 has been proposed in various forms. The following page shows several photo montages of what the shoreline version (purple colour on Figure 7.1) would look like.

Figure 7.1

West Island Line and South Island Line and Route 7

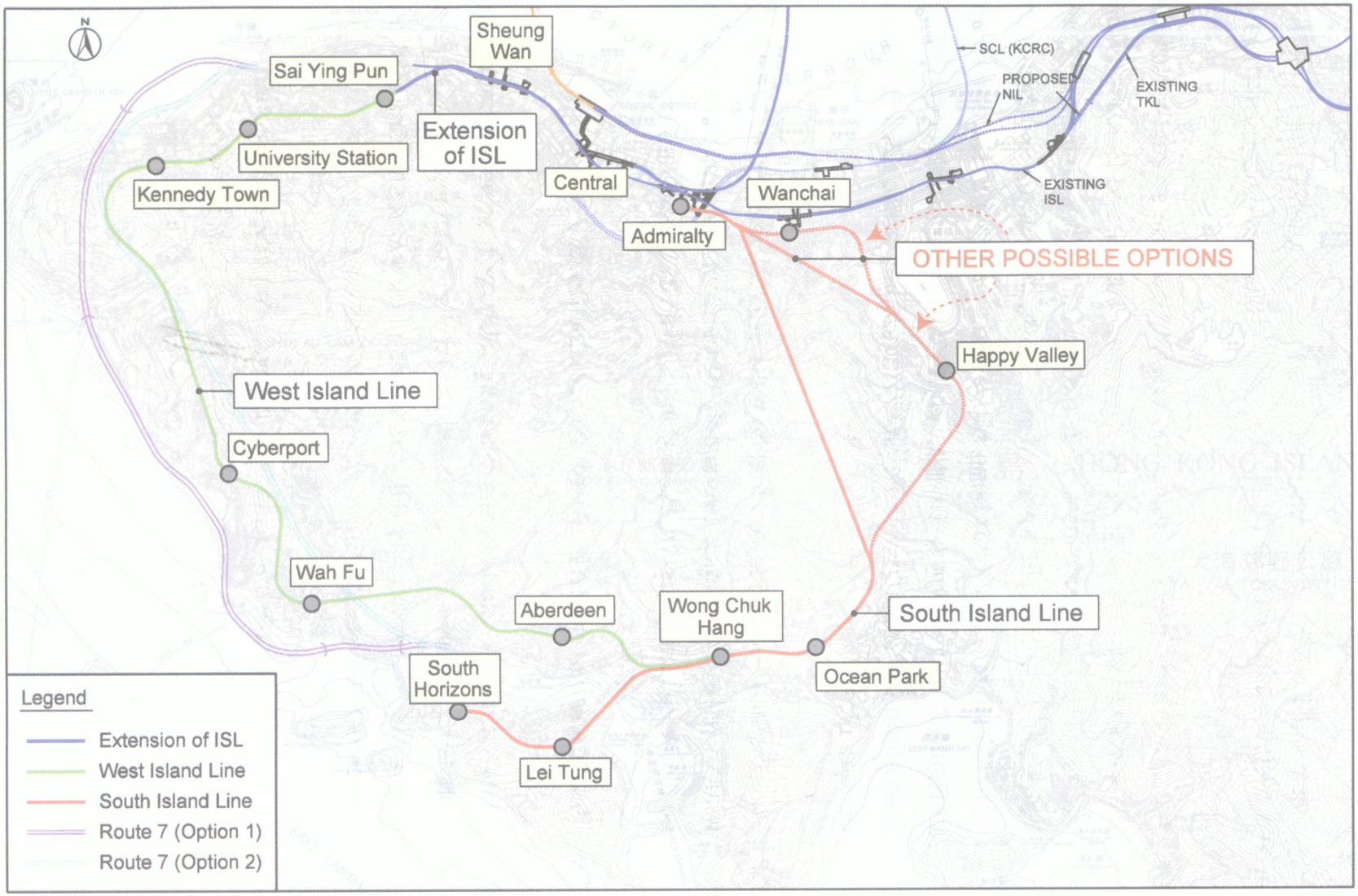

Fig. 7.2 'Pokfulam Flying Falls', Waterfall Bay, Wah Fu

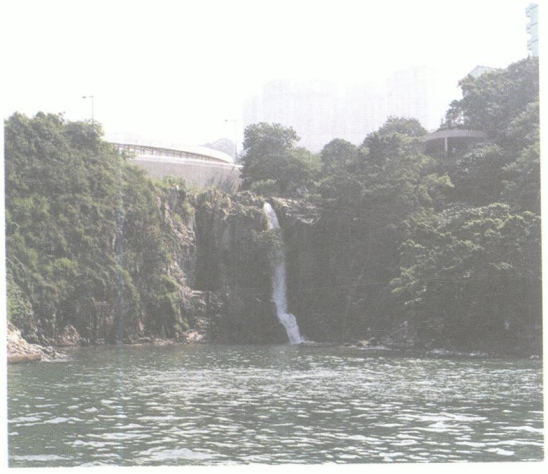

Fig. 7.3 Montage: Route 7 crossing Waterfall Bay

Fig. 7.4 Evening at East Lamma Channel (a view that could become a popular one without Route 7)

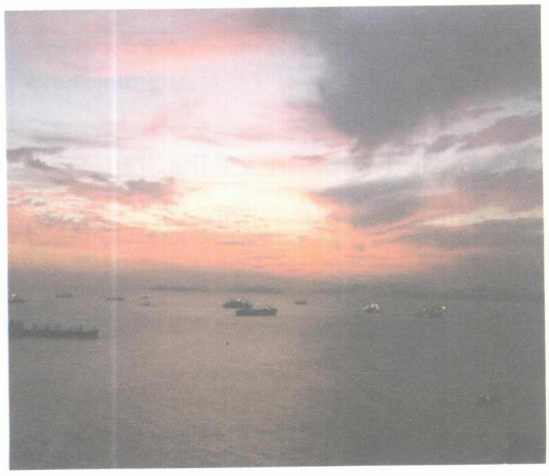

Fig. 7.5 Route 7 along East Lamma Channel

Photo Credits: Fig. 7.2 and 7.4 Bill Barron
Fig. 7.3 Jeffrey Aranita
Fig. 7.5 John Bowden, S.O.S.

7.6 It is possible that Route 7 could be put completely underground as indicated in blue in Figure 7.1. However, we should note that the approximate cost for Route 7 shown in Table 7.1 (as well as in Tables S.1 and 8.1) is based on the shoreline version. The underground version would presumably cost more for construction and incur an added on-going cost for pumping out pollution from the tunnel.

7.7 The WIL/SIL is a loop rail system overcoming the road bottlenecks at Pokfulam Road in Sai Ying Pun and at the Aberdeen Tunnel. In contrast,

> *Route 7 is a fast road between Aberdeen and Kennedy Town* (and from there on it actually contributes to traffic problems in Sheung Wan or the Aberdeen Tunnel).

7.8 As outlined in Table 7.1, WIL/SIL and Route 7 may be compared on the basis of a number of factors.

7.9 The cost to government in terms of the needed support for the WIL/SIL is less than half of that needed for construction of Route 7. Yet, the WIL/SIL's carrying capacity is twice as high.

Table 7.1

Comparison of WIL/SIL with Route 7 Extension (Kennedy Town to Wah Kwai)

Basis of Comparison	*WIL/SIL*	*Route 7*	*Net WIL/SIL*
Capacity			
Projected Passenger (capacity/direction/hr)	20,000	Less than 10,000	**+ 10,000/direction/ hr**
Goods Vehicles (usage/day)	0	25,000[a]	**- 25,000/day**
Financial Impacts on Government			
Financial Cost to Government	$5 billion[b]	$10 – 12 billion[c]	**$5 – 7 billion**
Returns to Government (property value increases)	$4.3 – 5.1 billion	↑ in some areas but ↓ where fronting Route 7	**Clearly in favour of WIL/SIL**
Direct Savings in Public Health Care Expenditures	$0.4 billion	Adds to health care costs	**Min. est. $0.4 billion ↑**
Economic Benefits to the Community			
Value of Time Savings	$18.5 billion	?	**Clearly in favour of WIL/SIL**
Net Returns to Private Property Owners[d]	$14.4 – 17.6 billion	?	**Clearly in favour of WIL/SIL**
Value of Selected Health benefits[e]	$0.5 billion	Negative	**Clearly in favour of WIL/SIL**
Environment			
Local Pollutant Emissions NO_2, PM[f]	↓ 6% – 12%	↑ 3%	**Clearly in favour of WIL/SIL**
Local Noise Impacts	Low	High: Sandy Bay – Wah Kwai	**Clearly in favour of WIL/SIL**
Options for Amenity Uses of Shoreline	Keeps shoreline free for alternative uses	Removes options, including at Waterfall Bay and Cyperport[g]	**Clearly in Favour of WIL/SIL**
Traffic Relief			
Congestion in Central/Wan Chai (Central Business District)	Reduces road traffic and lessens congestion in the Central Business District	Increases road traffic and adds to congestion in the Central Business District	**Clearly in favour of WIL/SIL.**

Notes to Table 7.1

[a] Highways Department 15/12/99.

[b] Approximate level based on assumed 1/3 funding deficit for the capital cost of $15 billion.

[c] Construction cost only. Fuel taxes for projected vehicle usage of Route 7 about cover annual maintenance costs (Barron and Kwok, 2000). Since maintenance costs for the WIL/SIL is covered by passenger fares, capital costs to government for WIL/SIL and Route 7 are comparable one-off outlays (unless Route 7 is put entirely in tunnel which incurs on-going electricity costs to clear pollution from the long tunnel).

[d] Net of rates and without Happy Valley.

[e] Includes PM and nitrogen dioxide direct avoided costs for private health care, value of avoided sick time and premature death; excludes impacts of other vehicular pollutants.

[f] While electric power for WIL/SIL increases power generation, it appears likely that the coming of the WIL/SIL will move forward the timing of the increasing role for natural gas in Hong Kong Electric's power plants. Such a shift will tend to offset the added emissions from greater power generation. Further, exposures to roadside and power plants emissions are not directly comparable. Roadside emissions expose large numbers of persons to relatively concentrated toxins.

[g] Except where the four to six lane Route 7 is in tunnel.

7.10 In addition, unless Route 7 is entirely underground (which presumably comes at a higher construction cost and annual outlays for electric power for ventilation) it takes up yet more of Hong Kong Island's shrinking shoreline (i.e. the part that has not yet been effectively destroyed for amenities uses by a highway running along its length). Finally, and certainly not least, Route 7 adds to exposure of roadside pollution and noise, while the WIL/SIL lessens exposure to both.

7.11 Indeed, the only point for which Route 7 comes out ahead is for its capacity to handle goods vehicles. Yet, the trend of the daily movement of goods vehicles across the Hong Kong external cordon from 1992 through 2002 has been a downward one.[40] In addition, the WIL/SIL with its capacity of up to 20,000 passengers per hour per direction would certainly free-up peak period road space in the Aberdeen Tunnel and Pokfulam Road[41] and that would allow for an increase in goods vehicle traffic if and when it occurs.

[40] The average for 1998- 2002 is down about 9% from that for 1992-1997.
[41] Of course, another approach to the problem of goods vehicles adding to congestion would be to restrict (or charge for) the movement of goods vehicles at the peak periods in the most congested areas.

8. Wrap-up

8.1 At this point it is useful to show the summary table again (here labeled Table 8.1). Overall, WIL/SIL offers considerable external benefits – a significant portion of which are in the form of financial benefits to the private sector and government.

8.2 We have demonstrated that even considering only direct external benefits (and doing so in a highly conservative manner so as to make the findings robust) the external benefits are substantial. Further, a significant portion of the external benefits result in enhancements to government revenues.

8.3 In addition to the direct external benefits, it is likely that significant indirect ones exist in the form of higher employment and rejuvenation of older areas. With respect to the catchments of the WIL/SIL such indirect external benefits are the subject of on-going research.

Table 8.1
Summary of Direct External Benefits

Type of External benefit	Annual Benefits *(HK $ Million)*	Present Value in 2004 of future returns *(HK$ Billion)*[a]
ECONOMIC VALUE OF TIME SAVINGS/SAFETY[b]	**$ 1,016**	**$ 18.5**
Time Savings	$ 985	$ 17.9
Safety Benefits	$ 31	$ 0.6
PROPERTY VALUE INCREASES	**$1,594 – 1,978**	**$ 18.7– 22.7**
Private Property Owners (w/o Happy Valley)[c]	$1,266 – 1,543	$ 14.4 – 17.6
Financial Returns to Government[d]	$ 328 – 435	$ 4.3 – 5.1
Rates	*($ 84 – 103)*	*($1.7 – 2.0)*
Property Tax	*($ 76 – 84)*	*($ 1.5 – 1.7)*
Land Premium[e]	*($ 150 – 230)*[e]	*($ 0.7 – 1.0)*
Cyberport Rent	*($ 18)*	*($ 0.4)*
ENVIRONMENTAL HEALTH BENEFITS[f]	**$ 23**	**$ 0.4**
Direct PRIVATE Health Care Savings	$ 12	$ 0.3
Direct PUBLIC Health Care Savings	$ 6	$ 0.045
Avoided Productivity Losses	$ 5	$ 0.1
TOTAL DIRECT EXTERNAL BENEFITS	**$2.6 – 3.0 billion/ yr.**	**≈ $ 38 – 42 billion**
EIRR[g]	**NA**	**24% to 26%**
If Route 7 is canceled, net financial benefits to government go up by an additional		**≈ $ 12 billion**

Notes to Table 8.1

[a] This column represents annual values summed in perpetuity and discounted at a real rate of 4% for government income, and discounted to 2004. The stream of benefits begins in 2010. For private property, the increase in value is assumed to generate a rental income equal to 7% of value. If the rate were to be lower, owners would find it more profitable to sell their property and invest the assets elsewhere. In effect, this approach raises the real discount rate for the private property owner to 7%.

[b] At first glance these time savings benefits may appear to be rather low. However, in contrast to many other studies of external benefits of major transport infrastructure, we have separately identified expected property value increases. Since the value of time savings is one of the features likely to drive up property values in the WIL/SIL catchments, we avoided double-counting by including only the time savings of Southern and Western residents who live in public housing (and hence do not participate in the property value changes).

[c] Net of rates to government. Happy Valley would add $1.3 to $1.5 million/year in net external benefits to private property owners. The 'annual' value is based on the estimated increase in value for properties using 'let' properties as the guide. Research carried out as part of this study confirms that this assumption is a realistic one.

[d] Conservatively estimated to offset likelihood of value transfer from elsewhere in Hong Kong.

[e] To reflect the likelihood that not all of the land premium would come to government in 2010 (the projected start of WIL/SIL operation), we spread the premium out over 5 years. Hence, while the other figures in the annual benefit column are in perpetuity, this one is only for 5 years (2010-2014).

[f] We estimated effects of a 10% reduction in PM and NO_2. Effects of other transport pollutants such as SO_2, CO, and hydrocarbons are not assessed here. The values are also exclusive of an estimated $3.0 billion in associated *willingness to pay* (WTP). In other words the values shown here are only a sub-set of actual values.

[g] From the perspective of a 1/3 government capital contribution to WIL/SIL (i.e., $ 5 billion of $15 billion). If the full capital cost ($15 billion) is applied, the EIRR is 12% to 13%.

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Appendix A

Economic Evaluation of Time Savings, Safety Benefits, and Estimation of Emissions Reduction with WIL/SIL

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A.1 Introduction

A.1.1 Appendix A elaborates the methodology for the imputed economic value of time savings and road safety benefits associated with the introduction of the West Island Line and South Island Line (WIL/SIL) It also describes the estimation procedures for roadside pollutant emissions reduction which became the baseline information for the estimates of environmental health benefits by the University of Hong Kong's Department of Community Medicine shown in Appendix C which follows.

A.1.2 These estimates are based on WIL/SIL alignment 7ADS using the MVA transport model (MVCTS). The base year of the project is 2010, but all dollar values are shown in terms of 2004 present values[1]. In terms of the purchasing power of the dollars they are in constant 2002 dollar values.

[1] In order to be consistent with MTRC practices, values for the base year are brought back to the present (for example a value for 2010 is discounted by the factor of $(1.04)^6$ to bring it back to a 2004 *present* value)

A.2 Time Savings

Overview

A.2.1 We used the MVCTS model, an SAR-wide multi-modal forecasting model[2] developed and updated by MVA over a period of 20 years, as the basis of our estimations for improved journey times. Model runs were made for the years 2011 and 2016, with and without the WIL/SIL, to obtain daily travel time saved for public transport passengers (in hours), private vehicle users and goods vehicles (both in vehicle-hours). Public transport passenger time savings refers to savings for both rail and non-rail public transport passengers (i.e., they also reflect the time savings experiences by road users stemming from reduced traffic congestion with the coming of the new rail service). We then converted daily time savings into annual time savings by a set of annualisation factors as shown in Table A.1.

Table A.1
Annualisation Factors for Economic Evaluation

Cost/Benefit/Revenue Item	*Annualisation Factor*
Public transport user benefits	354
Private vehicle user benefits	350
Benefits for goods vehicles	325
Daily traffic flows (for use in accident analysis)	350

Adapted from MVA/Maunsell (2000).

[2] This model is compatible with the CTS model used by government. It estimates trip generation, trip destination, modal choice, and assignment of travel routes between pairs of origins and destinations. (MVA Working Paper 3: Validation of Domestic Transport Model, March 2003).

A.2.2 Based on the annual time saved for years 2011 and 2016, we estimated annual time savings for the study period, from 2010 to 2049. We assumed a linear pattern for changes in time savings from 2010 to 2016, and no increase in time savings beyond 2016.[3] Time savings for 2010 and for the years between 2011 and 2016 are estimated by extrapolation and interpolation, respectively. Time savings for the post-2016 years are set constant at the 2016 value.

A.2.3 Annualised time savings are then multiplied by a set of values of time (VOT) (dollars per hour) by user class to obtain a monetized value for each year. For public transport users, we used the MVCTS assumption which is based on a value of time estimated during the Travel Characteristics Study in 1992. For private vehicle users, the value of time was adopted from CTS-3, and is derived from behavioural values and average occupancy rates. For goods vehicles, time value was estimated from a set of relationships developed also for CTS-3. We have converted all values of time into constant 2002 dollar values for this study. Table A.2 below shows some of these values.

Table A.2
Values of Time (VOT) (HK$/hour, at 2002 prices)

Year	*Public Transport Evaluative VOT*	*Private Transport VOT*	*Goods Vehicles VOT*
2001	46 54	82	207
2006	50.09	88	223
2011	54.92	97	244
2016	60.69	107	270

Source: MVCTS assumptions.

A.2.4 Values of time are assumed to increase over time in line with the forecast growth of real GDP per capita, and we estimated the value for

[3] In effect this adds to the conservativeness of our estimates of the value of time savings.

each year in different user groups over the study period. These values were then applied to the results from the model.

The Issue of Double Counting

A.2.5 We ran the model in such a way as to avoid double counting of benefits. The argument here is that the imputed value of time savings benefits accrues to tenants and property owners in Southern and Western is likely to be reflected in the higher rents the tenants are willing to pay and also in higher property values. In order not to double count, we applied the time savings value only to the proportion of residents living in public rental housing (PRH) in Southern and Western Districts, as the benefits of time savings with the coming of the WIL/SIL is not reflected in the rent paid by public housing residents. For travellers living in other districts we count the full value of time savings, since we would expect limited or no change in property value in those districts as a result of WIL/SIL.[4]

A.2.6 Based on the 2001 Census, we calculated the percentage of PRH residents for both Southern and Western Districts. We then use the percentages as factors to estimate time savings benefits accrued to PRH residents in the two districts. For Southern District, the factor is 0.38 and for Western District 0.034 (see Table A.3).

[4] This approach underestimates the actual time savings by probably is 15% to 20% since it does not capture those persons living in private housing in the two districts (Southern and Western) who are not within our 'walk-in' catchments of 400 meters from a WIL/.SIL station. In other words, those persons who probably will experience some level of property value increase (though not the full effect experienced by those residents within a catchment). However, since we did not investigate such property impacts outside the catchments, we simply leave out this component of benefits, thus adding to overall conservativeness of our estimates of external benefits.

Table A.3
Public Rental Housing (PRH) Residents in Southern and Western

Area	*Population*	*PRH Residents*	*Percentage*
Southern District	290 240	110 529	38.1%
Western District*	182 956	6 291	3.4%

* Western District includes the six tertiary planning units (TPUs) of 1.1.1; 1.1.2; 1.1.3; 1.1.5; 1.1.6; and 1.4.1

Sources: Census and Statistics Department (2002); Planning Department (2001).

Benefits for Public Transport Passengers

A.2.7 From the sector matrix provided by the MVCTS mode, which shows daily time saved in hours based on all origin and destination (O-D) pairs between major geographical areas, we were able to examine all the time savings benefits associated with Southern and Western Districts.

A.2.8 For example, we obtained public transport users' daily travel time savings in hours from the model runs for 2011, and the numbers are presented by major O-D pairs as in Table A.4 below.

Table A.4
Example: Daily Public Transport Time Savings by Major O-D Pairs, 2011

Origin-Destination (O-D) Pairs	*Daily Time Saved (hours)*
Southern-Rest / Rest-Southern	38,043
Western-Rest / Rest-Western	16,885
Southern-Western / Western-Southern	3,497
Southern-Southern	2,098
Western-Western	94
Rest-Rest	784
Total	**61,401**

A.2.9 By multiplying daily time savings by an annualisation factor of 354 for public transport user benefits (see Table A.1) and also to a time value of

HK$54.92 for public transport users in Year 2011 (see Table A.2), we then came up with a set of monetized values of annual travel time savings for public transport passengers in 2011 as shown in Table A.5.

Table A.5
Illustrative Example:
Annual Public Transport Time Saved in Dollar Value, 2011

O-D Pairs	***Annual Time Saved (HK$ million, 2002 prices)***
Southern-Rest / Rest-Southern	740
Western-Rest / Rest-Western	328
Southern-Western / Western-Southern	68
Southern-Southern	41
Western-Western	2
Rest-Rest	15
Total	**1,194**

A.2.10 From Tables A.4 and A.5, for example, we can tell that for all the public passenger trips made between Southern District and the rest of Hong Kong in 2011, there will be a daily time savings of roughly 38,000 hours, and in monetary terms sum up to an annual savings of HK$740 million.

A.2.11 However, trip purpose is not retained in MVA's public transport model. Consequently, we were unable to identify from the outputs of the model the residency of public transport trips. Hence, the proportion of time savings benefits enjoyed by residents of Southern and Western Districts is unclear (for example, a trip between Southern District and the rest of Hong Kong may be made by a resident living in North Point). For our estimation, we assumed that, for each origin and destination (O-D) pair, half of the trips are inbound and the other half outbound; half of the trips are made by residents living in the origin and the other half by residents living in the destination.

A.2.12 For reasons stated in the last section on double counting, we then applied the PRH factors (see Table A.3) to the proportion of trips made by Southern or Western District public rental housing residents. For trips made by travellers living in other districts, we applied a factor of 1 to reflect the full value of time savings. The calculation of time savings benefits for different O-D pairs is set out in Table A.6.

Table A.6
Calculation of Public Transport Time Savings for each O-D Pair

O-D Pairs	***Calculation***
Southern-Rest / Rest-Southern	0.38 x 0.5 x time saving benefits (TS) + 1 x 0.5 x TS
Western-Rest / Rest-Western	0.034 x 0.5 x TS + 1 x 0.5 x TS
Southern-Western / Western-Southern	0.38 x 0.5 x TS + 0.034 x 0.5 x TS
Southern-Southern	0.38 x TS
Western-Western	0.034 x TS
Rest-Rest	1 x TS

A.2.13 Based on this approach, we estimated the following public transport time savings (in dollar) for 2011 in the illustrative example, as shown in Table A.7.

Table A.7
Example: Factored Time Savings for Public Transport Users in 2011

O-D Pairs	***Factored Annual Time Saved (HK$ million, 2002 prices)***
Southern-Rest / Rest-Southern	510.70
Western-Rest / Rest-Western	169.70
Southern-Western / Western-Southern	14.10
Southern-Southern	15.50
Western-Western	0.06
Rest-Rest	15.20
Total	**725.40**

A.2.14 For a period of 40 years at 4% discount rate[5], we estimated a time savings benefit of HK$15.1 billion for all public transport users.

Benefits for Road Users

A.2.15 A procedure similar to the one for public transport users was used to estimate time savings benefits accrue to private vehicles. However, as highway/road benefits listed by area are based on kilometerage travelled in each area, and there is no connection to residency, we assumed that half of the private vehicle trips made in each of the area is associated with residents of Southern or Western Districts, and we do not count the time savings benefits associated with these trips (assuming such benefits are already reflected by property value increase). The calculation of time savings benefits for travellers on private vehicles are set out in Table A.8.

[5] Aspects of the methodologies for time saving and property values were developed independently This led us to an inconsistently in the time frames. At 4% the 40 years evaluation period undercounts benefits by about 22% compared to the in perpetuity approach. However at about 40 years there is likely to be significant capital replacement on the WIL/SIL lines. We did not account for this since our focus is on benefits. Hence, in this respect a forty year timeframe is appropriate. Nonetheless, for property values this horizon arguably is artificially short. In the end we decided to the leave the separate assessments as they stand and again note that we defend our estimates as broadly indicate of actual values, rather than claiming, they are precise.

Table A.8

Calculation of Time Savings for Private Vehicle Users

District	*Calculation*
Southern	0.5 x time saving benefits (TS)
Central/Western	0.5 x TS
Other Districts	0.5 x TS

A.2.16 By way of illustration, Table A.9 shows annual travel time savings for private vehicle users in vehicle-hours from the model runs for 2011. By applying a time value of HK$97 per hour for private vehicles in 2011 (see Table A.2), we obtained monetized value of the time saved for 2011.

Table A.9

Example: Annual Time Savings for Private Vehicle Users, 2011

District	*Annual Time Saved (vehicle-hours)*	*Annual Time Saved (HK$ million, 2002 prices)*
Southern	452,377	44
Central/Western	317,088	31
Rest of HK Island	345,456	33
Total Hong Kong	1,469,431	142

A.2.17 We then applied the formulae in Table A.8 to these numbers and came up with the following factored dollar values in Table A.10.

Table A.10
Example: Factored Annual Time Savings for Private Vehicle Users, 2011

District	***Factored Annual Time Saved (HK$ million, 2002 prices)***
Southern	22
Central/Western	15
Rest of HK Island	17
Total Hong Kong	**71**

A.2.18 Based on this approach, we estimated a time savings benefit of HK$1.8 billion for road users travelling in private vehicles at 4% discount rate over 40 years.

A.2.19 Unlike public transport and private vehicle trips, we considered the full value of time savings for all goods vehicle trips. We estimated a benefit of HK$0.9 billion for all goods vehicle trips at 4% discount rate over 40 years.

Total Time Savings

A.2.20 All time savings for public transport users, private transport users and goods vehicles were then summed in perpetuity and discounted at 4% back to 2004. Our estimate of the imputed economic value of travel time savings is HK$17.9 billion.

A.3 Safety Benefits

A.3.1 Once again we used the MVCTS model as the basis for our estimation of safety benefits. Model runs were made for the years 2011 and 2016, with and without WIL/SIL, to estimate changes in passenger car unit-kilometre (pcu-km) travelled by major vehicle classes (public transport, private vehicles and goods vehicles).

A.3.2 The marginal impact of the WIL/SIL in terms of changes in pcu-km travelled was converted into vehicle-kilometre travelled (VKT) by a set of conversion factors (Table A.11). Daily VKT was also converted into annual VKT by an annualisation factor of 350 for accident analysis (see Table A.1).

Table A.11
PCU to Vehicle Conversion Factors

Year	*Private Vehicle PCU to Vehicle*	*Goods Vehicle PCU to Vehicle*	*Public Transport PCU to Vehicle*
2011	1.054	1.749	3
2016	1.050	1.767	3

Source: MVCTS assumptions.

A.3.3. Table A.12 illustrates what the data look like after conversions for private vehicle trips.

Table A.12
Example: Impact of WIL/SIL on Private Vehicle Trips, 2011

	Daily PCU-km
Southern without WIL/SIL	693,925
Central/Western without WIL/SIL	1,039,957
Hong Kong without WIL/SIL	21,291,434
Southern with WIL/SIL	670,469
Central/Western with WIL/SIL	1,018,942
Hong Kong with WIL/SIL	21,202,695

	Daily PCU-km saved	***Daily VKT saved***	***Annual VKT saved (million)***
Net changes in Southern	23,455	22,254	7.8
Net changes in Central/Western	21,015	19,939	7.0
Net changes in Hong Kong	88,739	84,193	29.5

A .3.4 We then applied a set of accident rates by major vehicle types per million VKT (Table A.13), developed by Transport Department, to determine the reduced number of accident cases as a result of changes in VKT travelled.

Table A.13
Accident Rates

Vehicle Type	***Accident Rate per million veh-kms***
Public buses	4.00
Private vehicles/taxis	1.72
Goods vehicles (light, medium and heavy)	1.91

Source: MVA/Maunsell (2000).

A.3.5 Based on the annual VKT savings for private vehicles in 2011, we estimated a reduction of approximately 51 cases of road traffic accidents as a result of that savings (29.5 x 1.72).

A.3.6 Safety benefits were then estimated by applying an accident cost to the reduced number of accident cases. We used an average accident cost of HK$115,500 (at 1998 prices), the same value proposed to be used in the RDS-2 final economic evaluation, for this study. The cost was re-valued by the GDP deflator at 2002 prices. The value per accident in any future year was then adjusted to account for projected growth in gross domestic product (GDP) per capita. Table A.14 shows accident costs for selected years.

Table A.14
Cost per Accident for Selected Years

Year	*Cost per Accident (HK$, 2002 prices)*
2001	153,112
2006	164,787
2011	180,694
2016	199,670

A.3.7 By using the same example, a reduction of 50.68 cases of road traffic accident in 2011 can be converted into a safety benefit of roughly HK$9.2 million.

A.3.8 We estimated safety benefits for all VKT savings (private vehicles, public transport and goods vehicles) over a period of 40 years. The imputed economic values of avoided road accidents were summed at perpetuity and discounted at 4% back to 2004. Our estimation of safety benefits is in the order of HK$0.6 billion.

A.4 Emissions Reduction

A.4.1 We estimate reductions in vehicular emissions both as a function of reduction in VKT and a function of speed improvement for Southern and Central/Western Districts. Model runs were made for 2011 and 2016, with and without WIL/SIL, to show marginal impact WIL/SIL in pcu-kms and in vehicle speed during morning peak, evening peak and off-peak periods.

Reduction in VKT

A.4.2 Daily pcu-kms by broad vehicle types (public transport, private vehicles and goods vehicles) during morning peak, evening peak and off-peak periods were converted into daily VKT by a set of conversion factors (see Table A.11). Reductions in VKT due to WIL/SIL in different time periods were then obtained for both 2011 and 2016.

A.4.3 We employed the latest fleet average emission factors (in gram/VKT by vehicle class) to estimate the scale of emission reduction as a result of reduced daily VKT for a number of common pollutants, including particulate matter (PM) and nitrogen oxides (NO_x). Emission factors for the years from 1991 to 2011 are provided by the Environment Protection Department (EPD) of the Hong Kong Special Administrative Region Government, and they are grouped under ten vehicle classes. Table A.15 below is an example of the emission factors provided by EPD. We assumed that emission factors for the years beyond 2011 will remain constant at the 2011 level.

Table A.15
Fleet Average Emission Factors for PM (g/km)

Year	*Private Vehicles*					*Goods Vehicles*		*Road-based Public Transport*		
	M/C	P/C	Taxi	PV	NFB	LGV	HGV	PLB	FBSD	FBDD
1991	0.03	0.04	0.76	0.77	1.45	0.62	1.48	0.84	1.62	1.62
1992	0.03	0.04	0.76	0.78	1.48	0.62	1.48	0.84	1.48	1.48
1993	0.03	0.04	0.76	0.78	1.48	0.62	1.48	0.84	1.48	1.48
1994	0.03	0.04	0.76	0.78	1.48	0.62	1.48	0.84	1.49	1.49
1995	0.03	0.04	0.75	0.77	1.48	0.61	1.48	0.80	1.48	1.48
1996	0.03	0.04	0.70	0.74	1.46	0.58	1.46	0.76	1.47	1.47
1997	0.03	0.04	0.65	0.74	1.56	0.54	1.42	0.72	1.49	1.49
1998	0.03	0.04	0.52	0.65	1.44	0.46	1.37	0.59	1.38	1.38
1999	0.03	0.04	0.46	0.59	1.35	0.42	1.29	0.53	1.32	1.32
2000	0.03	0.04	0.15	0.55	1.21	0.38	1.17	0.49	1.23	1.23
2001	0.03	0.03	0.08	0.40	0.97	0.28	0.94	0.34	0.88	0.88
2002	0.03	0.03	0.04	0.33	0.86	0.25	0.90	0.28	0.78	0.78
2003	0.03	0.03	0.01	0.28	0.79	0.21	0.84	0.24	0.74	0.74
2004	0.03	0.03	0.01	0.25	0.72	0.18	0.77	0.21	0.72	0.72
2005	0.03	0.03	0.01	0.22	0.65	0.16	0.71	0.17	0.69	0.69
2006	0.03	0.03	0.01	0.20	0.58	0.13	0.65	0.16	0.67	0.67
2007	0.03	0.03	0.01	0.18	0.52	0.12	0.57	0.14	0.61	0.61
2008	0.03	0.03	0.01	0.17	0.44	0.11	0.50	0.12	0.57	0.57
2009	0.03	0.03	0.01	0.15	0.40	0.10	0.43	0.09	0.53	0.53
2010	0.03	0.03	0.01	0.13	0.37	0.09	0.40	0.08	0.49	0.49
2011	0.03	0.03	0.01	0.12	0.33	0.09	0.36	0.07	0.45	0.45

Keys: M/C (motor cycles); P/C (private cars); PV (private vans, those registered as light bus with TD); NFB (non-franchised buses); LGV (light goods vehicles); HGV (heavy goods vehicles); PLB (public light buses); FBSD (single-decker franchised buses); FBDD (double-decker franchised buses).

Source: Personal communication from Mr. Ha Kong, Dr. Pao Lap-yan and Dr. Carol K L Wong, Motor Vehicle Emissions Group, Environmental Protection Department, 7 October 2003.

A.4.4 In order to apply the fleet average emission factors, we first disaggregated all the VKT numbers from three broad vehicle classes (public transport, private vehicles and goods vehicles) to a 10-vehicle class breakdown. We chose typical 16-hour traffic flow statistics documented in *the 2002 Annual Traffic Census for the Hong Kong External Cordon* as a reference for our conversion (Table A.16).

Table A.16
Vehicle Class Breakdown by Traffic Flow

	Private Vehicles					*Goods Vehicles*		*Road-based Public Transport*		
	M/C	**P/C**	**Taxi**	**PV**	**NFB**	**LGV**	**HGV**	**PLB**	**FBSD**	**FBDD**
Traffic Flow	3.7%	60.6%	28.6%	2.8%	4.3%	80.7%	19.3%	46.3%	4.1%	49.6%
	100%					100%		100%		

A.4.5 We then applied the fleet average emission factors to the reduced VKT (by 10 vehicle classes) and obtained a set of numbers showing reduction in pollutant emission in quantity by vehicle types, by periods of time and by districts. By aggregating these numbers we were able to illustrate, in Southern and in Central/Western, reductions in emission of various pollutants during morning peak, evening peak and off-peak periods.

A.4.6 Here is an illustration to show our calculation:

The model run estimated daily VKT savings of 960, 90 and 1468 vehicle kilometers for public transport, goods vehicles and private transport, respectively, in Central/Western District projected by MVCTS for the evening peak in 2011. We broke those numbers into 10 vehicle types based on the percentages in Table A.15. For example, public transport VKT savings (960) was disaggregated into VKT savings for public light buses (960 x 46.3% = 444), single-decker franchised buses (960 x 4.1% = 39) and double-decker franchised buses (960 x 49.6% = 476). Table A.17 below shows the VKT savings by 10 vehicle types.

Table A.17

Example: VKT Savings by 10 Vehicle Classes

	Private Vehicles					*Goods Vehicles*		*Road-based Public Transport*		
	M/C	**P/C**	**Taxi**	**PV**	**NFB**	**LGV**	**HGV**	**PLB**	**FBSD**	**FBDD**
VKT	54	890	420	41	63	73	17	444	39	476
saved	3.7%	60.6%	28.6%	2.8%	4.3%	80.7%	19.3%	46.3%	4.1%	49.6%

A.4.7 We estimated PM reduction stemming from the VKT, by applying the PM emission factors for 2011 to the VKT numbers (by vehicle class) to determine PM reduction by vehicle types. For example, given a 444 VKT savings for public light buses, there will be a PM reduction of 31 gram (444 x 0.07) during each evening peak hour (Table A.18).

Table A.18
Example: Estimation of PM Reduction

	Private Vehicles					*Goods Vehicles*		*Road-based Public Transport*		
	M/C	**P/C**	**Taxi**	**PV**	**NFB**	**LGV**	**HGV**	**PLB**	**FBSD**	**FBDD**
VKT saved	54	890	420	41	63	73	17	444	39	476
Emission factor (g/km)	0.03	0.03	0 01	0.12	0.33	0.09	0.36	0.07	0.45	0.45
PM Reduction (in gram)	2	27	4	5	21	7	6	31	18	214

A.4.8 Finally, we re-grouped the PM reduction figures into broad vehicle categories (Table A.19). Based on the calculation, we estimated a total PM reduction of 335 gram during each evening peak hour in Central/Western District in 2011 as a result of VKT savings due to WIL/SIL. We could then compare this with the corresponding figure in the base case (that is, no WIL/SIL) and obtain a percentage reduction. In this case, we estimated PM emissions of 5,574 gram for each evening peak hour in Central/Western District in 2011. Hence, a PM

reduction of 335 gram per hour as a result of SIL represents roughly a 6% PM reduction in each evening peak hour.

Table A.19
Estimated PM Reduction: Private Vehicles, Goods Vehicles, Public Transport: An Example

	Private Vehicles					*Goods Vehicles*		*Road-based Public Transport*		
	M/C	**P/C**	**Taxi**	**PV**	**NFB**	**LGV**	**HGV**	**PLB**	**FBSD**	**FBDD**
PM Reduction (in gram)	2	27	4	5	21	7	6	31	18	214
			59			13			263	

A similar process was conducted with respect to nitrogen dioxide emissions.

Speed Improvement

A.4.9 WIL/SIL will lead to VKT savings that directly reduce emissions from road traffic. In addition, for remaining traffic, the reduced number of vehicles will lessen congestion and result in better speed. Therefore, we also estimated the impact of speed improvement on additional emission reductions.

A.4.10 Model runs show that without WIL/SIL, average road speed (in kilometres per hour) for Southern and Central/Western will fall within the range of 22.7 to 32 kph in 2011 and within the range of 20.9 to 31.7 kph in 2016. With the WIL/SIL, the range will become 23.6 to 32 kph in 2011 and 22.2 to 31.7 kph in 2016. In this lower speed range, which is typical for traffic in Hong Kong's urban area, increases in average speed have the benefit of reducing pollutant emissions for *each kilometer traveled.* For this study, we roughly assumed a 10% reduction in emissions for every 5 kph change in average speed.[6]

[6] This approximation drew on information in *Manual of Environmental Appraisal.* (Department of Transport, 1983)

A.4.11 We then applied the speed correction factor to speed improvement with WIL/SIL and obtained an extra percentage of emission reduction for the remaining road traffic.

A.4.12 In the last example we estimated a total PM reduction of 335 gram during each evening peak hour in Central/Western District in 2011 as a result of VKT savings due to WIL/SIL. If WIL/SIL also improves speed by 0.4, 0.1 and 0.2 kph for public transport, goods vehicles and private vehicles during the same time period, we estimated an extra PM reduction of 14, 3 and 9 gram for the three vehicle classes, respectively (see Table A.20).

Table A.20
Example: Emission Reduction and Speed Improvement

	Private Vehicles	***Goods Vehicles***	***Road-based Public Transport***
Hourly PM emission from remaining VKT, with SIL (in gram)	2 135	1 298	1 806
Speed improvement (in kph)	0.2	0.1	0.4
Speed correction factor	0.02	0.02	0.02
Extra PM reduction (in gram)	9	3	14

Total Reduction in Vehicular Emissions

A.4.13 The two sets of emissions reduction estimates (by VKT saved and by improved speed) are additive and were estimated for both PM and NO_2. As outlined in the example for PM given above, we estimated a total PM reduction of 361 (335 + 26) gram per evening peak hour in Central/Western in 2011 as a result of the WIL/SIL.

Environmental Health Benefits

A.4.14 Based on our estimates of PM and NO_2 vehicular emissions reduction as a result of WIL/SIL, the Department of Community Medicine of the University of Hong Kong then applied their model to calculate environmental health benefits associated with the WIL/SIL. Please refer to Appendix C for details of that methodology.

A.5 References for Appendix A

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Appendix B

Lands and Buildings Value Assessment

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March 2004

B.1 Objective

B.1.1 The objective of the Study is to assess the likelihood and scale of an increase of property value (and subsequent returns accruable to Government and private property owners) with the coming of the proposed West Island Line and South Island Line (WIL/SIL) for southwestern Hong Kong Island.

B.1.2 The types of potential returns to property owners' returns and government we considered include the following:

(1) Financial returns due to property value enhancement accruing to private property owners in the catchments

(2) Associated revenues accruing to Government as a result of increased property value within the catchments from
   (a) increased rates
   (b) increased property tax on leased properties
   (c) the land premium from lease modification/land exchange, as required, upon redevelopment
   (d) added rental income to Government from non-domestic portion of Cyberport

(3) Financial returns due to property value enhancement accruing to private property owners in the catchments

B.2 Methodology

B.2.1 Stations Examined in the Property Value Assessment

Eight stations along the WIL and SIL were selected for the Study. They are: -

(1) Sai Ying Pun (SYP) (WIL)
(2) University Station (UNI) (WIL)
(3) Kennedy Town (KET) (WIL)
(4) Cyberport (CYP) (WIL)
(5) South Horizons (SOH) (SIL)
(6) Aberdeen (ABE) (SIL)
(7) Wong Chuk Hang (WCH) (SIL)
(8) Happy Valley (HAV) (SIL) (optional)

The catchments for these 8 stations include neighbourhoods of private properties where enhancement of values, if any, could be accruable. Other planned stations such as Lei Tung and Wah Fu where public housing dominates, are not included in this part of the study.

B.2.2 Definition of Boundaries for Rail Station Catchment Areas

As illustrated here, empirically, property value correlates with the provision of a rail station. The closer to a rail station the higher the value of the property. In this study we considered only properties within our catchments[1]. We define a 'catchment' here as the area within a 400m radius around an entrance to a rail station (i.e., roughly a 10-minute walking distance). It is only within this boundary, that we considered likely

[1] Where hilly terrain was especially evident, we made ad hoc reductions to the limits of the catchment to reflect this.

property values changes.[2] To further investigate the extent of such impacts, those buildings within a 200m radius around a proposed MTR entrance were reviewed most closely. For the purpose of the Study, the 200m radius catchment is defined as Zone A and the band between 200m radius and 400m radius is called Zone B. Areas beyond Zone B will be referred to as Zone C.

B. 2.3 Data Collection

Plans showing the proposed locations of station entrances of the eight selected stations were obtained from the MTRCL and the catchments drawn as above. A list of private properties within the catchments were then identified on 1:1000 survey maps obtained from the Maps Office of Lands Department of the Hong Kong Government.

Information on the age and floor area for buildings was divided into 4 use categories (ground floor commercial, upper floor commercial, domestic and industrial uses). Rateable Values (RV) for these respective uses were obtained from the Technical Services Section, Rating and Valuation Department (RVD), by means of a custom-designed computer programme. Regionalized property market data and analyses such as Property Capital and Rental Transaction Records were obtained from the Lands Office. Other property statistics were obtained from the *Property Reviews 2003* published by Rating and Valuation Department. Various publications by property consultants, surveyors' firms and research houses, were also reviewed to obtain supportive market information.

[2] This means we do not count property value increases in areas close to, but outside of, the strictly defined 'catchments'. In effect, our assessment leaves out somewhere perhaps 15%-20% of the population (and an unknown portion of the property values effects) in the two districts. Along with various other conservative approaches we have used (as noted), this offsets the potential for some of the value credited here being a transfer from elsewhere in Hong Kong.

B.2.4 Comparison Assessment Model Construction

In order to assess the value differentials for properties with and without rail service, different approaches were adopted for non-domestic properties and domestic properties to reflect their distinct market characteristics.

B. 2.4.1 Non-domestic Properties

Non-domestic properties are categorized into: -

(a) Ground Floor Commercial

(b) Upper Floor Commercial

(c) Industrial Uses

The properties in each category in the study catchments was matched with a comparison catchment already served by the MTR.

These comparison catchments (with existing rail service) were similarly divided into Zone A, Zone B and Zone C.

Market transactions in the comparison districts were then examined to determine whether there exists any value difference for property values for the respective zones. It was found that property values between Zone A, B and C in similar areas do differ with regard to whether there is an existing rail station nearby.

Based on these findings, models of value differentials for each of the three non-domestic property categories in each study catchment were established. The *value adjustment factor* was then applied to the Rateable Value of the properties in the Study catchments obtained from RVD to provide value enhancement estimates. Table B.3.4 (following) shows the various value adjustment factors applied to different property categories in different catchments.

In some cases the increased value of ground floor commercial properties with the coming of rail may be offset by decreased demand elsewhere, therefore, only one half of the estimated value enhancement for Ground Floor Shops in Zone A of all study catchments is included in the estimated returns.

B. 2.4.2 Domestic Properties

For domestic property value assessment, the same rationale of comparing the property value of those with and without existing rail service was adopted. Factors such as building age and the size of flats were also taken into consideration. However, the impact of rail provision on property values for domestic units is not as straightforward as non-residential property. Values of domestic property are also affected by the quality of the building, the perceived class of its neighbourhood, landscape features, etc. Those domestic units located farther away from rail entrance but enjoying a better view or being in 'a higher class' neighbourhood may have higher values. Therefore, instead of differentiating among Zones A, B, C in the analysis, a general profile, outlining value differentials of the properties in typical housing developments with and without rail service, are compared. This value differential became the value adjustment factor to estimate the increase in value due to rail provision. Table B.D.2 outlines the findings of such comparisons.

B. 2.4.3 Rates Differential Assessment

'Rates' are charged by government on all properties in Hong Kong. Rates are charged as a percentage of the Rateable Value (RV) which is the estimated *annual rental value* of a property at a designated valuation reference date (currently 1st October), as if it were a vacant possession to let in the open market. Currently, rates are charged at 5% of the RV and this level has been maintained for a decade or so.

The Rateable Value within each catchment obtained from RVD was adjusted through the value adjustment factor to estimate the aggregate increase in Rateable Value. The prevailing 5% level for Rates was then applied to calculate the increase in revenue to Government in form of Rates. This annual increase in Rates was then capitalized in perpetuity

at a real discount rate of 4%.

B. 2.4.4 Property Tax Differential Assessment

'Property Tax' is charged on properties which are being leased out by their owners. This tax is in addition to the rates paid. The property tax is based on the actual rental income payable to the owner of the property. The tax rate is usually set at 15% but may vary slightly from year to year according to financial needs of the Government as shown in Table B. 2.1 below.

Table B. 2.1

Recent Property Tax levels

Year of assessment	Tax rate
2004/05	16%
2003/04	15.5%
2002/03	15%
2001/02	15%
2000/01	15%

For the purpose of this study, Rateable Value[3] is taken as the rental value and the Property Tax level is taken as 15%.

[3]The Rateable value is a valuation of the annual rent of a property and therefore used as the assessment model for valuing the enhancement in property tax for the purpose of this study.

However, not every property in a catchment is let out and hence subject to the property tax[4]. Table B.2.2 shows classification of properties from *Schedule 7* of the *2001-02 Annual Report, Inland Revenue Department*:

Table B.2.2
Classification of Properties by Ownership (as at 31 March 2002)

Classification	Number of Properties	Percentage
Solely owned by individuals (with rental income, if any, reported in Composite tax returns)	**647,690**	32.70
Jointly owned, owned by tenants-in-common, or solely owned other than by individuals - **Letting - 98,911** Business use and/or rent free - 34,350 Wholly occupied by owners for residential use - 471,079 Vacant - 23,481 Letting but no liability under Personal Assessment – 63	627,884	31.70
Owned by corporations and exempt from Property Tax under the Inland Revenue Ordinance	341,183	17.22
Home Ownership Scheme or Private Sector Participation Scheme	246,675	12.45
Government owned	919	0.05
New Ownership - awaiting classification	116,446	5.88
Total	**1,980,797**	**100.00**

Source: Schedule 7, 2001-02 Annual Report, Inland Revenue Department.
The *let* portion of the total market for all uses is about **37.7%.**

Since there are no available statistics on the letting and the percentage of corporate ownership an individual use category, we made the following assumptions based on experience in Hong Kong.

i) Ground Floor Commercial—apply a reduction parameter of 40%, assuming almost all are let properties but more than half are owned by corporate owners.

ii) Upper Floor Commercial—apply a reduction parameter of 40%, assuming almost all are let properties but more than half are

[4] If the landlord is a corporation, the rental income derived from the let property will be computed for tax under the Profits Tax rather than Property Tax.

owned by corporate owners.

iii) Domestic—apply a reduction parameter of 10%[5], assuming most are owner-occupied and a certain amount of the let units are owned by corporate owners.

iv) Industrial uses—apply a reduction parameter of 40%, assuming almost all are let properties but more than half are owned by corporate owners.

B.2.4.5 Total Addition to Value of Government Land Premium

Consultations were held with the Hong Kong District Planning Office with regard to the Pokfulam Moratorium[6] and other rezoning possibilities in the catchment areas. They noted that they did not, at this stage, anticipate a lifting of Pokfulam Moratorium, nor, did they plan to propose any change in land uses due to WIL/SIL. In light of this, our assessment of increases in the Government land premium was based solely on redevelopment potentials of existing developments.

Since most Study catchments consist of old and low-rise building blocks, they have a good potential for redevelopment. Application for increased plot ratio or change in land use may be triggered by the provision of the rail service in order to reap the benefit of enhanced property value. To assess this, we identified those sites where Town Planning Board had given approval for change of land use, but the land

[5] In catchments such as SYP, UNI, KET and ABE, a residential letting rate at 10% is reasonable, since residential properties in these catchments are mainly medium to low-end value properties mostly owner-occupied. However, in catchments such as CYP, the residential letting rate may be higher (as higher as 20-25%) since many residential properties there may be leased by expatriates and corporate executives with housing allowances. Nevertheless, for the purpose of this study, we have adopted a rather conservative approach and use a residential letting rate of 10% in all catchments.

[6] The Pokfulam Moratorium is an administrative measure to prohibit any new land sale and lease modification for more intensive development in the area. It has been imposed on traffic grounds to prohibit excessive development of Pokfulam Area until there is an overall improvement in the transport network of the area.

lease modification had not been completed. In addition, all buildings that would be 40 years or older by 2010 were examined.

Representative land searches by cluster sampling were conducted to examine the lease conditions of the land lots to identify as to whether there is restriction on plot ratio or use. Land leases with more restrictions would generate lower value than those with fewer restrictions. There would be an increase in land value if restrictions on a land lease are reduced by the government. The increase of land value will then be recouped by the government in the form of the land premium.

Where there are applications for re-development or sites likely to be redeveloped with the coming of the WIL/SIL (e.g., those 40 years old and more in 2010), the existing lease conditions were examined and the impact of the removal of development restrictions on development intensity and/or change of user assessed. The difference of the two assessments (current and new) is the estimated financial benefit to Government in the form of land premium.

In view of likely fragmentation of ownership, difficulty in site assembly and technical problems in redevelopment, upper and lower bounds were set to reflect the percentage of sites that might reasonably be expected to be redeveloped within five years of the opening of the WIL/SIL station.

The lower bound sites include only those sites for which Town Planning Board approval has already been obtained and will likely be implemented due to the introduction of WIL/SIL. To be conservative, only 40% of these prospective projects were assumed to be realized in the first 5 years after the WIL/SIL is in place.

The upper bound on the estimated increase in premiums to government consists of two groups: (1) buildings of 40 years or above by 2010 within the catchment. There are 900 buildings in the eight catchments. (2) younger buildings where the coming of the WIL/SIL would reasonably be

expected to trigger redevelopment of existing building to conform with the intended land use zoning as shown on the respective Outline Zoning Plans (OZP). Examples, include the Shing Dao Industrial Building at 232 Aberdeen Main Road, the Fullagar Industrial Building at 234 Aberdeen Main Road and the Aberdeen Industrial Building at 236 Aberdeen Main Road. Each is zoned for "Residential (Group E)" use on the statutory OZPs. To account for the possible difficulties in relation to re-development, only 25% of these projects are assumed to be implemented in the first 5 years after WIL/SIL is built.

B.2.4.6 Revenue from Cyberport

The development of Cyberport is a joint venture between the government and Pacific Century CyberWorks (PCCW), whereby the land is contributed by the government and the project is developed by PCCW. Upon completion, the government will own the project and PCCW will enjoy a split of the profit of the domestic portion.[7] Only the rental income from the non-domestic portion is taken into account as an added benefit to the government for the purpose of this study.

Employing the same analytic model as described above respect to rates, and property tax, the value enhancement for commercial rental at Cyberport is similarly assessed and capitalized at 4% in perpetuity to arrive at the present value of the enhancement as of 2010.

[7] Information from Legislative Council Brief and various Press Releases from Commerce, Industry and Technology Bureau.

B.2.4.7 Assessment of Enhancement in Property Values to Private Property Owners

Based on the analytic models described above, the assessments of value enhancement in privately owned properties are similarly made.

B.3 The Process

B. 3.1 Identification of Properties in Study Catchments

Developments within Zone A and Zone B in each catchment were identified. It was found that a total of 4,000 buildings exist within the 8 catchments.

Table B.3.1
Number of Buildings in Each Catchment

Catchment		No. of Buildings
1	SYP (WIL)	1,857
2	UNI (WIL)	1,061
3	KET(WIL)	195
4	CYP (WIL)	40
5	SOH (SIL)	45
6	ABE (SIL)	241
7	WCH (SIL)	66
8	HAV (SIL)	495
Total		**4,000**

However, certain exclusions have been made for the following reasons:-

(a) Where the topography shows a significant elevation difference and the residents may not benefit from the WIL/SIL, e.g.
- In SYP-developments beyond the south of Lyttleton Road

(b) Some rail stations are rather close and their catchments overlap. In order to avoid double counting, some adjustments are made
- In UNI-developments covered by SYP catchment are excluded
- In KET-developments covered by the UNI catchment are excluded

B. 3.2 Review of Current Rateable Values in Study Catchments

The current Rateable Values (RV) of existing developments in Zone A and Zone B as supplied by Rating & Valuation Department are then listed separately on the spreadsheets to calculate the aggregated RV for each property categories. The results are shown in Table 3.2

Table B.3.2
Estimates of Rateable Value currently assessed by Rating & Valuation Department by Type of Use and Catchment

Zone A		Grd. Flr, shops	Upper Flr. Com	Residential	Industrial
1	SYP	151,251,600	109,152,600	418,116,900	3,133,200
2	UNI	144,090,600	30,256,260	1,267,076,580	27,224,700
3	KET	26,695,500	4,002,000	159,717,120	2,672,400
4	CYP	6,696,000	10,668,000#	146,191,140	-
5	SOH	-	-	528,924,300	-
6	ABE	158,275,800	28,227,900	232,319,400	-
7	WCH	2,150,400	-	-	138,091,500
8	HAV	73,774,800	3,833,400	875,845,740	-
Zone B		**Grd. Flr, shops**	**Upper Flr. Com**	**Residential**	**Industrial**
1	SYP	168,603,840	124,805,220	1,114,085,400	3,500,400
2	UNI	119,437,200	105,213,300	689,049,240	15,022,200
3	KET	3,097,500	911,400	196,429,320	-
4	CYP	-	-	217,625,820	-
5	SOH	594,600	-	528,131,520	-
6	ABE	46,792,200	31,395,000	201,857,040	29,969,700
7	WCH	2,222,400	37,885,800	96,369,240	125,143,920
8	HAV	35,831,100	2,714,400	785,862,120	-

Estimated Rates for the upper floor commercial properties in CYP have not yet been assessed by RVD at the time of this Study

B.3.3 Identification of Comparison Catchments

After considering the characteristics and geographical location of each catchment, the non-domestic properties were matched with a district served by existing rail for the analysis of market behaviour with and without nearby rail access. Table B.3.3 summaries the pair-wise comparisons.

Table B.3.3
Pair-wise Comparison of Non-domestic Properties with Rail Service

Study Catchment	Characteristics	Comparison catchments (with Existing Rail Service)
SYP	A traditional commercial & residential district organically developed; densely populated, and largely with secondary commercial activities e.g., wholesale and retail of dried sea foods and herbal medicine, scattered industrial uses can be found.	G/F: Sheung Wan U/F: Sheung Wan Industrial: Sheung Wan
UNI	(exclusive of university grounds). A residential district organically developed with a mix of typical tenement and composite buildings and newly built private housing estates, tertiary commercial, limited industrial developments.	G/F: Sheung Wan U/F: Sheung Wan Industrial: Tin Hau, Fortress Hill & North Point
KET	At fringe of urban area; composed of a mix of low-end private and public housing and industrial.	G/F: Sai Wan Ho, Shau Kei Wan & Chai Wan U/F: Sheung Wan Industrial: Chai Wan
CYP	A new comprehensively planned and built commercial and up-market residential developments	G/F: Sai Wan Ho, Shau Kei Wan & Chai Wan U/F: Sheung Wan Industrial: (Nil)
SOH	A typical comprehensively planned housing estate.	G/F: (N/A, see note 'a' below) U/F: (N/A, see note 'a) Industrial: (Nil)
ABE	Traditionally a fishing port but now developed into a small district consisting of tenement buildings, some housing estates and industrial developments with some tourist attractions.	G/F: Sai Wan Ho, Shau Kei Wan & Chai Wan U/F: Sai Wan Ho, Shau Kei Wan, Tin Hau, Fortress Hill & North Point Industrial: Chai Wan
WCH	Traditional industrial area with limited residential developments.	G/F: Sai Wan Ho, Shau Kei Wan & Chai Wan U/F: Sai Wan Ho, Shau Kei Wan, Tin Hau, Fortress Hill & North Point Industrial: Chai Wan
HAV	A traditional up-market residential area featured by the Race Course. A number of convenience shops are found in the neighbourhood.	G/F: Tin Hau, Fortress Hill & North Point U/F: Causeway Bay, Tin Hau, Fortress Hill & North Point Industrial: (Nil)

Note a: after investigation, we concluded that the commercial complex at South Horizons is an isolated one, serving only residents of the estate. Even with the provision of the MTR, it is expected that there will be relatively only little influx of new customers. Hence, we assumed that commercial conditions would remain unchanged and no comparison was made with other areas.

B.3.4 Analysis of Value Enhancement for Non-domestic Properties

In order to even out the impact of SARS on rental properties, the rental market transaction record over the past 24 months are analyzed in the comparison catchments. Table B.3.4 lists the relevant rental transactions examined. The unit rents in each comparison catchment are averaged. Where rental evidence was scarce, reference is also made to capital transaction (sale) price.

Table B.3.4
Value Enhancements in Zone A and Zone B in different Catchments for Non-domestic Properties

Study Catchment	Value enhancement in Zone A			Value enhancement in Zone B		
SYP	G/F	:	+72%	G/F	:	+20%
	U/F	:	+84%	U/F	:	+49%
	Industrial	:	+0%	Industrial	:	+0%
UNI	G/F	:	+72%	G/F	:	+20%
	U/F	:	+84%	U/F	:	+49%
	Industrial	:	+0%	Industrial	:	+0%
KET	G/F	:	+192%	G/F	:	+56%
	U/F	:	+84%	U/F	:	+49%
	Industrial	:	+0%	Industrial	:	+5%
CYP	G/F	:	+192%	G/F	:	+56%
	U/F	:	+84%	U/F	:	+49%
	Industrial	:	N/A	Industrial	:	N/A
SOH	G/F	:	N/A	G/F	:	N/A
	U/F	:	N/A	U/F	:	N/A
	Industrial	:	N/A	Industrial	:	N/A
ABE	G/F	:	+192%	G/F	:	+56%
	U/F	:	+29%	U/F	:	+5%
	Industrial	:	+0%	Industrial	:	+0%
WCH	G/F	:	+192%	G/F	:	+56%
	U/F	:	+29%	U/F	:	+5%
	Industrial	:	+0%	Industrial	:	+0%
HAV	G/F	:	+93%	G/F	:	+83%
	U/F	:	+0%	U/F	:	+0%
	Industrial	:	N/A	Industrial	:	N/A

Please see Supplemental Data Table B.D.1 for detailed Value Enhancement for Non-domestic Properties in Study Catchment after rail provision.

B.3.5 Value Enhancement for Domestic Properties

For domestic properties in WIL/SIL catchments, the value enhancement is established by comparing to property value trends of housing developments similar in age, flat size and scale in Hong Kong with rail service in the years 2000-2002 to see if there is any difference in the value profiles.

Please see Supplemental Data Table B.D.2 for the Comparison of Residential Market Profiles.

It can be seen in Table B.D.2 that in the years 2000-2002, there were a moderately wide range of value differences. Most of the value differences fall into the range of 15-25%. The average differences are between 18% and 19% in the years 2000-2002. However, for the purpose of this study, a conservative approach was adopted. As a lower bound we used and enhancement of **12%** in property value and as an upper bound of **17%** residential properties in WIL/SIL catchments. These bounds were also used for assessing the enhancement of rates and property tax revenues to government.

B. 3.6 Adjustments made for Foreseeable Use Changes

Our research shows that in some catchments there are already changes of land uses that may suggest an anticipation of the coming of the WIL/SIL.

[8] Information on Town Planning Board Approval Cases obtained from the official web-site of Town Planning Board

Since these redevelopments would probably be redeveloped before 2010, for the purposes of our calculations, their original RV's, if any, are replaced by estimates of RV's of the proposed redevelopments. Such adjustments are shown in the respective property tax and rates calculations. For reference, please see Supplemental Data Tables B.D.3 through B.D.6.

B. 3.7 Land Value Enhancement to the Government

In each catchment, developments that will be more than 40 years old by the time WIL/SIL is in place, (i.e., 2010). A total of 900 buildings were identified.

Land searches revealed that the sites in the catchments concerned are held under leases granted many years ago, when the development volume was usually not stipulated in the land leases.[9] Hence, no modification to the lease is required for redevelopment into higher plot ratio. Therefore, there will be no land value enhancement to the government upon redevelopment for these sites.

Research was also conducted to identify any developments which will be less than 40 years old by 2010 but would be potentially redeveloped in the light of the forthcoming WIL/SIL.

To reflect fragmentation of ownership, difficulty in site assembly and other technical problems, it is assumed that only 40% (of the lower bound) and 25% (of those potentially included in the upper bound) would be redeveloped in the first 5 years when SIL or WIL is in place. Please see Supplemental Data Table B.D.7 for a summary of the valuation.

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[9] We have also found that there are a few sites that might be exceptions (e.g. in catchments such as SYP). However, on light of their relatively small sizes and minimal impact on the assessments, they are ignored for this purpose of study.

B.3.8 Revenue from Cyberport

The rental income from the non-domestic portion of the Cyberport development is taken into account as an enhanced benefit to the government for the purpose of this study.

The non-domestic part of Cyberport consists of the following:-

- Retail and entertainment space—about 27,000 square meters (m^2)
- Grade A offices—about 100,000 (m^2)
- A 5-star 173-room hotel

The government will enjoy a value uplift in rates and property tax as the government would dispose of its assets in the open market when the whole project is completed by 2010, as well as in rental income from the above floor spaces. Please refer to Supplemental Data Table B.D.8 for details of the assessment.

B.3.9 Value Enhancement to Private Properties

The assessment of the enhancement in property value to private property owners follows the rationale for assessing the enhancements in rates and property tax. Market transactions are researched based on the model described above. Reference was made to actual market transactions of flats in typical estates with rail services. Please refer to Supplemental Data Tables B.D.9 and B.D.10 respectively for the details that went into the calculation of the lower and upper bound estimates.

B.4 The Findings

Please see Supplemental Data Tables B.D.3 through B.D.10 for details of the valuations. Table B.4.1 summarizes the findings.

Table B.4.1
Summary of Income Stream Enhancement for WIL/SIL catchments[10]

PRESENT VALUE of Value Enhancement at 2010

To Government		Lower bound		Upper bound
Rates	$	2,103,880,535	$	2,570,395,190 (Tables B.D 3 & B D 4)
Property Tax	$	1,894,288,342	$	2,097,499,016 (Tables B D 5 & B D 6)
Cyberportt	$	460,419,500	$	460,419,500 (Table B.D 8)
Land Premium	$	841,024,000	$	1,290,424,000 (Table B D 7)
	$	**5,299,612,377**	$	**6,418,737,706**
To Private Owners	**$**	**21,846,891,983**	**$**	**26,992,325,954** (Tables B D 9 & B D 10)

PRESENT VALUE of Property Value Enhancement as of 2004

To Government		Lower bound		Upper bound
Rates	$	1,662,065,622	$	2,030,612,200
Property Tax	$	1,496,487,790	$	1,657,024,222
Cyberport	$	363,731,405	$	363,731,405
Land Premium	$	664,408,960	$	1,019,434,960
	$	**4,186,693,777**	$	**5,070,802,787**
To Private Owners	**$**	**17,259,044,666**	**$**	**21,323,937,504**

[10] These were capitalized starting from year 2010 and discounted at back to a present value as of 2004.

B. 5 Conclusion

The assessment on the increase of value and subsequent returns accruable to Government and private property owners due to the introduction of the proposed West Island Line and South Island Line (WIL/SIL) for the southwestern part of Hong Kong has been carried out in a conservative manner.

Results show that rail provision will lead to increases in property value in the catchments. In turn, there will be an increase in revenue accruing to Government as a result of increased rates, increased property tax, land premium from lease modification/land exchange as well as from Cyberport which is partly owned by the Government. THE PRESENT VALUE (AS OF 2004) OF THE STREAM OF DIRECT FINANCIAL BENEFITS TO GOVERNMENT is conservatively estimated to be between HK$ 4.3 billion and HK $5.1 billion.

THE PRESENT VALUE (AS OF 2004) OF THE ESTIMATED PROPERTY VALUE ENHANCEMENTS ACCRUING TO PRIVATE PROPERTY OWNERS IN THE CATCHMENTS (excluding Happy Valley) amount between HK$ 14.4 billion and HK$ 17.6 billion.

Supplemental Data Tables follow.

Table B.D.1
Value Enhancement for Non-domestic Properties in Study Catchments after Rail Provision

Study Catchments	Categories	Comparison Catchment	Average Rental per square metre in Comparison Catchments over the past 24 months (Note 1)		
			Zone A	Zone B	Zone C (nil impact from rail)
1 **SYP**	G/F Shops	Sheung Wan	$ 730	$ 510	$ 425
	Increase from Zone C		***72%***	***20%***	
	U/F Commercial	Sheung Wan	$ 197	$ 159	$ 107
	Increase from Zone C		***84%***	***49%***	
	Industrial	Sheung Wan	No significant impact (Note 2)		
	Increase from Zone C				
2 **UNI**	G/F Shops	Sheung Wan	$ 730	$ 510	$ 425
	Increase from Zone C		***72%***	***20%***	
	U/F Commercial	Sheung Wan	$ 197	$ 159	$ 107
	Increase from Zone C		***84%***	***49%***	
	Industrial	Tin Hau, Fortress Hill, North Point	$ 94	$ 149	$ 134
	Increase from Zone C		No significant impact		
3 **KET**	G/F Shops	Sai Wan Ho, Shau Kei Wan	$ 799	$ 427	
	Increase from Zone C		***87%***		
		Chai Wan		$ 1,527	$ 977
	Increase from Zone C		***192%***	***56%***	
	U/F Commercial	Sheung Wan	$ 197	$ 159	$ 107
	Increase from Zone C		***84%***	***49%***	
	Industrial	Chai Wan	$ 56	$ 56	$ 60
	Increase from Zone C		No significant impact		
4 **CYP**	G/F Shops	Sai Wan Ho, Shau Kei Wan	$ 799	$ 427	
	Increase from Zone C		***87%***		
		Chai Wan		$ 1,527	$ 977
	Increase from Zone C		***192%***	***56%***	
	U/F Commercial	Sheung Wan	$ 197	$ 159	$ 107
	Increase from Zone C		***84%***	***49%***	
	Industrial	Nil	Nil		
	Increase from Zone C				
5 **SOH**	G/F Shops	N/A	N/A		
	Increase from Zone C				
	U/F Commercial	N/A	N/A		
	Increase from Zone C				
	Industrial	Nil	Nil		
	Increase from Zone C				

Study Catchments		Categories	Comparison Catchment	Average Rental per square metre in Comparison Catchments over the past 24 months (Note 1)		
				Zone A	Zone B	Zone C (nil impact from rail)
6	**ABE**	G/F Shops	Sai Wan Ho, Shau Kei Wan	$ 799	$ 427	
		Increase from Zone C		***87%***		
			Chai Wan		$ 1,527	$ 977
		Increase from Zone C		***192%***	***56%***	
		U/F Commercial (Note 3)	Sai Wan Ho, Shau Kei Wan	$ 20,000	$ 15,780	
		Increase from Zone C		***29%***		
			Tin Hau, Fortress Hill, North Point		$ 159	$ 159
		Increase from Zone C			No significant impact	
		Industrial	Chai Wan	$ 56	$ 56	$ 60
		Increase from Zone C			No significant impact	
7	**WCH**	G/F Shops	Sai Wan Ho, Shau Kei Wan	$ 799	$ 427	
		Increase from Zone C		***87%***		
			Chai Wan		$ 1,527	$ 977
		Increase from Zone C		***192%***	***56%***	
		U/F Commercial (Note 3)	Sai Wan Ho, Shau Kei Wan	$ 20,000	$ 15,780	
		Increase from Zone C		***29%***		
			Tin Hau, Fortress Hill, North Point		$ 159	$ 159
		Increase from Zone C			No significant impact	
		Industrial	Chai Wan	$ 56	$ 56	$ 60
		Increase from Zone C			No significant impact	
8	**HAV**	G/F Shops	Tin Hau, Fortress Hill, North Point	$ 678	$ 632	$ 349
		Increase from Zone C		***93%***	***83%***	
		U/F Commercial	Causeway Bay	$ 213	$ 243	
		Increase from Zone C			No significant impact	
			Tin Hau, Fortress Hill, North Point		$ 159	$ 159
		Increase from Zone C			No significant impact	
		Industrial	Nil		Nil	
		Increase from Zone C				

Note 1 : Information on rental in Comparison Catchments is based on the available public record from Land Registry.
The record shows only those rental agreements registered. Since registration of rental agreements are subjected to stamp duty, not all of them are registered.
Note 2 : Industrial transaction record in Sheung Wan was very scarce. In view of results of other comparison in the table,
it is reasonable to assume that there would be no singnificant impact in the industrial properties in SYP. The number is actually very few.
Note 3 : The anlysis of price was conducted where rental transactions were scarce.

For domestic properties in the catchments, the value enhancement is established by making reference to property value trends in the years 2000-2002 of typical similar housing developments in Hong Kong with and without rail service to identify if there is any difference in the value profiles. It is assumed that such difference in value profile is attributed to the availability of rail service. Totally there are eight pairs of comparison made. Table B.D.2 summarizes the comparison data.

Table B.D.2
Value Assessment for Residential Market Profiles of Significant Estates with Rail Provision

	Comparison Catchment	Built	Flat size s.f.	Findings	2000	2001	2002	
1	**Taikoo Shing**	76	485-1146	No. of transactions studied	660	532	626	With Rail
				Average price p.s.f. saleable	$ 4,799	$ 4,201	$ 3,825	
				Price difference	-	$ (598)	$ (376)	
				Increase/decrease	-	-12%	-9%	
	Chi Fu Fa Yuen	*78/81*	*200-582*	*No. of transactions studied*	*209*	*178*	*173*	*No Rail*
				Average price p.s.f. saleable	*$ 3,851*	*$ 3,401*	*$ 3,147*	
				Price difference	*-*	*$ (450)*	*$ (254)*	
				Increase/decrease	*-*	*-12%*	*-7%*	
				Price difference between comparables	**$ 948**	**$ 800**	**$ 678**	
					25%	**24%**	**22%**	
2	**Taikoo Shing**	76	485-1146	No. of transactions studied	660	532	626	With Rail
				Average price p.s.f. saleable	$ 4,799	$ 4,201	$ 3,825	
				Price difference	-	$ (598)	$ (376)	
				Increase/decrease	-	-12%	-9%	
	Whampoa Garden	*86/91*	*291-972*	*No. of transactions studied*	*564*	*718*	*577*	*No Rail*
				Average price p.s.f. saleable	*$ 4,377*	*$ 3,678*	*$ 3,347*	
				Price difference	*-*	*$ (699)*	*$ (331)*	
				Increase/decrease	*-*	*-16%*	*-9%*	
				Price difference between comparables	**$ 422**	**$ 523**	**$ 478**	
					10%	**14%**	**14%**	

	Comparison Catchment	Built	Flat size s.f.	Findings	2000	2001	2002	
3	**Kornhill**	86	431-1100	No of transactions studied	447	425	391	With Rail
				Average price p s f saleable	$ 4,509	$ 3,904	$ 3,542	
				Price difference	-	$ (605)	$ (362)	
				Increase/decrease	-	-13%	-9%	
	Whampoa Garden	*86/91*	*291-972*	*No of transactions studied*	*564*	*718*	*577*	*No Rail*
				Average price p s f saleable	*$ 4,377*	*$ 3,678*	*$ 3,347*	
				Price difference	*-*	*$ (699)*	*$ (331)*	
				Increase/decrease	*-*	*-16%*	*-9%*	
				Price difference between comparables	**$ 132**	**$ 226**	**$ 195**	
					3%	**6%**	**6%**	
4	**Lei King Wan**	88/89	489-884	No of transactions studied	118	108	112	With Rail
				Average price p s f saleable	$ 4,680	$ 4,123	$ 3,822	
				Price difference	-	$ (557)	$ (301)	
				Increase/decrease	-	-12%	-7%	
	Whampoa Garden	*86/91*	*291-972*	*No of transactions studied*	*564*	*718*	*577*	*No Rail*
				Average price p s f saleable	*$ 4,377*	*$ 3,678*	*$ 3,347*	
				Price difference	*-*	*$ (699)*	*$ (331)*	
				Increase/decrease	*-*	*-16%*	*-9%*	
				Price difference between comparables	**$ 303**	**$ 445**	**$ 475**	
					7%	**12%**	**14%**	
5	**Island Resort**	01	495-794	No of transactions studied	1,008	1,449	305	With Rail
				Average price p s f saleable	$ 6,003	$ 5,258	$ 5,239	
				Price difference	-	$ (745)	$ (19)	
				Increase/decrease	-	-12%	0%	
	South Horizons	*91/95*	*526-1328*	*No of transactions studied*	*499*	*607*	*441*	*No Rail*
				Average price p s f saleable	*$ 4,854*	*$ 4,155*	*$ 3,769*	
				Price difference	*-*	*$ (699)*	*$ (386)*	
				Increase/decrease	*-*	*-14%*	*-9%*	
				Price difference between comparables	**$ 1,149**	**$ 1,103**	**$ 1,470**	
					24%	**27%**	**39%**	

	Comparison Catchment	Built	Flat size s.f.	Findings	2000	2001	2002	
6	**Heng Fa Chuen**	86/90	566-1292	No. of transactions studied	300	366	298	With Rail
				Average price p.s f. saleable	$ 5,066	$ 4,212	$ 3,849	
				Price difference	-	$ (854)	$ (363)	
				Increase/decrease	-	-17%	-9%	
	South Horizons	*91/95*	*526-1328*	*No. of transactions studied*	*499*	*607*	*441*	*No Rail*
				Average price p.s.f. saleable	*$ 4,854*	*$ 4,155*	*$ 3,769*	
				Price difference	-	*$ (699)*	*$ (386)*	
				Increase/decrease	-	*-14%*	*-9%*	
				Price difference between comparables	**$ 212**	**$ 57**	**$ 80**	
					4%	**1%**	**2%**	
7	**City Garden**	82/86	610-1269	No. of transactions studied	103	134	128	With Rail
				Average price p.s.f. saleable	$ 4,726	$ 3,958	$ 3,574	
				Price difference	-	$ (768)	$ (384)	
				Increase/decrease	-	-16%	-10%	
	Aberdeen Centre	*79/82*	*440-750*	*No. of transactions studied*	*151*	*148*	*108*	*No Rail*
				Average price p.s.f. saleable	*$ 3,340*	*$ 3,001*	*$ 2,880*	
				Price difference	-	*$ (339)*	*$ (121)*	
				Increase/decrease	-	*-10%*	*-4%*	
				Price difference between comparables	**$ 1,386**	**$ 957**	**$ 694**	
					41%	**32%**	**24%**	
8	**Provident Centre**	82/83	713-1335	No. of transactions studied	71	71	54	With Rail
				Average price p.s.f. saleable	$ 4,497	$ 4,004	$ 3,586	
				Price difference	-	$ (493)	$ (418)	
				Increase/decrease	-	-11%	-10%	
	Aberdeen Centre	*79/82*	*440-750*	*No. of transactions studied*	*151*	*148*	*108*	*No Rail*
				Average price p.s.f. saleable	*$ 3,340*	*$ 3,001*	*$ 2,880*	
				Price difference	-	*$ (339)*	*$ (121)*	
				Increase/decrease	-	*-10%*	*-4%*	
				Price difference between comparables	**$ 1,157**	**$ 1,003**	**$ 706**	
					35%	**33%**	**25%**	
				Average	***19%***	***19%***	***18%***	

Note: It can be seen that in the years 2000-2002, there were a wide range of value differences. Most of the value differences fall into a range of 15-25%. The average difference for the three years was 19% for 2000 and 2001 and 18% for 2002.

Table B.D.3
Summary of Assessments of the Rates Enhancement (Lower Bound)
as at 2010 in the Study Catchments of WIL/SIL

Proposed Catchment	Categories	Rates Enhancement—LOWER bound								Total RV increase
		Zone A				Zone B				
		Existing RV	Projected Increase	Adj		Existing RV	Projected Increase			
1 **SYP**	G/F Shops	$ 151,251,600	72%	50%	$ 54,450,576	$ 168,603,840	20%	$ 33,720,768		
	U/F Comm	$ 109,152,600	84%	100%	$ 91,688,184	$ 124,805,220	49%	$ 61,154,558		
	Residential	$ 418 116 900	12%	100%	$ 50,174,028	$ 1,114,085,400	12%	$ 133,690,248		
	Industrial	$ 3,133,200	0%	100%	$ -	$ 3,500,400	0%	$ -		
					$ 196,312,788			**$ 228,565,574**	**$**	**424,878,362**
2 **UNI**	G/F Shops	$ 144 090 600	72%	50%	$ 51,872,616	$ 119,437,200	20%	$ 23,887,440		
	U/F Comm	$ 30,256,260	84%	100%	$ 25,415,258	$ 105,213,300	49%	$ 51,554,517		
	Residential	$ 1,267,076,580	12%	100%	$ 152,049,190	$ 689,049,240	12%	$ 82,685,909		
	Industrial	$ 27,224 700	0%	100%	$ -	$ 15,022,200	0%	$ -		
					$ 229,337,064			**$ 158,127,866**	**$**	**387,464,930**
3 **KET**	G/F Shops	$ 26,695,500	192%	50%	$ 25,627,680	$ 3,097,500	56%	$ 1,734,600		
	U/F Comm	$ 4,002,000	84%	100%	$ 3,361,680	$ 911,400	49%	$ 446,586		
	Residential	$ 159,717,120	12%	100%	$ 19,166,054	$ 196,429,320	12%	$ 23,571,518		
	Industrial	$ 2,672,400	0%	100%	$ -	$ -	0%	$ -		
					$ 48,155,414			**$ 25,752,704**	**$**	**73,908,119**
4 **CYP**	G/F Shops	$ 6,696,000	192%	50%	$ 6,428,160	$ -	56%	$ -		
	U/F Comm	$ 10,668,000	84%	100%	$ 8,961,120	$ -	49%	$ -		
	Residential	$ 146,191,140	12%	100%	$ 17,542,937	$ 217,625,820	12%	$ 26,115,098		
	Industrial	$ -	0%	100%	$ -	$ -	5%	$ -		
					$ 32,932,217			**$ 26,115,098**	**$**	**59,047,315**
5 **SOH**	G/F Shops	$ -	0%	50%	$ -	$ 594,600	0%	$ -		
	U/F Comm	$ -	0%	100%	$ -	$ -	0%	$ -		
	Residential	$ 528,924,300	12%	100%	$ 63,470,916	$ 528,131,520	12%	$ 63,375,782		
	Industrial	$ -	0%	100%	$ -	$ -	0%	$ -		
					$ 63,470,916			**$ 63,375,782**	**$**	**126,846,698**

Proposed Catchment	Categories	Rates Enhancement—LOWER bound									Total RV increase
		Zone A					Zone B				
		Existing RV	Projected Increase				Existing RV	Projected Increase			
				Adj							
6 **ABE**	G/F Shops	$ 158,275,800	192%	50%	$ 151,944,768		$ 46,792,200	56%	$ 26,203,632		
	U/F Comm	$ 28,227,900	29%	100%	$ 8,186,091		$ 31,395,000	5%	$ 1,569,750		
	Residential	$ 232,319,400	12%	100%	$ 27,878,328		$ 201,857,040	12%	$ 24,222,845		
	Industrial	$ -	0%	100%	$ -		$ 29,969,700	0%	$ -		
					$ 188,009,187				**$ 51,996,227**	**$**	**240,005,414**
7 **WCH**	G/F Shops	$ 2,150,400	192%	50%	$ 2,064,384		$ 2,222,400	56%	$ 1,244,544		
	U/F Comm	$ -	29%	100%	$ -		$ 37,885,800	5%	$ 1,894,290		
	Residential	$ -	12%	100%	$ -		$ 96,369,240	12%	$ 11,564,309		
	Industrial	$ 138,091,500	0%	100%	$ -		$ 125,143,920	0%	$ -		
					$ 2,064,384				**$ 14,703,143**	**$**	**16,767,527**
8 **HAV**	G/F Shops	$ 73,774,800	93%	50%	$ 34,305,282		$ 35,831,100	83%	$ 29,739,813		
	U/F Comm	$ 3,833,400	0%	100%	$ -		$ 2,714,400	0%	$ -		
	Residential	$ 875,845,740	12%	100%	$ 105,101,489		$ 785,862,120	12%	$ 94,303,454		
	Industrial	$ -	0%	100%	$ -		$ -	0%	$ -		
					$ 139,406,771				**$ 124,043,267**	**$**	**263,450,038**
									Total	**$**	**1,592,368,403**

Rates Adjustment (to avoid double counting on developments to be built before 2010)

		Use	Rooms	Existing RV	Est'd Future RV	RV/Room	Increase in RV	
CYP		Hotel	173	$ 3,027,500	$ 6,055,000	$ 35,000	$ 3,027,500	
SOH		Hotel		$ 39,650,625	$ 79,301,250		$ 39,650,625	
WCH	33-35 Wong Chuk Hang Road	Hotel	594	$ 8,561,400	$ 16,229,500	$ 27,322	$ 7,668,100	
	55-57 Wong Chuk Hang Road	Hotel	300	$ -	$ 14,584,500	$ 48,615	$ 14,584,500	
	50 Wong Chuk Hang Road	Hotel	297	$ 2,256,000	$ 7,662,200	$ 25,799	$ 5,406,200	
	8 Heung Yip Street	Hotel	320	$ -	$ 9,615,900	$ 30,050	$ 9,615,900	
	23 Yip Kan Street	Hotel	912	$ 11,791,800	$ 22,575,000	$ 24,753	$ 10,783,200	**$ 90,736,025**
							Total	**$ 1,683,104,428**

Rates to be charged at 5%	**$**	**84,155,221**
Years Purchase in Perpetuity @ 4%		25
Rates Enhancement as at 2010	**$**	**2,103,880,535**
Rates Enhancement as at 2004 (discounted at 4% over 6 years)	**$**	**1,662,065,622**

Table B.D.4
Summary of Assessments of the Rates Enhancement (Upper Bound)
as at 2010 in the proposed catchments of WIL/SIL

Proposed Catchment	Categories	Rates Enhancement—UPPER bound								Total RV increase
		Zone A				Zone B				
		Existing RV	Projected Increase	Adj		Existing RV	Projected Increase			
1 **SYP**	G/F Shops	$ 151,251,600	72%	50%	$ 54,450,576	$ 168,603,840	20%	$ 33,720,768		
	U/F Comm	$ 109,152,600	84%	100%	$ 91,688,184	$ 124,805,220	49%	$ 61,154,558		
	Residential	$ 418,116,900	17%	100%	$ 71,079,873	$ 1,114,085,400	17%	$ 189,394,518		
	Industrial	$ 3,133,200	5%	100%	$ 156,660	$ 3,500,400	5%	$ 175,020		
					$ 217,375,293			**$ 284,444,864**	**$**	**501,820,157**
2 **UNI**	G/F Shops	$ 144,090,600	72%	50%	$ 51,872,616	$ 119,437,200	20%	$ 23,887,440		
	U/F Comm	$ 30,256,260	84%	100%	$ 25,415,258	$ 105,213,300	49%	$ 51,554,517		
	Residential	$ 1 267,076,580	17%	100%	$ 215,403,019	$ 689,049,240	17%	$ 117,138,371		
	Industrial	$ 27,224,700	0%	100%	$ -	$ 15,022,200	0%	$ -		
					$ 292,690,893			**$ 192,580,328**	**$**	**485,271,221**
3 **KET**	G/F Shops	$ 26,695,500	192%	50%	$ 25,627,680	$ 3,097,500	56%	$ 1,734,600		
	U/F Comm	$ 4,002,000	84%	100%	$ 3,361,680	$ 911,400	49%	$ 446,586		
	Residential	$ 159,717,120	17%	100%	$ 27,151,910	$ 196,429,320	17%	$ 33,392,984		
	Industrial	$ 2,672,400	0%	100%	$ -	$ -	0%	$ -		
					$ 56,141,270			**$ 35,574,170**	**$**	**91,715,441**
4 **CYP**	G/F Shops	$ 6 696,000	192%	50%	$ 6,428,160	$ -	56%	$ -		
	U/F Comm	$ 10,668,000	84%	100%	$ 8,961,120	$ -	49%	$ -		
	Residential	$ 146,191,140	17%	100%	$ 24,852,494	$ 217,625,820	17%	$ 36,996,389		
	Industrial	$ -	0%	100%	$ -	$ -	5%	$ -		
					$ 40,241,774			**$ 36,996,389**	**$**	**77,238,163**
5 **SOH**	G/F Shops	$ -	0%	50%	$ -	$ 594,600	0%	$ -		
	U/F Comm	$ -	0%	100%	$ -	$ -	0%	$ -		
	Residential	$ 528,924,300	17%	100%	$ 89,917,131	$ 528,131,520	17%	$ 89,782,358		
	Industrial	$ -	0%	100%	$ -	$ -	0%	$ -		
					$ 89,917,131			**$ 89,782,358**	**$**	**179,699,489**
6 **ABE**	G/F Shops	$ 158,275,800	192%	50%	$ 151,944,768	$ 46,792,200	56%	$ 26,203,632		
	U/F Comm	$ 28,227,900	29%	100%	$ 8,186,091	$ 31,395,000	5%	$ 1,569,750		
	Residential	$ 232 319,400	17%	100%	$ 39,494,298	$ 201,857,040	17%	$ 34,315,697		
	Industrial	$ -	0%	100%	$ -	$ 29,969,700	0%	$ -		
					$ 199,625,157			**$ 62,089,079**	**$**	**261,714,236**

Proposed Catchment	Categories	Rates Enhancement—UPPER bound									Total RV increase
		Zone A					Zone B				
		Existing RV	Projected Increase				Existing RV	Projected Increase			
				Adj							
7 **WCH**	G/F Shops	$ 2,150,400	192%	50%	$ 2,064,384		$ 2,222,400	56%	$ 1,244,544		
	U/F Comm	$ -	29%	100%	$ -		$ 37,885,800	5%	$ 1,894,290		
	Residential	$ -	17%	100%	$ -		$ 96,369,240	17%	$ 16,382,771		
	Industrial	$ 138,091,500	0%	100%	$ -		$ 125,143,920	0%	$ -		
					$ 2,064,384				**$ 19,521,605**	**$**	**21,585,989**
8 **HAV**	G/F Shops	$ 73,774,800	93%	50%	$ 34,305,282		$ 35,831,100	83%	$ 29,739,813		
	U/F Comm	$ 3,833,400	0%	100%	$ -		$ 2,714,400	0%	$ -		
	Residential	$ 875,845,740	17%	100%	$ 148,893,776		$ 785,862,120	17%	$ 133,596,560		
	Industrial	$ -	0%	100%	$ -		$ -	0%	$ -		
					$ 183,199,058				**$ 163,336,373**	**$**	**346,535,431**
									Total	**$**	**1,965,580,127**

Rates Adjustments

		Use	Rooms	Existing RV	Est'd Future RV	RV/Room	Increase in RV	
CYP		Hotel	173	$ 3,027,500	$ 6,055,000	$35,000	$ 3,027,500	
SOH		Hotel		$ 39,650,625	$ 79,301,250		$ 39,650,625	
WCH	33-35 Wong Chuk Hang Road	Hotel	594	$ 8,561,400	$ 16,229,500	$27,322	$ 7,668,100	
	55-57 Wong Chuk Hang Road	Hotel	300	$ -	$ 14,584,500	$48,615	$ 14,584,500	
	50 Wong Chuk Hang Road	Hotel	297	$ 2,256,000	$ 7,662,200	$25,799	$ 5,406,200	
	8 Heung Yip Street	Hotel	320	$ -	$ 9,615,900	$30,050	$ 9,615,900	
	23 Yip Kan Street	Hotel	912	$ 11,791,800	$ 22,575,000	$24,753	$ 10,783,200	**$ 90,736,025**

Total $ 2,056,316,152

Rates to be charged at 5% $ 102,815,808

Year Purchase in Perpetuity @ 4% 25

Rates Enhancement as at 2010 $ 2,570,395,190

Rates Enhancement as at 2004 (discounted at 4% over 6 years) $ 2,030,612,200

Table B.D.5
Summary of Assessments of the Property Tax Enhancement (Lower Bound)
as at 2010 in the Proposed Catchments of WIL/SIL

Proposed Catchment	Categories	Property Tax Enhancement—LOWER bound											
		Zone A				Zone B				Total RV Increase =Rental Increase	Let %	Rental subject to Property Tax	
		Existing RV	Projected Increase	Adj		Existing RV	Projected Increase						
1 **SYP**	G/F Shops	$ 151,251,600	72%	50%	$ 54,450,576	$ 168,603,840	20%	$	33,720,768	$ 88,171,344	40%	$	35,268,538
	U/F Comm	$ 109,152,600	84%	100%	$ 91,688,184	$ 124,805,220	49%	$	61,154,558	$ 152,842,742	40%	$	61,137,097
	Residential	$ 418,116,900	12%	100%	$ 50,174,028	$ 1,114,085,400	12%	$	133,690,248	$ 1,114,085,400	10%	$	111,408,540
	Industrial	$ 3,133,200	5%	100%	$ 156,660	$ 3,500,400	5%	$	175,020	$ 331,680	40%	$	132,672
					$ 196,469,448			**$**	**228,740,594**			**$**	**207,946,846**
2 **UNI**	G/F Shops	$ 144,090,600	72%	50%	$ 51,872,616	$ 119,437,200	20%	$	23,887,440	$ 75,760,056	40%	$	30,304,022
	U/F Comm	$ 30,256,260	84%	100%	$ 25,415,258	$ 105,213,300	49%	$	51,554,517	$ 76,969,775	40%	$	30,787,910
	Residential	$ 1,267,076,580	12%	100%	$ 152,049,190	$ 689,049,240	12%	$	82,685,909	$ 234,735,098	10%	$	23,473,510
	Industrial	$ 27,224,700	0%	100%	$ -	$ 15,022,200	0%	$	-	$ -	40%	$	-
					$ 229,337,064			**$**	**158,127,866**			**$**	**84,565,442**
3 **KET**	G/F Shops	$ 26,695,500	192%	50%	$ 25,627,680	$ 3,097,500	56%	$	1,734,600	$ 27,362,280	40%	$	10,944,912
	U/F Comm	$ 4,002,000	84%	100%	$ 3,361,680	$ 911,400	49%	$	446,586	$ 3,808,266	40%	$	1,523,306
	Residential	$ 159,717,120	12%	100%	$ 19,166,054	$ 196,429,320	12%	$	23,571,518	$ 42,737,573	10%	$	4,273,757
	Industrial	$ 2,672,400	0%	100%	$ -	$ -	0%	$	-	$ -	40%	$	-
					$ 48,155,414			**$**	**25,752,704**			**$**	**16,741,976**
4 **CYP**	G/F Shops	$ 6,696,000	192%	50%	$ 6,428,160	$ -	56%	$	-	$ 6,428,160	40%	$	2,571,264
	U/F Comm	$ 10,668,000	84%	100%	$ -	$ -	49%	$	-	$ -	40%	$	-
	Residential	$ 146,191,140	12%	100%	$ 17,542,937	$ 217,625,820	12%	$	26,115,098	$ 43,658,035	10%	$	4,365,804
	Industrial	$ -	0%	100%	$ -	$ -	5%	$	-	$ -	40%	$	-
					$ 23,971,097			**$**	**26,115,098**			**$**	**6,937,068**
5 **SOH**	G/F Shops	$ -	0%	50%	$ -	$ 594,600	0%	$	-	$ -	40%	$	-
	U/F Comm	$ -	0%	100%	$ -	$ -	0%	$	-	$ -	40%	$	-
	Residential	$ 528,924,300	12%	100%	$ 63,470,916	$ 528,131,520	12%	$	63,375,782	$ 126,846,698	10%	$	12,684,670
	Industrial	$ -	0%	100%	$ -	$ -	0%	$	-	$ -	40%	$	-
					$ 63,470,916			**$**	**63,375,782**			**$**	**12,684,670**

Proposed Catchment	Categories	Property Tax Enhancement—LOWER bound														
		Zone A					Zone B				Total RV Increase =Rental Increase		Let %		Rental subject to Property Tax	
		Existing RV	Projected Increase		Adj		Existing RV	Projected Increase								
6 **ABE**	G/F Shops	$ 158,275,800	192%	50%	$ 151,944,768		$ 46,792,200	56%	$ 26,203,632		$ 178,148,400		40%	$	71,259,360	
	U/F Comm	$ 28,227,900	29%	100%	$ 8,186,091		$ 31,395,000	5%	$ 1,569,750		$ 9,755,841		40%	$	3,902,336	
	Residential	$ 232,319,400	12%	100%	$ 27,878,328		$ 201,857,040	12%	$ 24,222,845		$ 52,101,173		10%	$	5,210,117	
	Industrial	$ -	0%	100%	$ -		$ 29,969,700	0%	$ -		$ -		40%	$	-	
					$ 188,009,187				**$ 51,996,227**					**$**	**80,371,814**	
7 **WCH**	G/F Shops	$ 2,150,400	192%	50%	$ 2,064,384		$ 2,222,400	56%	$ 1,244,544		$ 3,308,928		40%	$	1,323,571	
	U/F Comm	$ -	29%	100%	$ -		$ 37,885,800	5%	$ 1,894,290		$ 1,894,290		40%	$	189,429	
	Residential	$ -	12%	100%	$ -		$ 96,369,240	12%	$ 11,564,309		$ 11,564,309		10%	$	4,625,724	
	Industrial	$ 138,091,500	0%	100%	$ -		$ 125,143,920	0%	$ -		$ -		40%	$	-	
					$ 2,064,384				**$ 14,703,143**					**$**	**6,138,724**	
8 **HAV**	G/F Shops	$ 73,774,800	93%	50%	$ 34,305,282		$ 35,831,100	83%	$ 29,739,813		$ 64,045,095		40%	$	25,618,038	
	U/F Comm	$ 3,833,400	0%	100%	$ -		$ 2,714,400	0%	$ -		$ -		40%	$	-	
	Residential	$ 875,845,740	12%	100%	$ 105,101,489		$ 785,862,120	12%	$ 94,303,454		$ 199,404,943		10%	$	79,761,977	
	Industrial	$ -	0%	100%	$ -		$ -	0%	$ -		$ -		40%	$	-	
					$ 139,406,771				**$ 124,043,267**					**$**	**105,380,015**	

	Total	**$**	**520,766,554**
Tax rate @	15%	$	78,114,983
Notional Allowance @	3%	$	2,343,449
		$	75,771,534
Years Purchase in Perpetuity @	4%		25
Property Tax Enhancement as at 2010		**$**	**1,894,288,342**
Property Tax Enhancement as at 2004 (discounted at 4% over 6 years)		**$**	**1,496,487,790**

Table B.D.6
Summary of Assessments of the Property Tax Enhancement (Upper Bound)
as at 2010 in the Proposed Catchments of WIL/SIL

Proposed Catchment		Categories	Property Tax Enhancement--UPPER bound											
			Zone A				Zone B				Total RV Increase			
			Existing RV	Projected Increase	Adj		Existing RV	Projected Increase			= Rental increase	Let %		Rental subject to Property Tax
1	SYP	G/F Shops	$ 151,251,600	72%	50%	$ 54,450,576	$ 168,603,840	20%	$	33,720,768	$ 88,171,344	40%	$	35,268,538
		U/F Comm	$ 109,152,600	84%	100%	$ 91,688,184	$ 124,805,220	49%	$	61,154,558	$ 152,842,742	40%	$	61,137,097
		Residential	$ 418,116,900	17%	100%	$ 71,079,873	$ 1,114,085,400	17%	$	189,394,518	$ 1,114,085,400	10%	$	111,408,540
		Industrial	$ 3,133,200	0%	100%	$ -	$ 3,500,400	0%	$	-	$ -	40%	$	-
						$ 217,218,633			**$**	**284,269,844**			**$**	**207,814,174**
2	UNI	G/F Shops	$ 144,090,600	72%	50%	$ 51,872,616	$ 119,437,200	20%	$	23,887,440	$ 75,760,056	40%	$	30,304,022
		U/F Comm	$ 30,256,260	84%	100%	$ 25,415,258	$ 105,213,300	49%	$	51,554,517	$ 76,969,775	40%	$	30,787,910
		Residential	$ 1,267,076,580	17%	100%	$ 215,403,019	$ 689,049,240	17%	$	117,138,371	$ 332,541,389	10%	$	33,254,139
		Industrial	$ 27,224,700	0%	100%	$ -	$ 15,022,200	0%	$	-	$ -	40%	$	-
						$ 292,690,893			**$**	**192,580,328**			**$**	**94,346,072**
3	KET	G/F Shops	$ 26,695,500	192%	50%	$ 25,627,680	$ 3,097,500	56%	$	1,734,600	$ 27,362,280	40%	$	10,944,912
		U/F Comm	$ 4,002,000	84%	100%	$ 3,361,680	$ 911,400	49%	$	446,586	$ 3,808,266	40%	$	1,523,306
		Residential	$ 159,717,120	17%	100%	$ 27,151,910	$ 196,429,320	17%	$	33,392,984	$ 60,544,895	10%	$	6,054,489
		Industrial	$ 2,672,400	0%	100%	$ -	$ -	0%	$	-	$ -	40%	$	-
						$ 56,141,270			**$**	**35,574,170**			**$**	**18,522,708**
4	CYP	G/F Shops	$ 6,696,000	192%	50%	$ 6,428,160	$ -	56%	$	-	$ 6,428,160	40%	$	2,571,264
		U/F Comm	$ 10,668,000	84%	100%	$ -	$ -	49%	$	-	$ -	40%	$	-
		Residential	$ 146,191,140	17%	100%	$ 24,852,494	$ 217,625,820	17%	$	36,996,389	$ 61,848,883	10%	$	6,184,888
		Industrial	$ -	0%	100%	$ -	$ -	5%	$	-	$ -	40%	$	-
						$ 31,280,654			**$**	**36,996,389**			**$**	**8,756,152**
5	SOH	G/F Shops	$ -	0%	50%	$ -	$ 594,600	0%	$	-	$ -	40%	$	-
		U/F Comm	$ -	0%	100%	$ -	$ -	0%	$	-	$ -	40%	$	-
		Residential	$ 528,924,300	17%	100%	$ 89,917,131	$ 528,131,520	17%	$	89,782,358	$ 179,699,489	10%	$	17,969,949
		Industrial	$ -	0%	100%	$ -	$ -	0%	$	-	$ -	40%	$	-
						$ 89,917,131			**$**	**89,782,358**			**$**	**17,969,949**
6	ABE	G/F Shops	$ 158,275,800	192%	50%	$ 151,944,768	$ 46,792,200	56%	$	26,203,632	$ 178,148,400	40%	$	71,259,360
		U/F Comm	$ 28,227,900	29%	100%	$ 8,186,091	$ 31,395,000	5%	$	1,569,750	$ 9,755,841	40%	$	3,902,336
		Residential	$ 232,319,400	17%	100%	$ 39,494,298	$ 201,857,040	17%	$	34,315,697	$ 73,809,995	10%	$	7,380,999
		Industrial	$ -	0%	100%	$ -	$ 29,969,700	0%	$	-	$ -	40%	$	-
						$ 199,625,157			**$**	**62,089,079**			**$**	**82,542,696**

Proposed Catchment		Categories	Property Tax Enhancement--UPPER bound											
			Zone A				Zone B			Total RV Increase				
			Existing RV	Projected Increase	Adj		Existing RV	Projected Increase		= Rental increase		Let %		Rental subject to Property Tax
7	**WCH**	G/F Shops	$ 2,150,400	192%	50%	$ 2,064,384	$ 2,222,400	56%	$ 1,244,544	$ 3,308,928		40%	$	1,323,571
		U/F Comm	$ -	29%	100%	$ -	$ 37,885,800	5%	$ 1,894,290	$ 1,894,290		40%	$	189,429
		Residential	$ -	17%	100%	$ -	$ 96,369,240	17%	$ 16,382,771	$ 16,382,771		10%	$	6,553,108
		Industrial	$ 138,091,500	0%	100%	$ -	$ 125,143,920	0%	$ -	$ -		40%	$	-
						$ 2,064,384			**$ 19,521,605**				**$**	**8,066,109**
8	**HAV**	G/F Shops	$ 73,774,800	93%	50%	$ 34,305,282	$ 35,831,100	83%	$ 29,739,813	$ 64,045,095		40%	$	25,618,038
		U/F Comm	$ 3,833,400	0%	100%	$ -	$ 2,714,400	0%	$ -	$ -		40%	$	-
		Residential	$ 875,845,740	17%	100%	$ 148,893,776	$ 785,862,120	17%	$ 133,596,560	$ 282,490,336		10%	$	112,996,134
		Industrial	$ -	0%	100%	$ -	$ -	0%	$ -	$ -		40%	$	-
						$ 183,199,058			**$ 163,336,373**				**$**	**138,614,172**

Total	**$**	**576,632,032**
Tax Rate @15%	$	86,494,805
Notional Allowance @3%	$	2,594,844
	$	83,899,961
Years Purchase in Perpetuity @4%		25
Property Tax Enhancement as at 2010	**$**	**2,097,499,016**
Property Tax Enhancement as at 2004 (discounted at 4% over 6 years)	**$**	**1,657,024,222**

Table B.D.7
Summary of Land Premium valuations
of Significant re-developable sites in catchments as at 2010

	Site Location	Area	Valuation summary							Lower bound	Upper bound
				Use	PR	GFA	AV	Value			
SYP	First & Second Street (URA Scheme)	3,511	*Existing*	Tenement building	8	28,088	$ 15,000	$ 421,320,000			
			Future	Composite building	11	38,621	$ 20,000	$ 772,420,000		**$ 351,100,000**	
	280 Des Voeux Road West (Probable)	6,817	*Existing*	Western Police Station & Quarters	-	-	$ -	$ -			
			Future	Commercial	15	102,255	$ 15,000	$ 1,533,825,000			**$ 1,533,825,000**
UNI	12A North St Sitting-out Area (TPB approval sought)	776	*Existing*	Sitting-out Area	-	-	$ -	$ -			
			Future	Residential (A)	8	3,547	$ 15,000	$ 53,205,000		**$ 53,205,000**	
KET	Forbes Street (CDA project)	5,346	*Existing*	Playground	-	-	$ -	$ -			
			Future	RCHE & old people's flats	-	6,000	$ 10,000	$ 60,000,000		**$ 60,000,000**	
SOH	SOH Commercial Centre (TPB approval sought)	5,035	*Existing*	HK Electrical Operation Headquarters	-	-	$ -	$ -			
			Future	Hotel	15	75,525	$ 15,000	$ 1,132,875,000		**$ 1,132,875,000**	
ABE	232 Aberdeen Main Road (Probable)	1,438	*Existing*	Industrial	15	21,570	$ 5,000	$ 107,850,000			
			Future	Residential (E)	5	7,190	$ 15,000	$ 107,850,000			$ **0**

	Site Location	Area	Valuation summary						Lower bound	Upper bound
			Use		PR	GFA	AV	Value		
ABE	234 Aberdeen Main Road (Probable)	1,144	*Existing*	Industrial	15	17,160	$ 5,000	$ 85,800,000		
			Future	Residential (E)	5	5,720	$ 15,000	$ 85,800,000		$ **0**
	236 Aberdeen Main Road (Probable)	1,615	*Existing*	Industrial	15	24,225	$ 5,000	$ 121,125,000		
			Future	Residential (E)	5	8,075	$ 15,000	$ 121,125,000		$ **0**
WCH	54 Wong Chuk Hang Road (Probable)	727	*Existing*	Industrial	15	10,905	$ 5,000	$ 54,525,000		
			Future	Commercial	15	10,905	$ 10,000	$ 109,050,000		$ **54,525,000**
	59-61 Wong Chuk Hang Road (Probable)	1,110	*Existing*	Industrial	15	16,650	$ 5,000	$ 83,250,000		
			Future	Commercial	15	16,650	$ 10,000	$ 166,500,000		$ **83,250,000**
	63 Wong Chuk Hang Road (Probable)	1,680	*Existing*	Industrial	15	25,200	$ 5,000	$ 126,000,000		
			Future	Commercial	15	25,200	$ 10,000	$ 252,000,000		$ **126,000,000**
	33-35 Wong Chuk Hang Road (TPB approval sought)	1,546	*Existing*	Industrial	15	23,190	$ 5,000	$ 115,950,000		
			Future	Hotel	15	23,185	$ 10,000	$ 231,850,000	$ **115,900,000**	
	55-57 Wong Chuk Hang Road (TPB approval sought)	1,389	*Existing*	Industrial	15	20,835	$ 5,000	$ 104,175,000		
			Future	Hotel	15	20,835	$ 10,000	$ 208,350,000	$ **104,175,000**	

	Site Location	Area	Valuation summary							Lower bound	Upper bound
				Use	PR	GFA	AV		Value		
WCH	50 Wong Chuk Hang Road (TPB approval sought)	727	*Existing*	Industrial	15	10,905	$	5,000	$ 54,525,000		
			Future	Hotel	15	10,946	$	10,000	$ 109,460,000	**$ 54,935,000**	
	8 Heung Yip Street (TPB approval sought)	910	*Existing*	Industrial	15	13,650	$	5,000	$ 68,250,000		
			Future	Hotel	15	13,737	$	10,000	$ 137,370,000	**$ 69,120,000**	
	23 Yip Kan Street (TPB approval sought)	2,150	*Existing*	Industrial	15	32,250	$	5,000	$ 161,250,000		
			Future	Hotel	15	32,250	$	10,000	$ 322,500,000	**$ 161,250,000**	

	Lower bound	Upper bound
Total	**$ 2,102,560,000**	**$ 1,797,600,000**
	40%	25%
as at 2010 (Lower Bound)	**$ 841,024,000**	**$ 449,400,000**
	Lower Bound	**$ 841,024,000**
as at 2010 (Upper Bound)		**$ 1,290,424,000**
		Upper Bound
as at 2004 (discounted at 4% over 6 years)	**$ 664,408,960**	**$ 1,019,434,960**

Table B.D.8
Value Enhancement as 2010 to the
Government from Non-domestic Portions of CyberPort

G/F Shops	Rental uplift	$	6,428,160
U/F Comm	Rental uplift	$	8,961,120
Hotel	Rental uplift	$	3,027,500
		$	**18,416,780 p.a.**
	Years Purchase in Perpetuity @4%		25
	Value Enhancement as at 2010	**$**	**460,419,500**
	Value Enhancement as at 2004 (discounted at 4% over 6 years)	**$**	**363,731,405**

Upon completion of CyberPort, the government will own the non-domestic portion of the project plus a split of the profit of the domestic portion.

Only the rental income from the non-domestic portion is taken into account as an enhanced benefit to the government for the purpose of this study.

Table B.D.9
Summary of Enhancement of Property Value (Lower Bound)
as at 2010 to Private Property Owners

Proposed Catchment	Categories	Private Value Enhancement--LOWER Bound								Total Value increase
		Zone A				Zone B				
		Cap value	Projected Increase			Cap value	Projected Increase			
			Adj							
1 **SYP**	G/F Shops	$ 2,160,737,143	72%	50%	$ 777,865,371	$ 2,408,626,286	20%	$ 481,725,257		
	U/F Comm	$ 1,559,322,857	84%	100%	$ 1,309,831,200	$ 1,782,931,714	49%	$ 873,636,540		
	Residential	$ 5,973,098,571	12%	100%	$ 716,771,829	$ 15,915,505,714	12%	$ 1,909,860,686		
	Industrial	$ 44,760,000	0%	100%	$ -	$ 50,005,714	0%	$ -		
					$ 2,804,468,400			**$ 3,265,222,483**	**$**	**6,069,690,883**
2 **UNI**	G/F Shops	$ 2,058,437,143	72%	50%	$ 741,037,371	$ 1,706,245,714	20%	$ 341,249,143		
	U/F Comm	$ 432,232,286	84%	100%	$ 363,075,120	$ 1,503,047,143	49%	$ 736,493,100		
	Residential	$ 18,101,094,000	12%	100%	$ 2,172,131,280	$ 9,843,560,571	12%	$ 1,181,227,269		
	Industrial	$ 388,924,286	0%	100%	$ -	$ 214,602,857	5%	$ 10,730,143		
					$ 3,276,243,771			**$ 2,269,699,654**	**$**	**5,545,943,426**
3 **KET**	G/F Shops	$ 381,364,286	192%	50%	$ 366,109,714	$ 44,250,000	56%	$ 24,780,000		
	U/F Comm	$ 57,171,429	84%	100%	$ 48,024,000	$ 13,020,000	49%	$ 6,379,800		
	Residential	$ 2,281,673,143	12%	100%	$ 273,800,777	$ 2,806,133,143	12%	$ 336,735,977		
	Industrial	$ 38,177,143	0%	100%	$ -	$ -	5%	$ -		
					$ 687,934,491			**$ 367,895,777**	**$**	**1,055,830,269**
4 **CYP**	G/F Shops	$ 95,657,143	192%	50%	$ 91,830,857	$ -	56%	$ -		
	U/F Comm	$ 152,400,000	84%	100%	$ 128,016,000	$ -	49%	$ -		
	Residential	$ 2,088,444,857	12%	100%	$ 250,613,383	$ 3,108,940,286	12%	$ 373,072,834		
	Industrial	$ -	0%	100%	$ -	$ -	5%	$ -		
					$ 470,460,240			**$ 373,072,834**	**$**	**843,533,074**
5 **SOH**	G/F Shops	$ -	0%	50%	$ -	$ 8,494,286	0%	$ -		
	U/F Comm	$ -	0%	100%	$ -	$ -	5%	$ -		
	Residential	$ 7,556,061,429	12%	100%	$ 906,727,371	$ 7,544,736,000	12%	$ 905,368,320		
	Industrial	$ -	0%	100%	$ -	$ -	5%	$ -		
					$ 906,727,371			**$ 905,368,320**	**$**	**1,812,095,691**
6 **ABE**	G/F Shops	$ 2,261,082,857	192%	50%	$ 2,170,639,543	$ 668,460,000	56%	$ 374,337,600		
	U/F Comm	$ 403,255,714	29%	100%	$ 116,944,157	$ 448,500,000	5%	$ 22,425,000		
	Residential	$ 3,318,848,571	12%	100%	$ 398,261,829	$ 2,883,672,000	12%	$ 346,040,640		
	Industrial	$ -	0%	100%	$ -	$ 428,138,571	5%	$ 21,406,929		
					$ 2,685,845,529			**$ 764,210,169**	**$**	**3,450,055,697**

Proposed Catchment		Categories	Private Value Enhancement--LOWER Bound								Total Value increase
			Zone A				Zone B				
			Cap value	Projected Increase	Adj		Cap value	Projected Increase			
7	**WCH**	G/F Shops	$ 30,720,000	192%	50%	$ 29,491,200	$ 31,748,571	56%	$	17,779,200	
		U/F Comm	$ -	29%	100%	$ -	$ 541,225,714	5%	$	27,061,286	
		Residential	$ -	12%	100%	$ -	$ 1,376,703,429	12%	$	165,204,411	
		Industrial	$ 1,972,735,714	0%	100%	$ -	$ 1,787,770,286	12%	$	214,532,434	
						$ 29,491,200			**$**	**424,577,331**	**$ 454,068,531**
8	**HAV**	G/F Shops	$ 1,053,925,714	93%	50%	$ 490,075,457	$ 511,872,857	83%	$	424,854,471	
		U/F Comm	$ 54,762,857	0%	100%	$ -	$ 38,777,143	5%	$	1,938,857	
		Residential	$ 12,512,082,000	12%	100%	$ 1,501,449,840	$ 11,226,601,714	12%	$	1,347,192,206	
		Industrial	$ -	0%	100%	$ -	$ -	5%	$	-	
						$ 1,991,525,297			**$**	**1,773,985,534**	**$ 3,765,510,831**

	Total	**$ 22,996,728,403**
Less.		
Rates @ 5% cap value		$ 1,149,836,420
Value enhancement after tax as at 2010		**$ 21,846,891,983**
Value enhancement after tax as at 2004 (discounted at 4% over 6 years)		**$ 17,259,044,666**

Table B.D.10
Summary of Enhancement of Property Value (Upper Bound) as at 2010 to Private Property Owners

Proposed Catchment	Categories	Private Value Enhancement—UPPER Bound								Total Value increase
		Zone A				Zone B				
		Cap value	Projected Increase			Cap value	Projected Increase			
			Adj							
1 **SYP**	G/F Shops	$ 2,160,737,143	72%	50%	$ 777,865,371	$ 2,408,626,286	20%	$ 481,725,257		
	U/F Comm	$ 1,559,322,857	84%	100%	$ 1,309,831,200	$ 1,782,931,714	49%	$ 873,636,540		
	Residential	$ 5,973,098,571	17%	100%	$ 1,015,426,757	$ 15,915,505,714	17%	$ 2,705,635,971		
	Industrial	$ 44,760,000	0%	100%	$ -	$ 50,005,714	0%	$ -		
					$ 3,103,123,329			**$ 4,060,997,769**	**$**	**7,164,121,097**
2 **UNI**	G/F Shops	$ 2,058,437,143	72%	50%	$ 741,037,371	$ 1,706,245,714	20%	$ 341,249,143		
	U/F Comm	$ 432,232,286	84%	100%	$ 363,075,120	$ 1,503,047,143	49%	$ 736,493,100		
	Residential	$ 18,101,094,000	17%	100%	$ 3,077,185,980	$ 9,843,560,571	17%	$ 1,673,405,297		
	Industrial	$ 388,924,286	0%	100%	$ -	$ 214,602,857	5%	$ 10,730,143		
					$ 4,181,298,471			**$ 2,761,877,683**	**$**	**6,943,176,154**
3 **KET**	G/F Shops	$ 381,364,286	192%	50%	$ 366,109,714	$ 44,250,000	56%	$ 24,780,000		
	U/F Comm	$ 57,171,429	84%	100%	$ 48,024,000	$ 13,020,000	49%	$ 6,379,800		
	Residential	$ 2,281,673,143	17%	100%	$ 387,884,434	$ 2,806,133,143	17%	$ 477,042,634		
	Industrial	$ 38,177,143	0%	100%	$ -	$ -	5%	$ -		
					$ 802,018,149			**$ 508,202,434**	**$**	**1,310,220,583**
4 **CYP**	G/F Shops	$ 95,657,143	192%	50%	$ 91,830,857	$ -	56%	$ -		
	U/F Comm	$ 152,400,000	84%	100%	$ 128,016,000	$ -	49%	$ -		
	Residential	$ 2,088,444,857	17%	100%	$ 355,035,626	$ 3,108,940,286	17%	$ 528,519,849		
	Industrial	$ -	0%	100%	$ -	$ -	5%	$ -		
					$ 574,882,483			**$ 528,519,849**	**$**	**1,103,402,331**
5 **SOH**	G/F Shops	$ -	0%	50%	$ -	$ 8,494,286	0%	$ -		
	U/F Comm	$ -	0%	100%	$ -	$ -	5%	$ -		
	Residential	$ 7,556,061,429	17%	100%	$ 1,284,530,443	$ 7,544,736,000	17%	$ 1,282,605,120		
	Industrial	$ -	0%	100%	$ -	$ -	5%	$ -		
					$ 1,284,530,443			**$ 1,282,605,120**	**$**	**2,567,135,563**
6 **ABE**	G/F Shops	$ 2,261,082,857	192%	50%	$ 2,170,639,543	$ 668,460,000	56%	$ 374,337,600		
	U/F Comm	$ 403,255,714	29%	100%	$ 116,944,157	$ 448,500,000	5%	$ 22,425,000		
	Residential	$ 3,318,848,571	17%	100%	$ 564,204,257	$ 2,883,672,000	17%	$ 490,224,240		
	Industrial	$ -	0%	100%	$ -	$ 428,138,571	5%	$ 21,406,929		
					$ 2,851,787,957			**$ 908,393,769**	**$**	**3,760,181,726**

Proposed Catchment		Categories	Private Value Enhancement—UPPER Bound								Total Value increase
			Zone A				Zone B				
			Cap value	Projected Increase			Cap value	Projected Increase			
				Adj							
7	**WCH**	G/F Shops	$ 30,720,000	192%	50%	$ 29,491,200	$ 31,748,571	56%	$	17,779,200	
		U/F Comm	$ -	29%	100%	$ -	$ 541,225,714	5%	$	27,061,286	
		Residential	$ -	17%	100%	$ -	$ 1,376,703,429	17%	$	234,039,583	
		Industrial	$ 1,972,735,714	0%	100%	$ -	$ 1,787,770,286	17%	$	303,920,949	
						$ 29,491,200			**$**	**582,801,017**	**$ 612,292,217**
8	**HAV**	G/F Shops	$ 1,053,925,714	93%	50%	$ 490,075,457	$ 511,872,857	83%	$	424,854,471	
		U/F Comm	$ 54,762,857	0%	100%	$ -	$ 38,777,143	5%	$	1,938,857	
		Residential	$ 12,512,082,000	17%	100%	$ 2,127,053,940	$ 11,226,601,714	17%	$	1,908,522,291	
		Industrial	$ -	0%	100%	$ -	$ -	5%	$	-	
						$ 2,617,129,397			**$**	**2,335,315,620**	**$ 4,952,445,017**

Total	**$**	**28,412,974,689**
Less		
Rates@5% cap value	$	1,420,648,734
Value enhancement after tax as at 2010	**$**	**26,992,325,954**
Value enhancement after tax as at 2004 (discounted at 4% over 6 years)	**$**	**21,323,937,504**

Appendix C

Environmental Health Benefits from Reduction in Roadside Pollution with WIL/SIL

Lead responsibility for this part of the analysis

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March 2004

Summary

C.S.1 **Introduction:** Urban air pollution is a major environmental health risk, responsible for serious illness episodes in children and adults and premature death from cardiovascular and respiratory diseases. Hong Kong has a strong track record in examining the health impacts of air pollution over the last 15 years with many internationally published papers describing the excess risks for respiratory symptoms, primary care use, public hospital admissions and mortality. Benefits of reduced SO_2 levels in Hong Kong were demonstrated as reduced respiratory symptoms and bronchial reactivity in primary school children, avoided deaths, hospital admissions and a reduction in premature deaths. Health benefits of air pollution reductions are seen in both younger and older members of the population.

C.S.2 **Methods:** In this costing, we used existing evidence on health risks and population mortality and morbidity to show the direct cost of illness due to air pollution and the associated production losses. To this evidence we apply the projected reduction in emissions expected to result from implementation of the medium capacity rail West Island Line/South Island line (WIL/SIL). We varied the estimates used to test the sensitivity of the final results. Because this costing captures only a part of the full cost of ill health due to air pollution, we also deal briefly with issues of willingness to pay in Hong Kong to avoid the ill effects of roadside air pollution. In principle, *willingness to pay* (WTP) to avoid the health risk associated with exposure to pollution provides the most comprehensive measure of the value people put on the problem. All methods used here are in line with international recommendations and practice.

C.S.3 **Results:** Our estimate of the annual direct benefits arising from avoided cost of illness, including productivity loss, associated with the coming of WIL/SIL is $22.4 million (with a range of $18.3 to $25.4 million. Of this value, 79% ($17.7 million) is for health care costs. Of the health care costs, 34% are public health care costs falling to the Government. Thus, with the reduced roadside pollution associated with having a major share of transport in Southern and Western shifting to rail, government experiences a direct benefit in the form of reduced expenditures for public health care of about $6 million per year.

C.S.4 While the above savings are modest, they nonetheless serve to illustrate the point that a move toward more rail-based (and less road-based) transport in Hong Kong brings with it direct external benefits in the form of lower health care costs, a portion of which are borne directly by the government.

C.1 Introduction

C.1.1 Urban air pollution is considered by the World Health Organization to be one of the major environmental risks to health responsible for cardiovascular and respiratory mortality. "Air pollution" is not a single risk factor but contains complex mixtures of fine particulate matter (PM) and some or all of sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and ozone (O_3). Many studies worldwide have quantified the association between mortality and these various components of air pollution and while strong associations have been found with fine particles, in Hong Kong gaseous pollutants had the biggest impact. As with other risk factors, air pollution causes a pyramid of health effects with mortality and serious morbidity or illness at the top end and less serious morbidity down to minor symptoms and irritation at the lower levels.

C.1.2 Hong Kong has a strong track record in examining the health impacts of air pollution over the last 15 years. Many published papers describe the excess risks found for respiratory symptoms, primary care use, public hospital admissions and mortality. The benefits of reducing the pollutants caused by the combustion of fossil fuels has been demonstrated in Hong Kong following restriction of sulphur in fuels, where there was a reduction in morbidity and mortality from cardio-respiratory disease. The health benefits were seen in both young and older members of the population.

C.1.3 This Appendix explains and documents how we assessed the economic cost that could be avoided due to the reduction in vehicle emissions after implementation of the WIL/SIL.

C.1.4 We have used the estimated reduction in emissions as a proxy for reductions in ambient concentrations to calculate the impact on health.

Since there is not yet an appropriate system for modeling the change in ambient pollutant levels consequent on a change in emissions -- see reference endnote (1), other researchers have used emissions as a proxy for pollution levels (2). We have tested our assumptions in sensitivity analyses.

C.1.5 Below, we explain further the rationale for the approach taken to the calculation:

- ***Cardio-respiratory diseases***: We have included only cardio-respiratory diseases because they are the main category of diseases found in published studies consistently related to air pollution (3, 4). However, it should be noted that mortality from "all causes" varies with air pollutant concentrations.

- ***Nitrogen dioxide (NO_2) and Respirable Suspended Particulates (RSP)***: In many Western (5, 6, 7) and European countries (8, 9), RSP appears to have the strongest impact on health while NO_2 shows the strongest adverse health effects in Hong Kong (10, 11). Hong Kong has reported the only intervention study worldwide (12) of the effect of reduction of a single pollutant, SO_2. However, SO_2 has not been included in this costing because information on expected reductions in emissions of SO_2 per vehicle kilometer by vehicle class were not available from EPD at the time at this analysis. In this respect, our overall estimates can be considered very conservative.

- ***Risk estimates:*** Our data are based on risk estimates obtained from time-series studies. Cohort follow-up and intervention studies usually yield larger risk estimates for pollutant exposures. As a result, our estimates of benefits arising from the reduction in vehicular traffic are conservative.

- ***Using Nitrogen Dioxide (NO_2) or Nitrogen Oxides (NO_x)***: The Hong Kong Environmental Protection Department (EPD) has commissioned

many studies on the short-term health effects of air pollutants, including NO_2, SO_2, RSP and O_3, on mortality and morbidity (13, 14, 15, 16). Emissions data is reported for NO_x rather than NO_2. The transformation of NO_x to NO_2 is complex, but the correlation between NO_2 and NO_x is very high (Figure C.1). It was therefore considered reasonable to estimate the value of reducing NO_x emissions using effects of NO_2.

- ***Age groups included***: We have included all ages in this costing and the risk effects are averaged for the whole population. But larger effects have been demonstrated for some population sub groups such as the young (17), the elderly (18) and those with existing chronic disease (19).

Databases involved

- ***Mortality data***: Known deaths data for the years 1995-2000 was available from the Census & Statistics Department, Hong Kong Special Administrative Region. The data set included daily mortality with demographic information including age and sex of the deceased.

- ***Hospital admission data***: Hospital records for patients discharged between 1.1.1995 and 30.6.2001 were retrieved from the computerized Clinical Management System of the Hospital Authority (HA). The database keeps all admission and discharge records of all public hospitals (95% of all admissions) in Hong Kong.

C.2 Methodology

C.2.1 In general, the computation method is the summation of total direct cost of illness (COI), plus the indirect cost of productivity loss (PL) due to illness and premature death caused by air pollution multiplied by the expected reduction in pollution which would result from implementation of WIL/SIL. The procedure is as follows:

- ***Assessment of health impact of air pollution***

  Poisson regression modeling on daily time-series data (20) for the years 1995-2000 was used to estimate the health effects for each of the pollutants. This method has been widely used in international (21, 22) and local studies (10, 11, 23) and is in line with the methods used in a major assessment - Air Pollution and Health: a European Approach (APHEA). Time-series analyses give a more conservative estimate of risk than cohort studies.

C.2.2 In this approach a core model was first constructed to explain the trend and seasonal variations as well as other variations arising from confounding. Statistical diagnostic checking procedures (residual plots and partial autocorrelation plots) were used to ensure the validity of the core model and to reduce the estimation biases.

C.2.3 In each core model, daily counts of mortality and hospital admissions were the outcome variables. Non-parametric smoothing terms (Loess function) (24) for trend on days, seasonality, temperature, relative humidity, and dummy variables for the days of the week, holidays, and influenza epidemics were the explanatory variables. In order to get the estimates of pollutant effects, the daily concentration of the pollutant was added into the core model. All effect estimates were converted to excess

risks (ER) per 10μg/m^3 increase in pollutant concentration using an assumption of linearity in the risk estimate. (Table C.1).

- ***Direct cost of illness due to air pollution***

C.2.4 The direct cost of illness (COI) was estimated from the cost of health services due to respiratory and cardiovascular diseases. These included admissions to public hospitals (item a), admissions to private hospitals (item b), visits to accident and emergency departments (item c), specialty (item d) and general outpatient clinics (item e) and private general practitioners (item f).

C.2.5 Total direct cost of illness due to total air pollution is calculated from multiplying (A) the cost per episode/visit, (B) total number of episodes/visit in a year and the excess risks (ER) of respiratory and cardiovascular diseases per unit of air pollutant. (Table C.2)

C.2.6 The components of total direct cost were estimated as follows:

A. Cost per episode/visit

The calculation of the cost per episode/visit (in HK$) was estimated to be

Average cost for each bed-day	X	Mean length of stay (LOS) for an episode

- For item (a) & item (b) in Table C.2, the mean lengths of stay (LOS) for an episode in a public hospital due to respiratory or cardiovascular disease in acute general (n=15), chronic infirmary (n=19) and coronary care unit (n=3) hospitals for both sexes in Hong Kong Island were obtained from the HA inpatient database for the year 2000. Since there is no information for private hospital admissions, the mean LOS for private hospitals was assumed to be the same as for acute general public hospitals. Average costs for each bed-day for acute general

($3,132), chronic infirmary ($2,735) and coronary care units ($5,188) were provided by HA (25). Unit costs in the same setting were assumed to be the same for all patients.

- For items (c)-(e), average cost per visit for accident & emergency units ($571) (25), specialty outpatient clinic ($660) (25) and general outpatient clinic visits (HA $302, Department of Health $219) were obtained from HA (25) and Department of Health (26). The costs were assumed to be the same for all categories of disease and both sexes.

- For item (f), the mean consultation fee for a visit for cold, flu or fever to a private general practitioner ($174) was estimated from a Household Survey 1998 (27) deflated to year 2000 prices (28).

B. Total number of episodes/visits per year

- Item (a) - Public hospital admissions: The number of episodes for Hong Kong Island in the year 2000, for respiratory and cardiovascular diseases, in females and males, and in each of acute general, chronic infirmary hospitals and coronary care unit (CCU), were derived from HA inpatient databases.

- Item (b) - Private hospital admissions: The total number of hospital admissions for respiratory and cardiovascular diagnoses in the past 12 months in HA and private hospitals were estimated from the Annual Digest of Statistics (2000) (28) (respiratory 151,330; cardiovascular 110,877). Total numbers from HA hospitals were derived from HA inpatient databases (respiratory 120,018; cardiovascular 93,629); and the numbers from private hospitals were obtained by taking the difference between the two sets of two numbers. The ratio of the population of Hong Kong Island to the whole of Hong Kong (29) was applied to obtain the number of hospital admissions in

Hong Kong Island.

- Item (c) - A&E visits: The total number of visits for Hong Kong in the year 2000 was obtained from HA (25) and multiplied by the proportion of the population in Hong Kong Island. The proportions due to respiratory and cardiovascular diseases were assumed to be the same as for HA inpatient admissions (acute general and chronic infirmary hospitals).

- Item (d) - SOPC visits: The total numbers of visits in Departments of Medicine and Surgery of all SOPCs under the HA, were obtained from HA (25). The proportions due to respiratory and cardiovascular diseases were assumed to be the same as for HA inpatient admissions (acute general and chronic infirmary hospitals). The number of visits for Hong Kong Island was calculated by multiplying by the proportion of the population in Hong Kong Island. (29)

- Item (e) - GOPC visits: The total number of visits to GOPCs under the Department of Health was obtained (25). The proportions due to respiratory and cardiovascular diseases were taken to be the same as for HA inpatient admissions (acute general and chronic infirmary hospitals). The population ratio for Hong Kong Island was applied. (29)

- Item (f) - Private GP visits: In 2001 (15), the average number of visits per GP for respiratory complaints was estimated to be 6203 for 11 GPs (data for 7 GPs for the whole year 2000 and for 4 GPs for first nine months of the year, adjusted to yearly data, were used). Wong et al (15) quote an estimate of 4202 GPs (range 3173-5231) in practice in Hong Kong. The total numbers of GP visits for the two categories of complaint were then estimated by multiplication of total number of GPs by the average number of visits per GP and the population proportion

of Hong Kong Island (29).

- ***Productivity loss due to health impacts of air pollution***

C.2.7 Productivity loss (PL) was estimated in order to assess the indirect cost of morbidity and mortality. This included the productivity loss due to absence from work estimated from length of stay in hospital, sick leave granted by private GPs, time of travel to and from consultations, and person-years of life lost from deaths younger than 65 years. (Table C.3)

C.2.8 The cost of PL due to the total air pollution for each aspect was estimated by multiplying the productivity loss per event by the total number of events for Hong Kong Island due to air pollution where an event was an episode in hospital, a visit to a GP resulting in sick leave or a loss of a life year due to death under 65 years. The following formulae were used:

- Cost per episode = Mean length of stay (in days) x median daily income (30)
- Cost per day of sick leave = Mean sick leave/consultation (16) (per day) x median daily income (30)
- Waiting & travel cost per consultation = Mean waiting and traveling time/consultation (in hours) (27) x median hourly income (30)
- Number of episodes for those in work = Number of episodes in Hong Kong Island (working group aged from 15-64 years) x labour force rate (28) x employment rate (28)
- Number of consultations for those in work = Number of consultations x population proportion of Hong Kong Island (29) x labour force rate (28) x employment rate (28)
- Number of life years lost < 65 years = Total number of years between death and age 65 for those who were aged over 15, lived in Hong Kong Island and died before 65 years old
- Production value of a life year = Median monthly income by sex (30) x 12

- ***Health care cost avoidable from West Island Line/South Island Line (WIL/SIL)***

C.2.9 In estimating the health care cost avoidable from WIL/SIL, the reduction in air pollutants and the population affected in Hong Kong Island were taken into account. The parameters and the computation are shown below:

Known parameters:

TRAP Traffic-related air pollutants (in % of total air pollution): (31)
NO_2 66.6; RSP 38.8

MEAN Mean level of pollutant concentration (in $\mu g/m^3$): (32)
General level –
NO_2 58.3;
RSP 50.4
Roadside level –
NO_2 96;
RSP 83.5

Estimated parameters:

POP Population exposed, based on the numbers who live in Central & Western/Southern Districts or the rest of Hong Kong Island (in % of population in that district): (33)
Central & Western/ Southern Districts –
Most affected (roadside) 49;
Less affected (non-roadside) 51
Rest of Hong Kong Island –
Most affected (roadside) 53;
Less affected (non-roadside) 47

REDUC The reduction in mean annual pollutant concentrations, based on the estimate of the expected reduction in emissions resulting from WIL/SIL (in % of mean pollutant concentrations):
RSP 10, NO_2 10

Health care cost avoidable for roadside population from WIL/SIL
= (COI + PL) x POP (roadside) x REDUC x MEAN (roadside level)
plus
Health care cost avoidable for non-roadside population from WIL/SIL
= (COI + PL) x POP (non-roadside) x REDUC x TRAP x MEAN (general level)

C.2.10 The costs were estimated for levels of NO_2 and RSP. Since NO_2 has the

strongest impact on health in previous studies (10, 11, 23), the economic cost due to NO_2 alone is the *minimum* approach and gives a minimum value. We have previously calculated the correlation between NO_2 and RSP. A *conservative* approach to calculating total air pollution, that takes into account possible overlapping of health effects of these two pollutants, is to include 58% of RSP effects because of its correlation (0.65) with NO_2 concentration. This is used as the main estimate but it may understate the impact because it does not include additional effects of other pollutants such as SO_2. A maximum (additive) value for the two pollutants is obtained by adding the effects of NO_2 and RSP together; we have used this as an upper bound. (Table C-4)

- ***Sensitivity analysis***

C.2.11 Table C.5 compares the effects of the changes in different parameters and shows the range of costs after implementing the WIL/SIL.

- Change in estimated reduction in pollutant levels for Central & Western/ Southern districts: This was varied between 7% and 25% to match the range of the expected emission reductions of Central & Western/Southern Districts.

- Change in estimated reduction in pollutant levels for rest of Hong Kong Island: The estimated emission reduction was varied up to 10% in order to show the benefit of the same reduction in the whole of Hong Kong Island.

- Change in level of roadside pollutants: The mean roadside levels of pollutants were estimated from the roadside monitoring stations in Hong Kong Island (Central & Western; Causeway Bay) (32). Maximum (NO_2 98 $\mu g/m^3$; RSP 101 $\mu g/m^3$) and minimum (NO_2 94 $\mu g/m^3$; RSP 66 $\mu g/m^3$) levels between these two stations were used instead of the mean. A sensitivity analysis showed that varying the levels used between the maximum and minimum levels changed the final costs by less than $1 million.

C.3 Alternative estimate of economic gain due to WIL/SIL-related reduction in air pollution

C.3.1 Our analysis of costs values morbidity only as health care use and lost working days. This *cost-of-illness* approach is recognized to include only a part of the true value of avoiding mortality and morbidity and may be considered a lower bound for the true value.

C.3.2 A second approach is to use locally derived estimates of willingness to pay to avoid a) a premature death b) a hospital admission for respiratory disease c) a hospital admission for cardiovascular disease and d) a day of coughing. These estimates of willingness to pay to avoid an event were obtained in Hong Kong in 2001 by asking people to estimate how much they would be willing to pay to reduce or avoid the risk of ill health.[1]

C.3.3 Calculation of value of avoided events

- **Overview:** The number of avoided events due to a reduction in air pollution as a result of the WIL/SIL was multiplied by the willingness to pay (WTP) value of avoiding such an event to generate the total value of the air pollution reduction.

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[1] We have been discussing estimates of DIRECT COSTS. By their nature, such estimates account for only a subset (and often a modest one) of the full value people place on the impacts of air pollution. An alternative approach is to carry-out a willingness to pay (WTP) survey. In principle, WTP estimates can be fully comprehensive with respect to the range of values people hold. Yet, WTP surveys may raise issues of methodology (e.g., the extent to which respondents fully understand the nature of the questions being asked and are willing to answer honestly). Nonetheless, they are often cited as additional evidence of un-priced values. In Hong Kong a large scale and carefully designed WTP survey for air pollution was conducted in 2001 by the University of Hong Kong's Department of Community Medicine. When the survey results were applied to the level and types of roadside pollutant reductions associated with the coming of the WIL/SIL the estimated **WTP was $3 billion.** Unfortunately, there is no clear way to determine how much of this WTP is already captured in our property valuation increases. Further, WTP is a form of 'contingent valuation' which is a quite different set of valuation techniques compared to those of *direct costs and benefits* and *hedonic pricing* (property value charge) that constitute the major focus of this estimation of external benefits. Hence, we decided to not use the WTP figure as a formal part of our estimate of the monetary valuation of the health-related benefits of the WIL/SIL (but we do report it here for information purposes).

- **Number of events avoided:** For the first three types of events, premature death, hospital admission due to respiratory disease and admission due to cardiovascular disease, the number of events avoided has already been calculated (see Table C.6). For cough, we estimated the number of events avoided as follows: the proportion of the population affected by cough was estimated from a population survey by the Department of Community Medicine (33) in which 68% believed that air pollution caused them to suffer symptoms and, of these, one third believed that it caused them to cough. This comes to around 20% of the whole population. As a conservative estimate, we have halved this and taken 10% as the main estimate of the number affected. Further, we have estimated the number of days when symptoms occur based on levels of NO_2 only. The number of days in Hong Kong when the level of NO_2 was higher than the median plus one standard deviation (120 $\mu g/m^3$) was 49 in 2000. Assuming that these 10% of people coughed only on these high pollution days, we obtain an estimate of about 7 million cough-days for Hong Kong Island. We have estimated a reduction in coughing due to WIL/SIL as 10% for the population of Central & Western/Southern and 2.5% for the rest of Hong Kong Island. For example,

Number of days of cough due to air pollution	=	% with cough due to pollution (10%)	x	Population of Central & Western/ Southern districts	x	Number of days with high levels of pollution

Number of days of cough avoided with WIL/SIL	=	Number of days of cough due to air pollution	x	% reduction (10%)

The same calculation was carried out for the population of the rest of Hong Kong Island using an expected reduction of 2.5% rather than 10%. The number of days of cough avoided is 370,644 cough-days.

C.3.4 **Validation:** The World Health Organization (WHO) (34) reports estimates of excess risks for cough, per 10ug/m^3 increase in fine particulates as 3.6% (95% CI 2.0-5.2). This would give, in our population with ambient levels around 50µg/m^3, an estimate of 18% affected by cough with a confidence interval of 10 to 26%. Hence our estimate of 10% is at the lower bound of the WHO projection.

- **Value of avoided events:** The value of avoiding a premature death is estimated in Hong Kong to be at least HK$10 million (35). This value is in the low to middle range of international values for avoiding a death and was validated by a local survey in 2001. The value of avoiding an admission for respiratory disease and that for cardiovascular disease has been estimated in local surveys as $4,900 and $4,100 respectively (36). The value of avoiding a day of coughing has been estimated in a local survey as $184 in 2001 (37). The total value of the events avoided was calculated by multiplying the number of events by the monetary value of avoiding them and summing over each type of event (Table C.7).

C.4 Conclusion

C.4.1 The annual direct benefit arising from avoided cost of illness, including productivity loss, of WIL/SIL is $22.4 million with a range of $18.3 to $25.4 million. Of this, 79% (17.7 million) is health care costs. Of the health care costs, 34% are public health care costs falling on the Government; this comes to $6.1 million per year in direct Government healthcare costs avoided due to WIL/SIL.

References to Appendices follow Figures and Tables.

Figure C.1
Correlation plot between NO_2 and NO_x for the air quality monitoring stations at Central & Western and Causeway Bay from 1998-2002

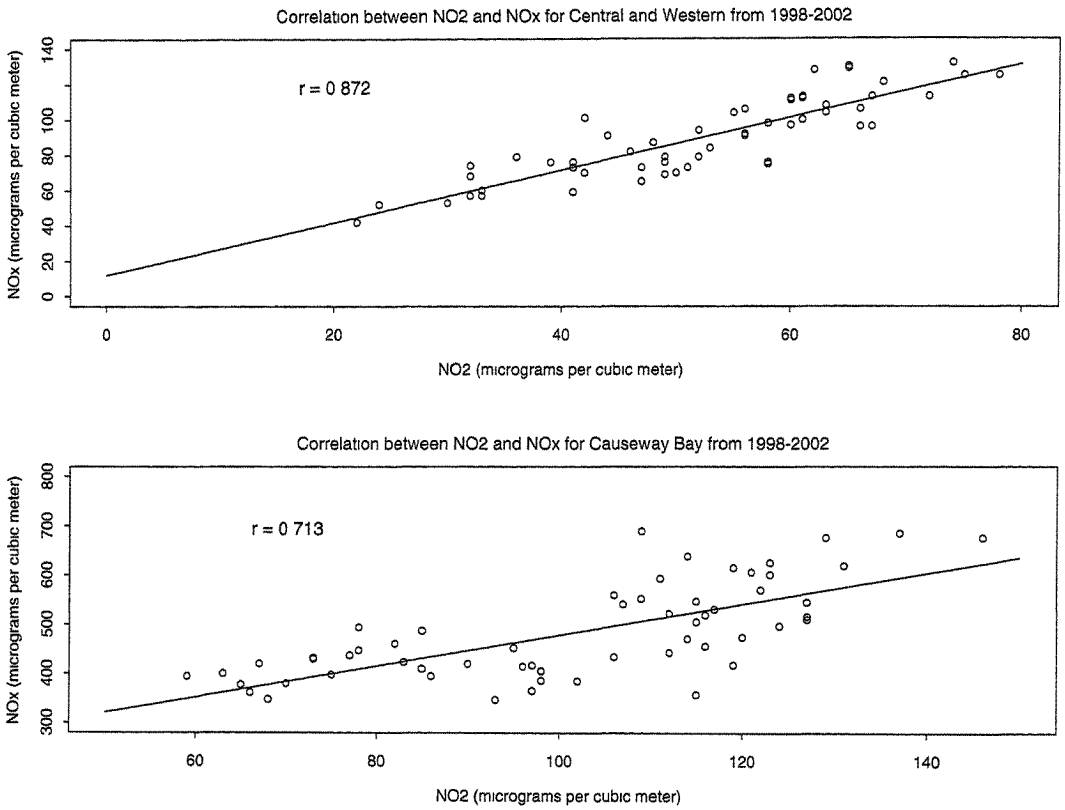

Table C.1
Excess risks (ER) (%) for a 10 μg/m^3 change in pollutant concentration for mortality, hospital admissions and general practitioner visits (15) due to respiratory and cardiovascular diseases; average for all ages

	ER* (%) per 10 μg/m^3	
	NO_2	RSP
Mortality		
Respiratory	0.81	0.40
Cardiovascular	0.94	0.37
Hospital admissions		
Respiratory	0.54	0.50
Cardiovascular	0.73	0.37
General practitioner visits		
Respiratory	2.98	1.42

Note:
* The excess risk was estimated from a statistical model which accounted for daily variations of each health outcome for all ages, and is equal to the relative risk (RR) per 10μg/m^3 change of each single pollutant in the model minus one (i.e. ER=RR-1)

Table C.2
Annual direct cost of illness (HK$) due to each 10 μg/m^3 change in each air pollutant for Hong Kong Island in Year 2000

	Cost (HK$) per episode/ visit	Total no. of episodes/ visits per year	Direct cost of illness per 10 μg/m^3	
	A	B	NO_2 COI = A*B*ER[#]	RSP
(a) Hospital admissions – Public Hospitals				
Respiratory			(A*B *0.54%)	(A*B *0.50%)
1. Acute General				
F $3,132 x 5.92 (LOS)	18,541.44	10,292	1,030,474	954,143
M $3,132 x 5.85 (LOS)	18,322.20	15,283	1,512,098	1,400,091
2. CR Infirmary				
F $2,735 x 18.93 (LOS)	51,773.55	970	271,190	251,102
M $2,735 x 18.27 (LOS)	49,968.45	1,225	330,541	306,057
3. Coronary Care Unit				
F $5,188 x 3.33 (LOS)	17,276.04	121	11,288	10,452
M $5,188 x 3.10 (LOS)	16,082.80	149	12,940	11,982
Cardiovascular			(A*B *0.73%)	(A*B *0.37%)
1. Acute General				
F $3,132 x 6.36 (LOS)	19,919.52	8,413	1,223,355	620,057
M $3,132 x 6.00 (LOS)	18,792.00	8,963	1,229,559	623,201
2. CR Infirmary				
F $2,735 x 20.02 (LOS)	54,754.70	1,574	629,142	318,880
M $2,735 x 20.83 (LOS)	56,970.05	1,319	548,548	278,031
3. Coronary Care Unit				
F $5,188 x 3.74 (LOS)	19,403.12	131	18,555	9,405
M $5,188 x 3.48 (LOS)	18,054.24	137	18,056	9,152
		Cost for item (a):	***6,835,747***	***4,792,551***

Table C.2 (continued)

	Cost (HK$) per episode/ visit	Total no. of episodes/ visits per year	Direct cost of illness per 10 μg/m^3	
	A	B	NO_2 COI = A*B*ER[#]	RSP
(b) Hospital admissions – Private Hospitals				
Respiratory			(A*B *0.54%)	(A*B *0.50%)
$3,132 x 5.88 (LOS)	18,416.16	6,374	633,877	586,923
Cardiovascular			(A*B *0.73%)	(A*B *0.37%)
$3,132 x 6.17 (LOS)	19,324.44	3,511	495,291	251,038
		Cost for item (b):	***1,129,168***	***837,961***
(c) Accident & Emergency Visit				
Respiratory			(A*B *0.54%)	(A*B *0.50%)
	571.00	64,865	200,005	185,190
Cardiovascular			(A*B *0.73%)	(A*B *0.37%)
	571.00	48,587	202,525	102,650
		Cost for item (c):	***402,530***	***287,839***
(d) Specialty Outpatient Clinic Visit				
Respiratory			(A*B *0.54%)	(A*B *0.50%)
	660.00	60,716	216,392	200,363
Cardiovascular			(A*B *0.73%)	(A*B *0.37%)
	660.00	45,480	219,123	111,062
		Cost for item (d):	***435,514***	***311,425***

Table C.2 (continued)

	Cost (HK$) per episode/ visit	Total no. of episodes/ visits per year	Direct cost of illness per 10 μg/m^3	
	A	B	NO_2 COI = A*B*ER#	RSP
(e) General Outpatient Clinic Visit				
Respiratory			(A*B *2.98%)	(A*B *1.42%)
1. Department of Health	219.00	151,334	987,636	470,618
2. Hospital Authority	302.00	21,764	195,867	93,333
Cardiovascular			(A*B *2.98%)	(A*B *1.42%)
1. Department of Health	219.00	113,357	739,790	352,518
2. Hospital Authority	302.00	16,302	146,711	69,909
		Cost for item (e):	***2,070,005***	***986,378***
(f) Private General Practitioner Visit				
Respiratory			(A*B *2.98%)	(A*B *1.42%)
	174.00	5,306,284	27,514,144	13,110,767
		Cost for item (f):	***27,514,144***	***13,110,767***
Annual total direct cost per 10μg/m^3:			**38,387,108**	**20,326,921**
Annual total direct cost due to mean general concentration@ of air pollutants:			**223,796,841**	**102,447,683**

Notes:
(1) Figures may not add up to totals owing to rounding.
(2) # - ER is the excess risk of an event (e.g. admission) per 10μg/m^3 increase in the air pollutant.
(3) @ - Mean annual concentration of air pollutants for NO_2 and RSP in general level are 58.3μg/m^3 and 50.4 μg/m^3 respectively.

Table C.3
Annual productivity loss (PL) (HK$) due to each 10 μg/m^3 change in each air pollutant for Hong Kong Island in year 2000

	PL (HK$) per event	Total no. of events per year	Productivity loss Per 10 μg/m^3	
			NO_2	RSP
	A	B	PL = A*B*ER	
(a) Hospital admissions – Public Hospitals				
Respiratory			(A*B *0.54%)	(A*B *0.50%)
1. Acute General				
F	1,136.22#	951^	5,835	5,403
M	2,118.58#	2,451^	28,040	25,963
2. CR Infirmary				
F	1,699.07#	58^	532	493
M	4,020.16#	143^	3,104	2,874
3. Coronary Care Unit				
F	781.15#	11^	46	43
M	1,270.36#	22^	151	140
Cardiovascular			(A*B *0.73%)	(A*B *0.37%)
1. Acute General				
F	1,328.22#	1,118^	10,840	5,494
M	2,004.16#	2,651^	38,785	19,658
2. CR Infirmary				
F	3,135.12#	160^	3,662	1,856
M	6,304.44#	330^	15,187	7,698
3. Coronary Care Unit				
F	799.56#	15^	88	44
M	1,226.96#	33^	296	150
		Productivity loss:	***106,567***	***69,816***

Table C.3 (continued)

	PL (HK$) per event	Total no. of events per year	Productivity loss per 10 µg/m^3	
			NO_2	RSP
	A	B	PL = A*B*ER	
(b) Hospital admissions – Private Hospitals				
Respiratory			(A*B *0.54%)	(A*B *0.50%)
	1,640.55#	2,598^	23,016	21,311
Cardiovascular			(A*B *0.73%)	(A*B *0.37%)
	1,666.85#	1,249^	15,198	7,703
		Productivity loss:	***38,213***	***29,014***
(c) Private General Practitioner Visits				
Respiratory			(A*B *2.98%)	(A*B *1.42%)
1. Sick leave	55.89@	2,491,501+	4,149,650	1,977,350
2. Waiting & travelling time	20.55~	2,491,501+	1,525,770	727,045
		Productivity loss :	***5,675,420***	***2,704,395***
Annual productivity loss for item (a), (b) & (c) per 10µg/m^3 :			**5,820,200**	**2,803,225**
Annual productivity loss for item (a), (b) & (c) due to mean concentration of air pollutants:			**33,931,766**	**14,128,252**

Table C.3 (continued)

	PL (HK$) per event	Total no. of events per year	Productivity loss per 10 μg/m^3	
	A	B	NO_2 PL = A*B*ER	RSP
(d) Premature death				
Respiratory			(A*B *0.81%)	(A*B *0.40%)
F	96,000.00[=]	197[>]	153,187	75,648
M	144,000.00[=]	388[>]	452,563	223,488
Cardiovascular			(A*B *0.94%)	(A*B *0.37%)
F	96,000.00[=]	908[>]	819,379	322,522
M	144,000.00[=]	2,189[>]	2,963,030	1,166,299
Annual productivity loss per 10μg/m^3:			***4,388,160***	***1,787,957***
Annual productivity loss due to Mean concentration of air pollutants:			***25,582,973***	***9,011,302***
Annual total productivity loss per 10 μg/m^3:			**10,208,360**	**4,591,181**
Annual total productivity loss due to mean general concentration of air pollutant:			**59,514,739**	**23,139,555**

Note:
(1) Formula –
[#] Mean LOS (in days) x median daily income
[@] Mean sick leave (in days) x median daily income
[~] Mean waiting and travelling time/consultation (in hours) x median hourly income
[^] Number of episodes for working group (aged from 15-64) x labour force rate x employment rate
[+] Number of consultations x labour force rate x employment rate
[=] Median monthly income by sex x 12
[>] Total number of years lost for those who died in year 2000 aged from 15-64
(2) Figures may not add up to totals owing to rounding.

Table C.4
Annual total cost of illness avoidable (HK$) from
West Island Line/South Island Line (WIL/SIL) in year 2000

	POP[1] (%)	RS/NRS[2] (%)	REDUC[3] (%)	TRAP[4] (%)		MEAN[5] (μg/m³)		TOTAL (HK$)	
				NO_2	RSP	NO_2	RSP	NO_2	RSP
Health care cost									
Central Western/ Southern districts									
1. Roadside	41	49	10			96.0	83.5	7,403,491	3,409,871
2. Non-roadside	41	51	10	66.6	38.8	58.3	50.4	3,116,608	831,166
Rest of Hong Kong Island									
1. Roadside	59	53	2.5			96.0	83.5	2,880,876	1,326,863
2. Non-roadside	59	47	2.5	66.6	38.8	58.3	50.4	1,033,280	275,565
						Sub-total:		*14,434,255*	*5,843,465*
Productivity loss									
Central Western/ Southern districts									
1. Roadside	41	49	10			96.0	83.5	1,968,825	770,177
2. Non-roadside	41	51	10	66.6	38.8	58.3	50.4	828,806	187,733
Rest of Hong Kong Island									
1. Roadside	59	53	2.5			96.0	83.5	766,117	299,695
2. Non-roadside	59	47	2.5	66.6	38.8	58.3	50.4	274,782	62,241
						Sub-total:		***3,838,530***	***1,319,846***
						Annual total cost per pollutant due to cost of illness and productivity loss:		**18,272,785**	**7,163,311**

Note:
1 Central Western/ Southern districts population proportion of Hong Kong Island
2 Proportion of roadside population in those districts
3 Expected reduction in emissions after implementing WIL/SIL
4 Traffic Related fraction of Air Pollutants
5 Mean annual concentration of the pollutants

Table C.5
Combined effects of pollutant reductions on total cost using different approaches to the combination (HK$ million)

Variable	Total value (HK$ million)		
	Minimum NO_2	***Conservative*** NO_2 + 0.58 RSP	***Additive*** NO_2 + RSP
1. **Original value**	**18.3**	**22.4**	**25.4**
2.* *Changing the estimated reduction in emissions for Central & Western/Southern districts from base estimate of 10% to:*			
7%	14.3	17.5	19.9
13%	22.3	27.3	31.0
25%	38.2	46.9	53.2
Range:	**(14.3 – 38.2)**	**(17.5 – 46.9)**	**(19.9 – 53.2)**
3. *Changing the estimated reduction in emissions for rest of Hong Kong Island from 2.5% to:*			
5%	23.2	28.5	32.4
10%	33.1	40.7	46.2
Range:	**(23.2 – 33.1)**	**(28.5 – 40.7)**	**(32.4 – 46.2)**

Notes:
* This analysis shows the effect of adopting new values to replace that of the base value 10% which is the middle value of the expected reductions in emissions. The new values adopted are 7% (average expected reduction in emissions), 13% (peak expected reduction) and 25% which would not come from WIL/SIL alone but could be achieved through a variety of measures.
We prefer the *Conservative* over the *Minimum* estimate because there is now a body of evidence which shows that each pollutant has an adverse effect on health.

Table C.6

Willingness to Pay (WTP) estimate of the value of adverse health events avoided from the reduction in average ambient pollutant concentrations

	Number of events avoided		Unit value (HK$)	Total value (HK$ mil) of avoided events due to the reduction in	
	NO_2	RSP		NO_2	RSP
Hospital admission	**A1**		**B**	**A1*B**	
Respiratory	108	87	4,900	0.5	0.4
Cardiovascular	102	45	4,100	0.4	0.2
Day of respiratory illness	**A2**		**B**	**A2*B**	
Coughing	370,644	--	184	68.2	--
			Subtotal:	***69.1***	***0.6***
Premature death	**A1**		**B**	**A1*B**	
Age under 75					
Cardio-respiratory	5	2	10,000,000	48.6	17.6
			Subtotal:	***48.6***	***17.6***
Other deaths	11	4			

Note:

(1) A1 = Total number of events in Hong Kong Island in year 2000 * ER * REDUC*MEAN
A2 = Population * percentage of suffering * Number of high pollution days * REDUC

(2) The life expectancy for males and females in Hong Kong is 78.0 and 83.9 respectively. (28)

Table C.7
The value of days of coughing avoided by reductions in air pollutants due to WIL/SIL: effect of changing estimates (HK$ million)

Variable	Total value (HK$ mil)
1. **Original value**	**68.2**
2. *Changing the estimated percentage of people suffering coughing in Hong Kong Island from 10%* to 20%***	136.4
3. *Changing the estimated reduction in emissions for Central & Western/Southern districts and rest of Hong Kong Island from base estimate of 10% and 2.5% to 20% and 5% respectively*	136.4
4. *Changing the estimated number of high polluted days in Hong Kong Island from days greater than median+SD to days greater than:*	
Median	254.7
Mean	242.2

Note:
* Conservative estimate used as base estimate.
** This estimate is from a population survey by the Department of Community Medicine (33) in which 68% believed that air pollution caused them to suffer symptoms and, of these, one third believed that it caused them to cough. This comes to around 20% of the whole population

Table C.8
Total annual reduction, due to WIL/SIL on health care costs and related productivity losses (HK$ million)

	Total value from different approaches (HK$ million)		
	Minimum NO_2	***Conservative*** NO_2 + 0.58 RSP	***Additive*** NO_2 + RSP
Health care costs:			
NO_2 - $14 4	14.4	17.8	20.3
RSP – $5.8			
(Public Health Care Costs:	***4.9***	***6.1***	***6.9)***
Productivity loss:			
NO_2 – $3.8	3.8	4.6	5.2
RSP – $1.3			
Total:	**18.3**	**22.4**	**25.4**

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西南港島綫直接外部效益一覽表

外部效益	年計效益 *(單位：百萬港元)*	未來回報之二零零四年現價值[一] *(單位：億港元)*
節省交通時間及減少交通事故所帶來的經濟價值[二]	**$1,016**	**$185**
其中：交通時間的節省	$985	$179
交通安全效益	$31	$6
物業價值的提升	**$1,594 – 1,978**	**$187– 227**
其中：私人物業持有人所得的外部效益（未計算興建跑馬地站對物業價值的影響）[三]	$1,266 – 1,543	$144 – 176
政府所得的財務回報[四]	$328 – 435	$43 – 51
政府差餉	*($84 – 103)*	*($17 – 20)*
物業稅	*($76 – 84)*	*($15 – 17)*
補地價收入[五]	*($150 – 230)[五]*	*($7 – 10)*
數碼港所得租金	*($18)*	*($4)*
環境及醫護效益[六]	**$23**	**$4**
其中：直接私營醫療服務開支的減省	$12	$3
直接公營醫療服務開支的減省	$6	$0 45
可避免喪失之生產力之估值	$5	$1
直接外部效益總計	**$2,600 – 3,000**	**約 $380 – 420**
經濟內部報酬率[七]	不適用	**24% – 26%**
政府如取消興建七號幹線將可額外獲得之淨財務效益高達：	**不適用**	**約 $ 120**

附註：

[一] 我們將每年度的各項投資效益（於二零一零年開始實現），包括政府收益部分，按百分之四貼現率折算成二零零四年現價值，然後進行加總。至於私人物業方面，由於我們設定物業的租值將等同物業價值的百分之七（若低於此水平，物業持有人或會考慮將物業出售以尋求更佳的投資機會及回報），因此，我們實際上把用於私人物業回報方面的貼現率提高至百分之七。

[二] 驟眼看來，節省交通時間所帶來的效益頗低。可是，我們在本研究中把物業升值部分作個別探討，（這做法跟其他主要交通運輸基礎建設之外部效益研究有所不同），而節省交通時間所帶來的效益及經濟價值正就是其中一個可能帶動沿綫地區物業價值上升之原因。爲了避免犯上重覆計算效益的錯誤，我們在估計交通時間的節省及有關效益時，剔除了港島西區與南區內非公営房屋居民所節省的交通時間（因爲我們相信其經濟價值已被充分反映在物業價值的變動上）。

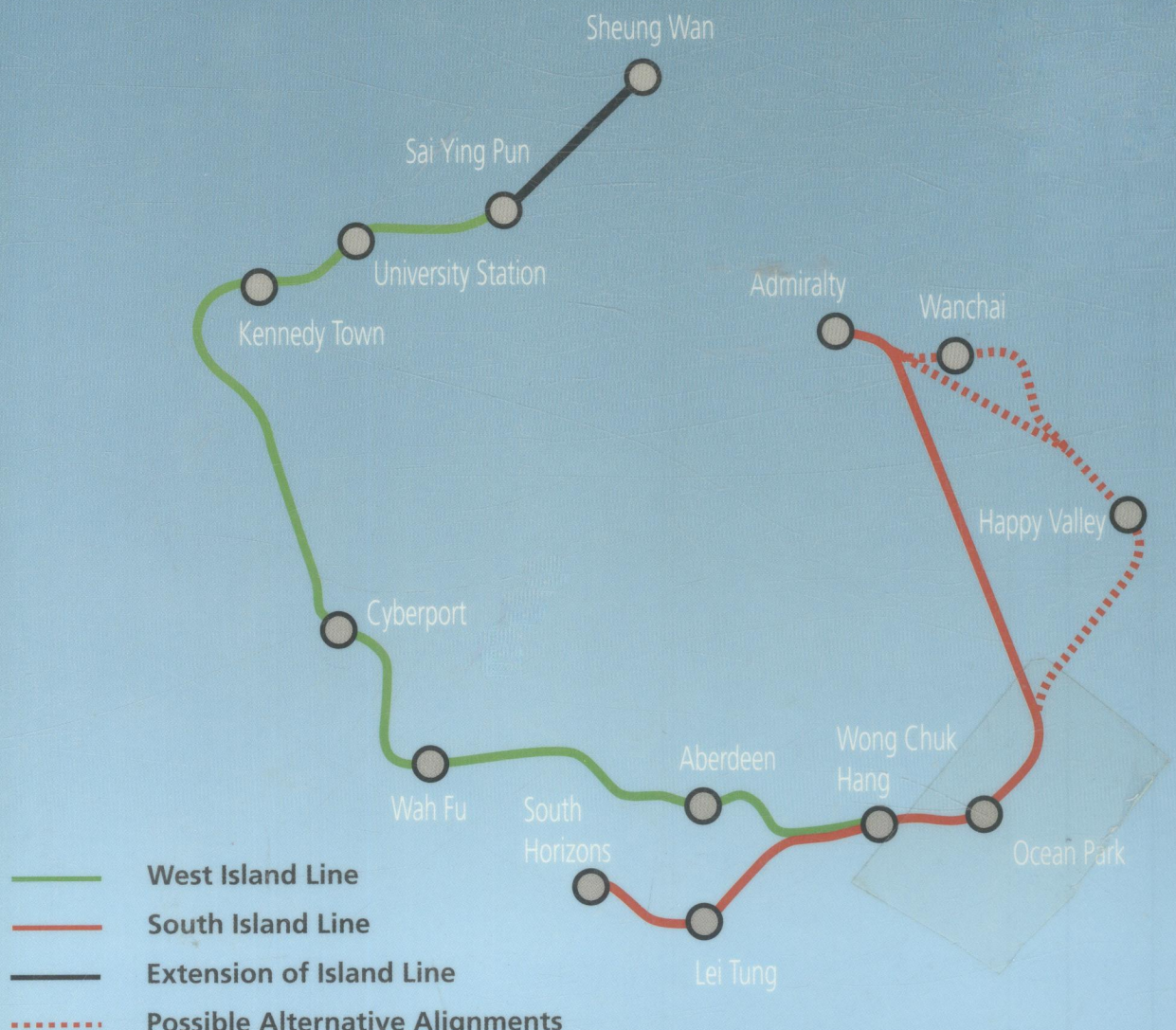
[三] 這估值已扣除政府收取之差餉。我們參考物業租值及物業價值的關係，設定合理的貼現率去折算物業增值，從而算出年計效益。此外，興建跑馬地站將會爲私人物業持有人額外帶來每年十三至十五億港元的淨外部效益。

[四] 由於西南港島綫沿綫地區之物業增值有可能是源於香港其他地區的價值或資金轉移，我們對於政府的財務回報作出了較爲保守的估值，以抵消上述因素。

[五] 我們認爲政府不一定在二零一零年（即西南港島綫預計落成年份）獲得所有補地價收益，故此，我們在年計效益一欄中有關補地價收入部分，把總補地價收益按五年（二零一零年至二零一四年）平均分配。

[六] 我們就減少排放百分之十粒子及二氧化氮對市民健康及醫護開支的影響作出評估，惟本研究未有爲其他從汽車排放的污染物如二氧化硫、一氧化碳及碳氫化合物等作出類似評估。此外，環境及醫護效益亦未包括市民爲保障個人健康或避免罹疾而願意支付的最高虛擬金額（即支付意願，估值約三十億港元）。因此，讀者應注意我們在這裏列舉的估值只反映了整體環境及醫護效益的一個部分。

[七] 這是根據政府會爲西南港島綫提供三份之一資金（即五十億港元）的設定而計算出來的。若把所有投資成本（即一百五十億港元）都計算在內，則經濟內部報酬率將介乎百分之十二至十三。


Sheung Wan
Sai Ying Pun
University Station
Kennedy Town
Admiralty
Wanchai
Happy Valley
Cyberport
Wah Fu
South Horizons
Aberdeen
Wong Chuk Hang
Ocean Park
Lei Tung
West Island Line
South Island Line
Extension of Island Line
Possible Alternative Alignments