Benefit Cost Analysis
Highway 97
Red Rock 4-Laning
And
Commercial Vehicle Inspection Station

Prepared for:

Ministry of Transportation
Northern Region
Prince George, BC

Prepared by:
Peter Lyall P.Eng.
Apex Engineering
Vancouver, BC

Project No. MoT-75
27 February, 2007

Apex Engineering Limited

Summary

The existing Prince George South Commercial Vehicle Inspection Station is located on Highway 97 at the south approach to Prince George, in an industrial area at the south end of the Simon Fraser Bridge. Encroaching development, public pressure and increasing congestion around the scale have made it impractical for the scale to remain at its present location.

With the implementation of the 4-lane Cariboo Connector from Cache Creek to Prince George, there is the opportunity to build a new median scale in a new section of divided 4-lane highway about 20 km south of Prince George near Red Rock Road. The new scale location will reduce average commercial vehicle delay by several minutes per vehicle and may also be equipped with Weigh-in-motion (WIM) and Automatic Vehicle Identification (AVI) technology allowing safe legal trucks to bypass the weigh scale at highway speeds.

The project is consistent with federal objectives to improve efficiency of the National commercial vehicle network through the use of electronic clearance and roadside inspection and with the Provincial objectives to 4-lane the Cariboo Connector from Cache Creek to Prince George.

The project reduces congestion for through traffic at the approach to Prince George and the Simon Fraser Bridge as well as delays to commercial vehicles entering the scale. Safety benefits stem from reduced intersection accidents at the signalised intersection access to the scale, the 5 km of improved 4-lane highway in the vicinity of the new scale and from improved commercial vehicle compliance. Pavement benefits stem from improved targeting of overweight vehicles.

At a 10% discount rate, the present value of benefits is $11.6 million without WIM/AVI and $14.3 with WIM/AVI. The difference is the savings to trucks of 2 to 3 minutes and 0.5 to 1.0 litres of fuel per truck with the new scale.

Costs for the inspection station, acceleration/deceleration lanes and 5 km. of 4-laning total $24.8 million. A notional $500,000 recoverable is used to reflect the value of the old site once it is abandoned.

The project returns a B/C ratio of 0.68 without WIM/AVI and .75 with WIM/AVI at a 10% discount rate and 1.17 and 1.26 at the Provincially recommended 6% discount rate. The rationale for the project includes the broader economic development and equity goals for Northern BC, implementation of the National CVIS network and enhancing north/south trade routes, in this case between the lower 48 states and Alaska via Canada.

Contents

Benefit Cost Analysis Highway 97 – Red Rock 4-Laning and Commercial Vehicle Inspection Station

1 Background

The existing Prince George South Weigh Scale is a bi-directional facility located within the City Limits at the intersection of Highway 97 and Railway Avenue (seg 1150, lki 111.75) at the south end of the Simon Fraser Bridge. The proposal is to relocate the weigh scale up to 25 km further south on Highway 97 and add weigh in motion (WIM) and automatic vehicle Identification (AVI). There are several reasons:

Exhibit 1-1 General Location

- The existing scale is congested and during busy periods it must close to prevent traffic from backing up onto Highway 97.
- Public consultation has underlined the public pressure to relocate the scale from its current location.
- Commercial traffic is able to bypass the existing scales using city streets and bridges.
- Access into and through the existing scale is poor and left turns exiting the scale conflict with NB trucks entering the scale.
- The new location would be suitable for WIM/AVI which allows safe, legal trucks to bypass the scale and is eligible for Federal/Provincial cost sharing

- The existing station will have to close for operational reasons. A new inspection station is required to ensure continued commercial vehicle safety compliance.

- The new scale would be constructed concurrent with 4-laning the adjacent section of Highway 97 consistent with the Caribou Connector vision of a 4-lane highway linking Cache Creek to Prince George.

- There is increasing land use competition from the adjacent CN rail yard.

Exhibit 1-2 Prince George South Weigh Scale

The user impacts of the relocation are expected to include reduced delay commercial vehicles, improved safety at the Railway Avenue intersection, improved commercial vehicle compliance, reduced commercial vehicle operating costs and improved safety on the new 4-lane section.

2 General Assumptions

2.1 Options

Several potential locations south of Prince George were reviewed and narrowed down to 4 candidates presented for public consultation. The four options were evaluated in a previous draft of this business case. Option 7 was identified by the previous business case and through public consultation as the preferred option. It is the least costly to construct and is the least environmentally and socially disruptive. All 4 options were of similar design and all returned virtually the same benefits. Option 7 has been developed to the detailed design and tendering stage and the cost estimates refined and is presented in this business case.

Option 7 is evaluated with and without weigh in motion (WIM) and Automatic Vehicle Identification (AVI). These technologies allow a portion of trucks to bypass the scale on the highway or on the in-scale bypass road. The inspection station is a median scale with full acceleration and deceleration lanes which allows inspectors to monitor both directions from a single location.

Exhibit 2-1 presents the general assumptions used for analysis. Safety assumptions are examined in section 3. The proposed case assumes running speed increases of 10 km/hr in the analysis section.

Exhibit 2-1 General Assumptions

	Existing	Option 7
Segment	1150	1150
from LKI	111.6	83.7
to LKI	111.8	88.7
Length (km)	0.20	5.0
AADT 2006 (est'd)	20,810	5,000
Counter	42-018	
Location	S. End Simon Fraser Br.	
Compound Growth Rate	1.0%	1.0%
% Trucks	5%	21%
Truck Traffic (AADTT)	1040	1040
Lanes	2	4
Median	no	yes
Shoulder	1.5 m	2.5m
Design Standard	RAU2	RAD4
Running Speed	70 km/hr	100 km/hr

2.2 Costs and Benefits

The benefits evaluated include:

- Reduction in accidents at the Railway Avenue/Highway 97 intersection where the existing scale traffic enters the scale at a signalized intersection
- Reduction in accidents on the new 5 km 4-lane divided section associated with the scale site development
- Time and vehicle operating cost savings to motor carriers using the new inspection station
- Time savings to local industrial traffic accessing Railway Avenue
- Improved motor carrier compliance
- Reduced pavement damage

The costs evaluated include:

- Property, engineering and construction associated with site and 4-lane road network
- On-board units (OBU's) or transponders, which the motor carriers must purchase in order to make use of the proposed WIM/AVI facility.
- Potential recoverables from the disposition of the existing site.
- Operating and maintenance costs associated with the WIM/AVI and transponder operations
- Incremental pavement maintenance and resurfacing costs associated with a new 4-lane highway section

Permit and Fine revenue are not included in the analysis since, in the social context, these are considered transfers, not costs or benefits. Typically the fine and permit revenue is equal to or exceeds the scale operating costs.

2.3 Base Case Assumptions

In the event that the proposed CVIS and 5 km of highway upgrade do not proceed, some alternate "do-minimum" solution must still be pursued. This CVIS is at a key location in the Provincial Highway System, capturing traffic from both Highway 97 and Highway 16. Eliminating the station altogether is not an option.

The existing site is now within the urban Price George area and would have to be extensively reconfigured and additional industrial property purchased to make it compatible with a proposed 4-laning project at this location. For planning purposes, this is considered to be the "do-minimum" option and would add an estimated $6 million ($2006) to the cost of the proposed 4 laning on the south approach to Prince George. This cost is subtracted from the cost of the proposed relocation options to get the net cost of the project for benefit cost analysis. The do minimum option would make the scale operational at its current location but would have no significant benefit above the current facility and is the primary reason for the proposed relocation.

2.4 WIM/AVI

Benefits of WIM/AVI (time, fuel, compliance, pavements etc.) depend on how many motor carriers have compatible transponders or other on-board units (OBU's) capable of communicating with the Automatic Vehicle Identification (AVI) system. The participation rate assumptions are presented in Exhibit 2-2.

The analysis assumes that the Prince George South Scale will be part of a broader network of inspection stations with Automatic Vehicle Identification (AVI) capability but the analysis considers only benefits and costs directly attributable to this station. Network level costs or benefits are not included in this analysis.

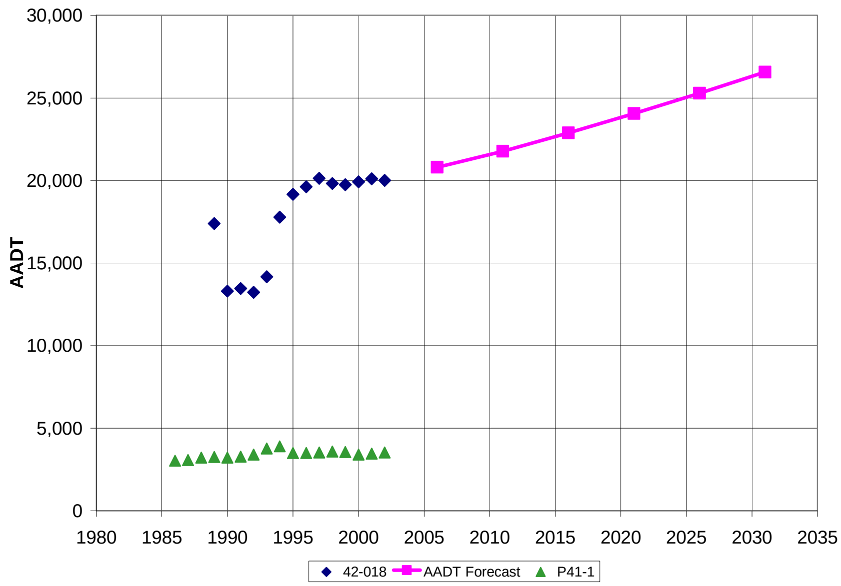
Exhibit 2-2 WIM/AVI Participation Rate

Participation Rate	Year	Trucks with TRANSPONDER
Current Year	2006	0%
Startup Year	2008	50%
Intermediate Year	2016	60%
Horizon Year	2031	60%
	Equivalent Annual Growth (%/yr)	
from	*to*	*growth*
2006	2008	0%
2008	2016	1.3%
2016	2031	0.0%

2.5 Traffic

Traffic volumes in Exhibit 2-3 are from counter 42-018 south of the Simon Fraser Bridge and next to the existing inspection station and permanent count station P41-1 located 37 km south of the bridge and south of the bridge and 12 km south of the Option 7 location.

Exhibit 2-3 Historical and Projected AADT



3 Safety Performance

3.1 Railway Avenue/Highway 97 Intersection

The accident analysis uses data for 7 years from 1996 to 2002. The estimated existing accident rate at the Highway 97/Railway Avenue intersection where the trucks enter the existing scale is 0.28 a/mev which is above the Provincial average 0.17 a/mev for intersections of this service class. Removing traffic from the intersection will eliminate about 1.4 intersection accidents per year.

Exhibit 3-1 Accident Rate at Railway Ave/Highway 97 Intersection

Observed Accidents Railway Ave/Hwy 97	**1996 to 2002**			
Segment	1150			
Start LKI	111.60			
Finish LKI	111.80			
Length (km)	0.20			
Service Class	RAU2			
AADT Average	19,905			
Years	7			
Exposure (mev)	51			
	Fat	Inj	PDO	All
Intersection Accidents	0	8	6	14
Observed Rate (a/mev)	0.000	0.16	0.12	0.28
Severity	0.0%	57.1%	42.9%	100.0%

Predicted Base Case Accidents	Fat **1996 to 2002**	Inj	PDO	All
Intersection Accidents				
Number	0.26	7.0	6.7	14.0
Predicted Rate (a/mev)	0.005	0.14	0.13	0.28
Severity	1.8%	50.1%	48.1%	100.0%

Proposed Case Accidents	Fat **1996 to 2002**	Inj	PDO	All
Intersection Accidents				
Number	0.1	2.2	2.1	4.3
Predicted Rate (a/mev)	0.002	0.04	0.04	0.08
Severity	1.8%	50.1%	48.1%	100.0%

3.2 Highway 97 at the New Scale Site

Safety benefits occur at the new sites where the existing 2 lane highway is reconstructed to a 4 lane divided cross section in the vicinity of the scale. The estimated existing accident rate on Highway 97 in the vicinity of the new inspection station is 0.32 a/mvk which is the same as the Provincial average for rural 2-lane sections with little or no access. Accident severity will be reduced but accident rate will decline only slightly if at all at the new location.

Exhibit 3-2 Accident Rates at Proposed Scale Location

Observed Accidents Hwy 97	**1996 to 2002**			
Segment	1150			
Start LKI	88.00			
Finish LKI	100.91			
Length (km)	12.91			
Service Class	RAU2			
AADT Average	4,783			
Years	7			
Exposure (mvk)	157.8			
	Fat	Inj	PDO	All
Accidents	4	24	23	51
Observed Rate (a/mev)	0.025	0.15	0.15	0.32
Observed Severity	7.8%	47.1%	45.1%	100.0%
Provincial Avg. Severity	2.8%	49.5%	47.7%	100.0%

Proposed Case Accidents	**1996 to 2002** Fat	Inj	PDO	All
RAD4				
Number	0.7	23.1	23.6	47.3
Predicted Rate (a/mev)	0.004	0.15	0.15	0.30
Severity	1.8%	50.1%	48.1%	100.0%

3.3 Safety Benefits of WIM/AVI

Safety benefits associated with the proposed WIM/AVI technology stem from two sources:

- Inspectors at an ECRI station have more time to focus on non-compliant operators or trucks
- There is likely to be a reduction in the number of non-compliant vehicles allowed to bypass a station during peak periods when queues were forming at the old station.

The potential safety benefits of preventing queues at inspection stations from backing up onto mainline traffic lanes are specifically excluded from the analysis. Queues should not be allowed to back up onto the mainline in the first place. Queuing vehicles onto a mainline will cause more accidents than are saved by inspecting them. This is generally recognized and inspectors at congested stations routinely close the station temporarily during peak periods until the queue clears.

Most of the research relating safety benefits to WIM/AVI implementation suggests there is little evidence of a direct safety benefit. There may be several reasons for this:

- The goal of WIM/AVI in many cases may not be increased safety. The goal may be to maintain the present level of safety without increasing staff to accommodate future traffic growth. While this may be true, this analysis takes the position that there are small savings in both safety and future staffing requirements.
- There is generally not a long history of this technology that can be traced in a before/after accident rate analysis to identify safety impacts.
- The benefit may be small enough that it is hidden by other background changes in the truck accident environment.
- The number of truck accidents with vehicle defects or other causal factors under the direct influence of commercial vehicle inspection programs is a limited sample size compared to the accident population at large.

The effect is unknown but there is likely a safety benefit to improved enforcement and compliance and so for analysis purposes a 0.5% reduction in truck accidents is assumed within the zone of influence of an inspection station for participating trucks.

In this case the zone of influence is assumed to be 263 k which is the half the length of primary highway between this scale and adjacent scales at Quesnel, Vanderhoof, Prince George North and Tete Jaune Cache.

The participation rate (carriers with transponders) is used as a proxy measure for the extent of the safety impact. Participating trucks are generally those with the best safety records. The real target for safety is actually the carriers who are not participating, but the greater the participation rate the greater the number of trucks that are known to be safe and also the more time inspectors can devote to carriers most likely to have safety violations.

The assignment of benefits, general assumptions and present value calculations are presented in Exhibit 3-3 and Exhibit 3-4.

Exhibit 3-3 Safety Assumptions Associated with WIM/AVI

Weigh Scale Zone of safety influence (km)	263
Typical truck accident rate (a/mvk)	0.7
Assumed reduction due to better enforcement	0.50%

Perspective	Notes			Average Truck Accident Cost
Social	Severity	Unit Cost	Distribution	
(Comprehensive cost)	Fatal	$5,693,954	2.5%	
	Injury	$99,999	35.5%	
	PDO	$7,342	62%	
			100.0%	$182,401

Exhibit 3-4 Present Value of Accident Savings related to WIM/AVI

Year	Transponder equipped trucks	Zone of influence (km)	Accidents Prevented	Annual Accident Cost Saving	Present Value
2006	0	263	0.00	$0	$0
2007	0	263	0.00	$0	$0
2008	132,615	263	0.12	$17,224	$15,329
2009	137,239	263	0.13	$17,825	$14,966
2010	141,927	263	0.13	$18,433	$14,601
2011	146,678	263	0.13	$19,050	$14,236
2012	151,494	263	0.14	$19,676	$13,871
2013	156,373	263	0.14	$20,310	$13,507
2014	161,316	263	0.15	$20,952	$13,145
2015	166,322	263	0.15	$21,602	$12,786
2016	171,393	263	0.16	$22,260	$12,430
2017	172,925	263	0.16	$22,459	$11,831
2018	174,456	263	0.16	$22,658	$11,260
2019	175,988	263	0.16	$22,857	$10,716
2020	177,520	263	0.16	$23,056	$10,198
2021	179,052	263	0.16	$23,255	$9,704
2022	180,584	263	0.17	$23,454	$9,233
2023	182,115	263	0.17	$23,653	$8,784
2024	183,647	263	0.17	$23,852	$8,356
2025	185,179	263	0.17	$24,051	$7,949
2026	186,711	263	0.17	$24,250	$7,561
2027	188,242	263	0.17	$24,449	$7,192
2028	189,774	263	0.17	$24,648	$6,840
2029	191,306	263	0.18	$24,847	$6,505
2030	192,838	263	0.18	$25,046	$6,186
2031	194,370	263	0.18	$25,245	$5,882
				Present Value ($millions)	$0.3

4 Truck Fuel Saving Benefits

The new scale location eliminates congestion fuel consumption costs associated with accessing the old site. If WIM/AVI is added, there is a further benefit since WIM/AVI allows safe, legal trucks to bypass a scale without pulling in for inspection. A truck that bypasses a scale consumes less fuel by eliminating the speed change cycle and idle time associated with stopping and moving up through a static weigh scale. A fuel consumption model was used to derive the fuel consumption for the base and proposed cases. The base case assumes trucks queue at the scale, move up and return to highway 97 through a signalized intersection with additional stopped delay varying by time period.

The proposed cases eliminate the signal delay costs. If WIM/AVI is added, there are further savings to in-scale bypass and mainline bypass traffic. The fuel consumption simulation assumes a 5-axle tractor/semi-trailer combination loaded to 27,000 kg GVW traveling 3.0 km. The 3.0-km distance is the same in base and proposed case and is used to allow trucks to fully slow down and accelerate back up to the same speed as mainline bypass trucks would be traveling. Mainline bypasses are assumed to travel at 90 km/hr, in-scale bypasses are assumed to slow to 50 km/hr and scale traffic is assumed to stop and move up several times depending on whether it is peak or off-peak period.

The general assumptions are presented in **Exhibit 4-1** and the Present Value Calculations are in **Exhibit 4-2**. An OBU is an On-Board Unit or transponder equipped truck. For analysis purposes it is assumed that all bypasses are mainline bypasses. There are no in-scale bypasses. The fuel saving to a mainline bypass truck is about 1.0 litre/bypass. The present value of fuel savings in excludes taxes as these are considered a transfer, not a cost.

Exhibit 4-1 Fuel Consumption Assumptions

		No WIM/AVI	WIM/AVI	
Vehicle Distribution	Base Case	Stops at Scale	In-Scale Bypasses	Mainline Bypasses
% Stopping at Scale	100%	90%	0%	5%
% In-scale bypass	0%	10%	100%	0%
% Mainline bypass	0%	0%	0%	95%
Total (must equal 100%)	100%	100%	100%	100%
Mainline Speed (km/hr)	60	90	90	90
Data for Vehicles stopping at the Scale				
Dwell Time at Scale (sec/truck)				
Peak	15	15	0	0
Shoulder	15	15	0	0
Low	15	15	0	0
Average Queu Size at Scale				
Peak	6	2	0	0
Shoulder	3	0	0	0
Low	1	0	0	0
Signal Delay at Hwy 97 (sec/truck)				
Peak	60			
Shoulder	30			
Low	20			
Proportion of Daily Truck Traffic				
Peak	30%	30%	30%	30%
Shoulder	50%	50%	50%	50%
Low	20%	20%	20%	20%
Average stopped time for vehicles using static scale (sec/truck)	91.7	24.0	0.0	0.0
Travel Time (sec/truck)				
for stopping Traffic	309.5	196.8	172.8	172.8
for in-scale bypass traffic		134.3	134.3	134.3
for mainline bypass traffic		116.8	116.8	116.8
Weighted Average for selected vehicle distribution (Sec/truck)	309.5	190.6	134.3	119.6
Saving		119	175	190
Fuel Consumption (L/truck)				
for stopping Traffic	2.176	1.777	1.547	1.547
for in-scale bypass traffic		1.297	1.297	1.297
for mainline bypass traffic		1.161	1.161	1.161
Weighted Average for selected vehicle distribution (L/truck)	2.176	1.729	1.297	1.181
Saving (L/truck)		0.447	0.879	0.995
Bulk Diesel Price				
Taxes (% of total price)		45%	45%	45%
Taxes ($/L)		$0.41	$0.41	$0.41
Net Cost ($/L)		$0.50	$0.50	$0.50
Total ($/L)		$0.90	$0.90	$0.90
Fuel Cost Saving ($/truck)				
Taxes		$0.181	$0.356	$0.403
Net Cost		$0.221	$0.435	$0.493
Total		$0.402	$0.791	$0.896

Exhibit 4-2 Present Value of Fuel Saving Benefits

Life Cycle Costs

WIM/AVI Option

	Static Scale		In-Scale Bypasses		Mainline Bypasses		Mainline + In-Scale	
Year	Trucks/yr	Value of Fuel Savings	In-Scale Bypasses/Yr	Value of Fuel Savings	Mainline Bypasses/Yr	Value of Fuel Savings	Value of Fuel Savings	Present Value
2006	0	$0	0	$0	0	$0	$0	$0
2007	0	$0	0	$0	0	$0	$0	$0
2008	132,615	$53,302	53,046	$41,976	79,569	$71,263	$166,541	$137,637
2009	127,197	$51,124	53,557	$42,380	87,030	$77,945	$171,449	$128,812
2010	121,652	$48,895	54,067	$42,784	94,618	$84,741	$176,420	$120,497
2011	115,978	$46,615	54,578	$43,188	102,334	$91,651	$181,454	$112,669
2012	110,177	$44,283	55,089	$43,592	110,177	$98,676	$186,551	$105,303
2013	104,248	$41,900	55,599	$43,996	118,148	$105,815	$191,711	$98,378
2014	98,192	$39,466	56,110	$44,400	126,247	$113,068	$196,935	$91,871
2015	92,008	$36,980	56,620	$44,804	134,473	$120,436	$202,221	$85,761
2016	85,696	$34,444	57,131	$45,209	142,827	$127,918	$207,570	$80,027
2017	84,541	$33,979	55,720	$44,092	147,947	$132,503	$210,574	$73,805
2018	83,351	$33,501	54,275	$42,949	153,134	$137,148	$213,598	$68,059
2019	82,128	$33,009	52,796	$41,779	158,389	$141,855	$216,643	$62,754
2020	80,870	$32,504	51,284	$40,581	163,713	$146,623	$219,708	$57,856
2021	79,579	$31,985	49,737	$39,357	169,104	$151,452	$222,794	$53,335
2022	78,253	$31,452	48,156	$38,106	174,564	$156,342	$225,900	$49,162
2023	76,893	$30,905	46,541	$36,828	180,092	$161,292	$229,026	$45,312
2024	75,499	$30,345	44,892	$35,523	185,688	$166,304	$232,172	$41,758
2025	74,072	$29,771	43,208	$34,191	191,352	$171,377	$235,339	$38,480
2026	72,610	$29,184	41,491	$32,833	197,083	$176,510	$238,527	$35,455
2027	71,114	$28,582	39,740	$31,447	202,884	$181,705	$241,734	$32,666
2028	69,584	$27,968	37,955	$30,034	208,752	$186,960	$244,962	$30,093
2029	68,020	$27,339	36,136	$28,595	214,688	$192,277	$248,210	$27,720
2030	66,422	$26,697	34,282	$27,128	220,692	$197,654	$251,479	$25,532
2031	64,790	$26,041	32,395	$25,635	226,765	$203,093	$254,768	$23,514
					Total PV of Fuel Savings ($millions)			**$1.63**

Without WIM/AVI Option

Trucks/yr	Value of Fuel Savings	Present Value
0	$0	$0
0	$0	$0
265,231	$106,603	$88,102
267,784	$107,629	$80,863
270,337	$108,655	$74,213
272,890	$109,681	$68,103
275,443	$110,707	$62,491
277,996	$111,734	$57,337
280,549	$112,760	$52,603
283,102	$113,786	$48,256
285,655	$114,812	$44,265
288,208	$115,838	$40,601
290,761	$116,864	$37,236
293,314	$117,890	$34,149
295,867	$118,916	$31,314
298,420	$119,942	$28,713
300,973	$120,969	$26,326
303,526	$121,995	$24,136
306,079	$123,021	$22,126
308,631	$124,047	$20,283
311,184	$125,073	$18,591
313,737	$126,099	$17,040
316,290	$127,125	$15,617
318,843	$128,151	$14,312
321,396	$129,177	$13,115
323,949	$130,203	$12,017
		$0.93

5 Truck Time Saving Benefits

Time savings to Carriers constitute the single largest benefit of a WIM/AVI system. The value of truck time includes the driver's wages plus wage burden and the fixed costs of truck ownership. The inventory cost of cargo is small in relation to these components and is omitted from this analysis. The cost items and time savings per truck are presented in Exhibit 5-1. Without WIM/AVI time savings are in the order of $2.35 per truck. With WIM/AVI savings are about $3.50 for each bypass. The time savings were calculated using the same vehicle simulation model used for fuel savings. The assumptions and present value calculations are presented in Exhibit 5-2.

Exhibit 5-1 Time Savings Assumptions

	($/hr)	($/hr)
Driver Payroll Cost ($/hr)		$34.93
Truck Fixed Costs	Yr 2006	
Tractor Depreciation	$14.06	
Tractor Licenses	$1.70	
Trailer Depreciation	$4.19	
Trailer Licenses	$0.02	
Administration	$16.18	
Subtotal Truck		$36.16
Total Time Cost for Truck & Driver ($/hr)		$71.09

	Base	Proposed Cases		
		Without WIM/AVI	With WIM/AVI	
	Static Scale	Static Scale	In-Scale Bypass	Mainline Bypass
Time (Sec/truck)	309.5	190.6	134.3	119.6
Average Time Saving (sec/truck)		118.9	175.1	189.9
Value of time saving ($/truck)		$2.35	$3.46	$3.75

Exhibit 5-2 Present Value of Time Savings

With WIM/AVI Equipped Scale

	Static Scale		In-Scale Bypasses		Mainline Bypasses		All Trucks	
Year	In-Scale Bypasses/ Yr	Value of Time Savings	In-Scale Bypasses/Yr	Value of Time Savings	Mainline Bypasses/Yr	Value of Time Savings	Value of Time Savings	Present Value
2,006	0	$0	0	$0	0	$0	$0	$0
2,007	0	$0	0	$0	0	$0	$0	$0
2,008	132,615	$311,375	53,046	$183,445	75,591	$283,443	$778,263	$643,192
2,009	127,197	$298,654	53,557	$185,210	82,678	$310,019	$793,883	$596,456
2,010	121,652	$285,633	54,067	$186,976	89,887	$337,049	$809,658	$553,007
2,011	115,978	$272,312	54,578	$188,742	97,217	$364,534	$825,588	$512,625
2,012	110,177	$258,691	55,089	$190,508	104,668	$392,474	$841,673	$475,103
2,013	104,248	$244,771	55,599	$192,273	112,241	$420,869	$857,913	$440,245
2,014	98,192	$230,551	56,110	$194,039	119,935	$449,719	$874,308	$407,871
2,015	92,008	$216,031	56,620	$195,805	127,750	$479,023	$890,858	$377,811
2,016	85,696	$201,211	57,131	$197,571	135,686	$508,782	$907,563	$349,905
2,017	84,541	$198,498	55,720	$192,692	140,549	$527,017	$918,208	$321,826
2,018	83,351	$195,705	54,275	$187,695	145,477	$545,496	$928,896	$295,975
2,019	82,128	$192,833	52,796	$182,581	150,470	$564,217	$939,630	$272,177
2,020	80,870	$189,880	51,284	$177,349	155,527	$583,180	$950,409	$250,272
2,021	79,579	$186,847	49,737	$171,999	160,649	$602,386	$961,232	$230,111
2,022	78,253	$183,734	48,156	$166,532	165,836	$621,835	$972,101	$211,557
2,023	76,893	$180,542	46,541	$160,947	171,087	$641,526	$983,014	$194,484
2,024	75,499	$177,269	44,892	$155,244	176,403	$661,459	$993,972	$178,775
2,025	74,072	$173,917	43,208	$149,424	181,784	$681,635	########	$164,321
2,026	72,610	$170,484	41,491	$143,485	187,229	$702,053	########	$151,025
2,027	71,114	$166,972	39,740	$137,429	192,739	$722,715	########	$138,795
2,028	69,584	$163,380	37,955	$131,256	198,314	$743,618	########	$127,545
2,029	68,020	$159,708	36,136	$124,964	203,953	$764,764	########	$117,199
2,030	66,422	$155,956	34,282	$118,555	209,658	$786,153	########	$107,684
2,031	64,790	$152,124	32,395	$112,028	215,426	$807,784	########	$98,935
							Total PV of Time Savings ($millions)	$7.22

Without WIM/AVI Equipped Scale

Year	Scale Traffic/yr	Value of Time Savings	Present Value
2,006	260,125	$0	$0
2,007	262,678	$0	$0
2,008	265,231	$622,751	$514,670
2,009	267,784	$628,745	$472,385
2,010	270,337	$634,739	$433,535
2,011	272,890	$640,733	$397,845
2,012	275,443	$646,728	$365,061
2,013	277,996	$652,722	$334,950
2,014	280,549	$658,716	$307,296
2,015	283,102	$664,710	$281,902
2,016	285,655	$670,705	$258,586
2,017	288,208	$676,699	$237,179
2,018	290,761	$682,693	$217,527
2,019	293,314	$688,688	$199,488
2,020	295,867	$694,682	$182,931
2,021	298,420	$700,676	$167,736
2,022	300,973	$706,670	$153,792
2,023	303,526	$712,665	$140,997
2,024	306,079	$718,659	$129,257
2,025	308,631	$724,653	$118,487
2,026	311,184	$730,647	$108,606
2,027	313,737	$736,642	$99,543
2,028	316,290	$742,636	$91,230
2,029	318,843	$748,630	$83,606
2,030	321,396	$754,624	$76,614
2,031	323,949	$760,619	$70,202
		Total PV of Time Savings ($millions)	$5.44

6 Pavement Life Benefits

Pavements are generally designed for a fixed number of "Load Equivalency Factors" (LEF's). This is a term used in pavement design to denote the design number of standard axle loadings. If a truck is overloaded, the number of LEF's generated by this truck increases exponentially (to the power of 2.5). With repeated traffic, this has the effect of shortening pavement life and imposing a "Build Sooner" cost for pavement overlays.

The pavement benefits assigned to a WIM/AVI system are assessed as a proportion of the potential savings based on the participation rate. The potential savings are assessed by first defining a base and proposed case. With lower enforcement conditions where scales are open intermittently or there are un-enforced scale bypass routes available, it is assumed that 5% of trucks are overloaded by 15% of their registered gross vehicle weight. In a higher enforcement condition, it is assumed that WIM/AVI allows inspection staff to better target habitual offenders and bring the proportion of overloaded trucks down to 1.5% with a 10% overload within the zone of influence of the inspection station. In a slightly lower enforcement environment without WIM/AVI at the new station, pavement benefits are assumed to be 40% lower for analysis purposes.

General assumptions and potential cost savings are presented in Exhibit 6-1 and Present Value calculations in Exhibit 6-2

The detailed Load Equivalency Factor calculations depend on the truck axle configuration and load distribution. These calculations have been modeled separately for this report but are not presented here.

Exhibit 6-1 Pavement Cost Savings Assumptions

	Base Case	Proposed Case
Overloaded Trucks Magnitude of Overload	5.0% 15%	1.5% 10%
Load Equivalency Factor (LEF) Pavement Life (yrs)	1.96 15.0	1.75 16.8
Typical Overlay Cost ($/2-ln-km)	$60,000	$60,000
Equivalent Annual Cost ($/2-ln-km/yr)	$4,000	$3,572
Costs Saving due to reduced Overloading ($/2-ln-km/yr)		$428
Zone of Influence/scale (km/scale)		263
Potential pavement cost saving /yr		
With WIM/AVI		$112,333
Without WIM/AVI		$67,400

Exhibit 6-2 Present Value of Pavement Cost Savings

Year	Participation Rate	Annual pavement cost saving/scale	Total Cost	Present Value
2006	0%	$0	$0	$0
2007	0%	$0	$0	$0
2008	50%	$56,167	$56,167	$46,419
2009	53%	$58,975	$58,975	$44,309
2010	55%	$61,783	$61,783	$42,199
2011	58%	$64,591	$64,591	$40,106
2012	60%	$67,400	$67,400	$38,045
2013	63%	$70,208	$70,208	$36,028
2014	65%	$73,016	$73,016	$34,063
2015	68%	$75,825	$75,825	$32,157
2016	70%	$78,633	$78,633	$30,316
2017	71%	$79,382	$79,382	$27,823
2018	71%	$80,131	$80,131	$25,532
2019	72%	$80,880	$80,880	$23,428
2020	73%	$81,629	$81,629	$21,495
2021	73%	$82,378	$82,378	$19,721
2022	74%	$83,126	$83,126	$18,091
2023	75%	$83,875	$83,875	$16,594
2024	75%	$84,624	$84,624	$15,220
2025	76%	$85,373	$85,373	$13,959
2026	77%	$86,122	$86,122	$12,801
2027	77%	$86,871	$86,871	$11,739
2028	78%	$87,620	$87,620	$10,764
2029	79%	$88,369	$88,369	$9,869
2030	79%	$89,118	$89,118	$9,048
2031	80%	$89,866	$89,866	$8,294
			Total PV ($millions)	
			With WIM/AVI	$0.59
			Without WIM/AVI	$0.35

7 Financial Account

7.1 Highway and Site Construction

Exhibit 7-1 presents the capital cost assumptions (Dec 2006 estimate) used for analysis. There is and additional line item for recoverables. This is a notional amount included to account for disposition of the existing scale site. The revenue would not accrue to this project but is a recoverable from the general revenue perspective and reflects the value of the resource.

Exhibit 7-1 Project Costs

	Option 7
Engineering & Mgmt Reserve	$1,150,000
+ Land	$2,000,000
+ Construction	$21,660,000
- Recoverables	$300,000
= Total	$24,510,000

7.2 Transponders

In order for a compliant vehicle to bypass a scale it must be carrying a transponder which identifies the vehicle to the inspection station and receives a bypass signal back form the station. The cost assumptions for transponders are presented In Exhibit 7-2 below. The failure rate is used to determine the cost of replacements over the analysis period.

Exhibit 7-2 Transponder Assumptions

Transponder at cost ($/unit)		$45
Registration and Handling ($/unit)		$10
	Cost	$55
Transponder failure rate/yr		4%

The present value of transponder costs is calculated in Exhibit 7-3 and assumes a rapid take-up during the initial 5 years of the benefit period and slowing during the latter years, reaching a plateau where 50% of trucks entering the scales are equipped with a transponder. The unit cost of transponders is assumed to decline 2% each year to reflect improved technology and production.

Exhibit 7-3 Transponder Life Cycle Cost Assumptions

Number of Transponders						Capital Cost		Replacements Cost		
Year	Trucks/yr through scale(s)	Trans-ponder Usage	Trans-ponders	New Transponders each year	Unit Cost	Total Cost for New transponders	Present Value for new units	Replacements for failed transponders	Total Cost for replacements	Present Value of replacements
2006	260,125	0%	0	0	$55.00	$0	$0	0	$0	$0
2007	262,678	0%	0	0	$53.90	$0	$0	0	$0	$0
2008	265,231	50%	2,210	2,210	$52.82	$116,750	$96,488	88	$4,670	$3,860
2009	267,784	53%	2,343	133	$51.77	$6,877	$5,167	94	$4,852	$3,645
2010	270,337	55%	2,478	135	$50.73	$6,848	$4,677	99	$5,029	$3,435
2011	272,890	58%	2,615	137	$49.72	$6,816	$4,232	105	$5,201	$3,229
2012	275,443	60%	2,754	139	$48.72	$6,784	$3,829	110	$5,368	$3,030
2013	277,996	63%	2,896	141	$47.75	$6,750	$3,464	116	$5,531	$2,838
2014	280,549	65%	3,039	143	$46.79	$6,714	$3,132	122	$5,689	$2,654
2015	283,102	68%	3,185	146	$45.86	$6,677	$2,832	127	$5,842	$2,478
2016	285,655	70%	3,333	148	$44.94	$6,639	$2,560	133	$5,991	$2,310
2017	288,208	71%	3,394	62	$44.04	$2,722	$954	136	$5,980	$2,096
2018	290,761	71%	3,457	62	$43.16	$2,692	$858	138	$5,968	$1,902
2019	293,314	72%	3,520	63	$42.30	$2,662	$771	141	$5,955	$1,725
2020	295,867	73%	3,583	64	$41.45	$2,632	$693	143	$5,941	$1,564
2021	298,420	73%	3,647	64	$40.62	$2,603	$623	146	$5,926	$1,419
2022	300,973	74%	3,712	65	$39.81	$2,573	$560	148	$5,911	$1,286
2023	303,526	75%	3,777	65	$39.01	$2,544	$503	151	$5,894	$1,166
2024	306,079	75%	3,843	66	$38.23	$2,515	$452	154	$5,877	$1,057
2025	308,631	76%	3,909	66	$37.47	$2,486	$406	156	$5,859	$958
2026	311,184	77%	3,976	67	$36.72	$2,457	$365	159	$5,840	$868
2027	313,737	77%	4,044	67	$35.98	$2,428	$328	162	$5,820	$787
2028	316,290	78%	4,112	68	$35.26	$2,400	$295	164	$5,800	$713
2029	318,843	79%	4,180	69	$34.56	$2,371	$265	167	$5,779	$645
2030	321,396	79%	4,250	69	$33.87	$2,343	$238	170	$5,757	$584
2031	323,949	80%	4,319	70	$33.19	$2,315	$214	173	$5,734	$529
						Total PV (millions($millions)	**$0.13**		Total PV ($millions)	**$0.04**

7.3 Auditing

The auditing role includes quality control checks on the system and confirming safety ratings and credentials for each fleet enrolled in the program at registration and on an annual basis thereafter. The general assumptions are presented in Exhibit 7-4 and the present value calculations in Exhibit 7-5

Exhibit 7-4 Auditing Cost Assumptions

National Average Fleet Size	% of Fleets[1]	Hrs/fleet Audit
1	62.2%	0.3
4	5.6%	0.5
7	15.5%	0.7
15	10.0%	1.2
35	4.7%	2.3
75	1.1%	4.6
100	0.9%	6.1
6.8	Weighted Average	0.66

6.8	Average Fleet Size
100%	Annual Fleet Sampling rate
0.66	Average fleet Audit time (hrs/audit)
$20.00	Audit Wage ($/hr)
125%	Overhead and wage burden
$45	Charge rate ($/hr)
$30	Cost/fleet audit

[1] R.A. Barton, "Profile of Private Trucking" presented to the Private Motor Truck Council of Canada, 1997 Annual General Meeting and Conference, Sept 9, 1997 Toronto Airport Hilton.

Exhibit 7-5 Present Value of Auditing Costs

Year	TRANSPONDERS	Fleet Audits	Audit Cost	Present Value
2006	0	0	0	$0
2007	0	0	0	$0
2008	2,210	323	9,563	$7,903
2009	2,343	343	10,138	$7,617
2010	2,478	362	10,722	$7,323
2011	2,615	382	11,315	$7,026
2012	2,754	403	11,917	$6,727
2013	2,896	423	12,529	$6,429
2014	3,039	444	13,150	$6,134
2015	3,185	466	13,780	$5,844
2016	3,333	487	14,419	$5,559
2017	3,394	496	14,686	$5,148
2018	3,457	506	14,956	$4,766
2019	3,520	515	15,229	$4,411
2020	3,583	524	15,503	$4,083
2021	3,647	533	15,781	$3,778
2022	3,712	543	16,060	$3,495
2023	3,777	552	16,342	$3,233
2024	3,843	562	16,627	$2,991
2025	3,909	572	16,914	$2,766
2026	3,976	582	17,204	$2,557
2027	4,044	591	17,496	$2,364
2028	4,112	601	17,790	$2,185
2029	4,180	611	18,087	$2,020
2030	4,250	621	18,386	$1,867
2031	4,319	632	18,688	$1,725
			($millions)	
			Total Present Value	**$0.11**

8 Advancement of Federal and Provincial Transportation Strategies

Linkages to Federal initiatives include:

Federal Strategy	Highway 97 – Red Rock CVIS and 4-Laning
• Strategic Highway Infrastructure Program • Canada Strategic Infrastructure Fund	Supports resource development in Northern BC, is a major north south trade route on the National Highway System, adheres to TAC guidelines, improves highway safety
• Border Infrastructure Fund	This is part of the Highway 97 North/South Trade Route from the US to Alaska
• Asia Pacific Gateway and Corridor Initiative	• No direct impact
• Greenhouse Gas Reduction (tonnes/yr)	• Carbon Dioxide, 318 • Nitrogen Oxide, 10 • Hydrocarbons, 14 • Annual Saving (tonnes/yr), 342
• Transport Canada, in partnership with the provinces and territories, is considering the establishment of a national Commercial Vehicle Operations (CVO) network.	• This project with AVI/WIM Supports the Federal objectives to improve efficiency in the National CV Network. This can be considered part of a National Network, not an individual station.

In the Provincial context, this project is consistent with the vision for the 4-lane Cariboo Connector from Cache Creek to Prince George. It also addresses one of the highest volume locations on the corridor. Linkages to Provincial Plans include:

Provincial Strategy	Highway 97 – Red Rock CVIS and 4-Laning
• Cariboo Connector	• Lies within the Cariboo Connector and supports this vision
• Mountain Pine Beetle Strategy - Includes $90 million for rehabilitation of highways impacted by increased logging traffic carrying beetle-killed timber	• Highway 97 between Prince George and Cache Creek is heavily impacted by Pine Beetle forest products traffic. Many of the major mills are located in and around Prince George
• Safety and Mobility	• Supports both objectives

9 Benefit Cost Analysis

9.1 Results

The benefit cost analysis is summarized in Exhibit 9-1 for Option 7 which was the preferred option identified from public consultation and from a lowest cost perspective. The other options previously analysed had similar benefits but higher costs and social and environmental impacts and are not repeated here.

Benefits stem primarily from reduced congestion around the existing scale site. The single largest benefit is time savings to commercial vehicles with a present value of $5.4 million without WIM/AVI and $7.0 million with WIM/AVI using the Federal 10% discount rate. In the case of the Prince George South Scale, a transponder equipped truck bypassing the scale saves about $3.75 per bypass since they no longer have to queue at the scales or the lights on Railway Avenue to enter or exit the scales.

Time savings also accrue to automobiles accrue from a reduction in signal delay at Railway Avenue after the truck turning movements area removed from the intersection. On Highway 97 in the vicinity of the new scale, there are minor time savings associated with the higher operating speeds for automobiles on the 4-lane cross section.

Accident Cost Savings with a present value of $2.4 million stem form a reduction in accidents at the Railway Avenue intersection where the minor street volume will decline as the scale is moved. There is also a safety benefit from a reduction in accident severity in the vicinity of the new scale by upgrading 5 km from a 2 lane to a 4-lane divided cross section.

Vehicle operating cost savings are dominated by fuel savings to participating transponder equipped trucks which bypass the scale. Fuel savings are close to 1 litre per bypass truck achieved by avoiding the excess fuel consumption associated with the scale queue, signal delay and acceleration back up to ambient speed. Other fuel savings are also achieved by the reduced signal delay at the Railway Avenue intersection.

Overall benefits exceeding $11 million are very good and the project is consistent with federal goals of improving efficiency of the commercial vehicle network and north/south trade routes and Provincial goals of 4-laning the Cariboo Connector between Cache Creek and Prince George.

Exhibit 9-1 Benefit Cost Analysis Prince George South Weigh Scale

Option	Median Scale and 5 km of 4-Lane	Add Wim/AVI
COSTS		
Capital Costs:		
Property	$2.0	$2.0
Engineering	$1.2	$1.2
Construction	$21.7	$21.7
WIM/AVI	$0.0	$1.5
Transponders	$0.0	$0.1
Subtract Recoverables	$0.5	$0.5
Subtract "Do-Minimum" Cost	$6.0	$6.0
Total Capital Costs	**$18.3**	**$19.9**
Operating and Maintenance (Present Value):		
WIM/AVI	$0.0	$0.2
Auditing	$0.0	$0.1
Replacement Transponders	$0.0	$0.0
Incremental Hwy Mtce.	$0.1	$0.1
Incremental Resurfacing Cost	$0.0	-$0.04
Total O&M	**$0.1**	**$0.4**
Equivalent Annual Amount	$0.01	$0.04
Salvage (Present Value)	**$1.8**	**$1.8**
Present Value of Costs	**$16.6**	**$18.5**
BENEFITS		
Travel Time		
Inspection Stn. Delay Reduction	$5.5	$7.2
Reduced Intersection Delay	$1.6	$1.6
Divided 4-lane	$1.1	$1.1
Subtotal	***$8.1***	***$9.9***
Vehicle Operating Costs		
Truck Fuel at Inspection Stn.	$0.5	$0.9
Reduced Intersection Delay	$0.1	$0.1
Auto Fuel on Divided 4-lane	-$0.4	-$0.4
Subtotal	***$0.3***	***$0.6***
Safety		
Improved Compliance	$0.2	$0.3
Intersection Accidents	$0.4	$0.4
Divided 4-lane	$1.8	$1.8
Subtotal	***$2.4***	***$2.5***
Other		
Pavement Life	$0.4	$0.6
Inspection Station Staffing	$0.1	$0.2
Subtotal	***$0.5***	***$0.8***
Present Value of Benefits	**$11.3**	**$13.9**
Benefit/Cost Ratio	0.68	0.75
Net Present Value	-$5.3	-$4.6

9.2 Sensitivity Analysis

This is intended to reflect the impact of alternate assumptions on the results of the analysis. In this case the NPV is positive at the Provincially recommended 6% discount rate in Exhibit 9-2

Exhibit 9-2 Sensitivity Analysis

	10% Discount Rate	6% Discount Rate	8% Discount Rate	+25% Construc-tion Cost	+10% Construc-tion Cost	Traffic Growth 1.5%	Traffic Growth 0.5%
Net Present Value (millions $)							
No WIM/AVI	-5.3	2.4	-2.1	-9.9	-7.1	-5.0	-5.6
With WIM/AVI	-4.6	4.2	-1.0	-9.6	-6.6	-4.3	-5.0
B/C Ratio							
No WIM/AVI	0.68	1.17	.86	.53	.61	.70	.67
With WIM/AVI	0.75	1.26	.95	.59	.68	.77	.73

Other risks are minimal. The project has community support. The cost estimates are based on a 100% design submission and the project is expected to be complete by August 2008.