



Cal-B/C Training Module 6e

Understanding Project Benefits and Costs for Cal-B/C Intermodal Freight

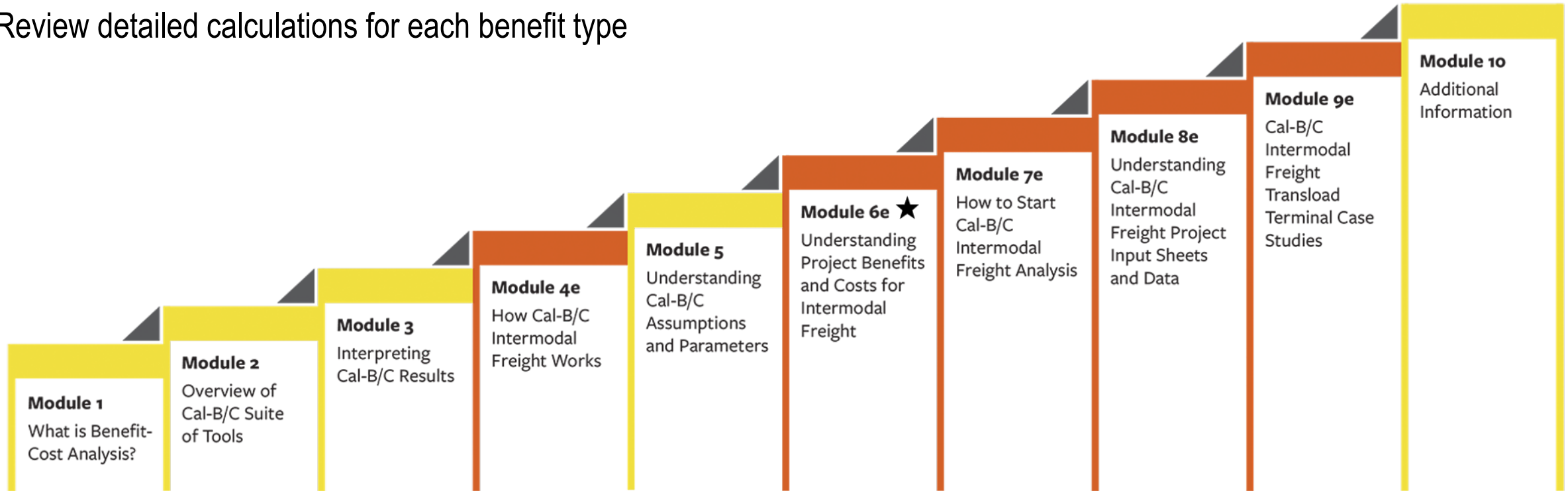


01

About This Module

This module will...

- Build on Modules 1 through 5 to provide a detailed understanding of project costs and benefits
- Describe benefit types and calculation methods
- Review detailed calculations for each benefit type



★ *This module is covered in this presentation*

Previous Modules...

- **Module 1** provided a basic introduction on benefit-cost analysis (BCA) and a general overview of how to conduct a BCA
- **Module 2** described the Cal-B/C suite of tools, discussed the types of projects that can be evaluated, and provided guidance on which tools to use for various project types
- **Module 3** presented the Cal-B/C results page, detailed what each output measure means, and explained how they are calculated
- **Module 4e** presented an overview of how Cal-B/C Intermodal Freight works, including a review of all worksheets and inputs
- **Module 5** highlighted the information in the Parameters worksheet and discussed key assumptions used by Cal-B/C

Terminology

Term	Definition
Bulk	Bulk cargo is loose cargo such as grain, coal, and iron ore. Bulk freight is not unitized or packaged and typically transported in cargo holds via bulk carriers. Bulk volumes are measured in short tons in Cal-B/C IF.
Break bulk	Break bulk cargo is cargo that is unitized and loaded individually. Break bulk cargo is generally packaged (e.g., bags, boxes, barrels, etc.) and not containerized. Break bulk volumes are measured in short tons in Cal-B/C IF.
Short tons	Short tons/US ton is measurement of weight equal to 2,000 pounds. Used as the unit of measure for bulk/break bulk volumes in Cal-B/C IF.
TEU	Twenty-foot equivalent unit (TEU) refers to container freight equivalent to a 20-footlong intermodal container. For instance, a 40-foot container would be equivalent to 2 TEU's.
Intermodal	Freight transportation that requires multiple modes of transportation without any handling of the freight itself when changing modes
Intermodal Train	A freight train that carries goods or commodities loaded into domestic or international shipping containers or highway semi-trailers on their own wheels.
Transload	The process of transferring a shipment from one mode of transportation to another.
Drayage	The transportation of goods over a short distance and usually part of a longer overall move – for instance from a port to a nearby rail yard.
Empty-haul trip	The movement of empty freight trucks and railcars.
Modal Diversion	The process of diverting freight volumes from one transportation mode to another. For instance, diverting freight shipments from trucks to rail.

Overview of Benefit Categories

Benefit Category	Cal-B/C IF
Travel time savings	
Vehicle operating cost savings	
Accident cost savings	✓
Emission cost savings	✓
Residual value	
Journey quality benefits	
Health benefits	
Shipper cost savings	✓

3

INVESTMENT ANALYSIS

SUMMARY RESULTS

Life-Cycle Costs (mil. \$)	\$316.3
Life-Cycle Benefits (mil. \$)	\$778.1
Net Present Value (mil. \$)	\$461.8
Benefit / Cost Ratio:	2.5
Rate of Return on Investment:	16.7%
Payback Period:	6 years

Should benefit-cost results include:

1) Shipper Costs? (y/n)	Y <small>Default = Y</small>
2) Accident Costs? (y/n)	Y <small>Default = Y</small>
3) Vehicle Emissions? (y/n) <small>includes value for CO₂e</small>	Y <small>Default = Y</small>

ITEMIZED BENEFITS (mil. \$)	Total Over	
	20 Years	Average Annual
Shipper Cost Savings	\$746.0	\$37.3
Modal Diversion and Freight Network Improvements	\$782.4	\$39.1
Transload and Operational Efficiency Improvements	-\$36.4	-\$1.8
Accident Cost Savings	\$30.3	\$1.5
Emission Cost Savings	\$1.8	\$0.1
TOTAL BENEFITS	\$778.1	\$38.9

EMISSIONS REDUCTION	Tons		Value (mil. \$)	
	Total Over 20 Years	Average Annual	Total Over 20 Years	Average Annual
CO Emissions Saved	339	17	\$0.0	\$0.0
CO ₂ Emissions Saved	439,543	21,977	\$12.3	\$0.6
NO _x Emissions Saved	-479	-24	-\$9.6	-\$0.5
PM ₁₀ Emissions Saved	-10	-1	-\$2.1	-\$0.1
PM _{2.5} Emissions Saved	11	1		
SO _x Emissions Saved	9	0	\$1.0	\$0.0
VOC Emissions Saved	40	2	\$0.1	\$0.0

Overview of Project Cost Types in Cal-B/C IF

Cal-B/C Intermodal Freight can accommodate the following cost types:

- Project support
- Right-of-way
- Construction
- Operation & Maintenance
- Rehabilitation

Project Costs

11 PROJECT COSTS (enter costs in thousands of dollars)									
Year	DIRECT PROJECT COSTS			SUBSEQUENT COSTS		Mitigation	Other Agency Cost Savings	Total Costs (in dollars)	
	Project Support	R / W	Construction	Maint./ Op.	Rehab.			Constant Dollars	Present Value
Construction Period									
2018	\$10,000							\$10,000,000	\$9,615,385
2019	\$5,000		\$100,000					\$105,000,000	\$97,078,402
2020	\$5,000		\$100,000					\$105,000,000	\$93,344,618
2021								\$0	\$0
2022								\$0	\$0
2023								\$0	\$0
2024								\$0	\$0
2025								\$0	\$0
2026								\$0	\$0
Project Open									
2021				\$8,000				\$8,000,000	\$6,838,434
2022				\$8,250				\$8,250,000	\$6,780,899
2023				\$8,500				\$8,500,000	\$6,717,673
2024				\$8,750				\$8,750,000	\$6,649,281
2025				\$9,000				\$9,000,000	\$6,576,212
2026				\$9,250				\$9,250,000	\$6,498,927
2027				\$9,500				\$9,500,000	\$6,417,860
2028				\$9,750				\$9,750,000	\$6,333,414
2029				\$10,000				\$10,000,000	\$6,245,970
2030				\$10,250				\$10,250,000	\$6,155,884
2031				\$10,500				\$10,500,000	\$6,063,488
2032				\$10,750				\$10,750,000	\$5,969,093
2033				\$11,000				\$11,000,000	\$5,872,990
2034				\$11,250				\$11,250,000	\$5,775,449
2035				\$11,500				\$11,500,000	\$5,676,723
2036				\$11,750				\$11,750,000	\$5,577,048
2037				\$12,000				\$12,000,000	\$5,476,643
2038				\$12,250				\$12,250,000	\$5,375,712
2039				\$12,500				\$12,500,000	\$5,274,442
2040				\$12,750				\$12,750,000	\$5,173,011
Total	\$20,000	\$0	\$200,000	\$207,500	\$0	\$0	\$0	\$427,500,000	\$321,487,560

02

Overview of Benefit Calculations in Cal-B/C IF

Overview of Benefit Calculations

- Benefit calculation worksheets produce detailed calculations for each benefit category
- They are provided for model transparency, not a “Black Box”
- Benefit estimates are functions of your inputs and assumptions contained in the Parameters worksheet

Shipper Cost Savings

Transportation Cost Savings
This sheet calculates total shipper cost benefits for modal diversion, drayage, terminal efficiency and transload operations.

Formulas:
 Annual Shipments = Volume by Mode / Volume per Vehicle
 Driver Travel Cost = (Driver Travel Cost / Truck Travel Cost) * (Truck Travel Cost / Truck Travel Cost)
 Transload Shipments = Annual Shipments * % of Shipments Transloaded
 Drayage Shipments = Volume by Mode * % of Shipments Drayaged
 Annual Delay = Delay per Year * Growth in Delay per Year

Modality Diversion Costs - Bulk/Breakbulk (Short Tons)

Year	TRUCKLOADS PER YEAR (Shipments/yr)		TRAILLOADS PER YEAR (Shipments/yr)		TRUCK COST (\$/unit)		RAIL COST (\$/unit)		MODAL DIVERSION BENEFIT (\$/unit)		Constant Dollars	Present Value
	No. Built	Unit	No. Built	Unit	No. Built	Unit	No. Built	Unit	Truck	Rail		
2022	15,652	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$17,327.33	\$17,327.33
2024	30,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$32,000.00	\$32,000.00
2025	32,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$34,000.00	\$34,000.00
2026	34,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$36,000.00	\$36,000.00
2027	36,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$38,000.00	\$38,000.00
2028	38,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$40,000.00	\$40,000.00
2029	40,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$42,000.00	\$42,000.00
2030	42,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$44,000.00	\$44,000.00
2031	44,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$46,000.00	\$46,000.00
2032	46,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$48,000.00	\$48,000.00
2033	48,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$50,000.00	\$50,000.00
2034	50,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$52,000.00	\$52,000.00
2035	52,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$54,000.00	\$54,000.00
2036	54,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$56,000.00	\$56,000.00
2037	56,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$58,000.00	\$58,000.00
2038	58,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$60,000.00	\$60,000.00
2039	60,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$62,000.00	\$62,000.00
2040	62,000	0	0	0	\$2,200.00	\$2,200.00	\$2,100.00	\$2,100.00	\$90.00	\$90.00	\$64,000.00	\$64,000.00
Total											\$1,732,733.33	\$1,732,733.33

Accident Savings

Accident Reduction Benefits
This sheet calculates accident benefits for modal diversion and drayage.

Formulas:
 Vehicle Miles Traveled - Dist. Traveled * No. of Vehicles
 Truck Acc. Cost = (Truck Acc. Cost / Total Acc. Cost) * Total Acc. Cost
 Rail Acc. Cost = (Rail Acc. Cost / Total Acc. Cost) * Total Acc. Cost

Modality Diversion Costs - Bulk/Breakbulk (Short Tons)

Year	TRUCK VMT (veh-miles/yr)		RAIL VMT (veh-miles/yr)		TRUCK ACCIDENT COSTS (\$/unit)		RAIL ACCIDENT COSTS (\$/unit)		Constant Dollars	Present Value	
	No. Built	Unit	No. Built	Unit	No. Built	Unit	No. Built	Unit			
2022	15,652	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2024	30,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2025	32,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2026	34,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2027	36,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2028	38,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2029	40,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2030	42,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2031	44,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2032	46,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2033	48,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2034	50,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2035	52,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2036	54,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2037	56,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2038	58,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2039	60,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
2040	62,000	0	0	0	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
Total										\$1,732,733.33	\$1,732,733.33

Emission Savings

Emission Reduction Benefits
This sheet calculates emissions benefits for modal diversion, drayage, and terminal efficiency.

Formulas:
 Truck Miles Traveled - Dist. Traveled * No. of Trucks
 Truck CO2 = (Truck CO2 / Total CO2) * Total CO2
 Rail CO2 = (Rail CO2 / Total CO2) * Total CO2

Modality Diversion - Truck

Year	BULK/BREAKBULK VMT (veh-miles/yr)		CONTAINER VMT (veh-miles/yr)		AVERAGE SPEED (mph)		BULK/BREAKBULK EMISSIONS (\$/unit)		CONTAINER EMISSIONS (\$/unit)		Constant Dollars	Present Value
	No. Built	Unit	No. Built	Unit	No. Built	Unit	No. Built	Unit	No. Built	Unit		
2022	15,652	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2024	30,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2025	32,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2026	34,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2027	36,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2028	38,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2029	40,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2030	42,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2031	44,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2032	46,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2033	48,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2034	50,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2035	52,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2036	54,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2037	56,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2038	58,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2039	60,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
2040	62,000	0	0	0	50.0	50.0	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
Total											\$1,732,733.33	\$1,732,733.33

Overview of Benefit Calculations

The Final Calculations worksheet:

- Tabulates all the benefits and costs by year, in present value and constant dollars, from the benefit estimation worksheets
- Calculates BCA metrics (B/C ratio, IRR, NPV, and payback period)

A NET PRESENT VALUE CALCULATION							B INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD							Years After Construction Begins		
Year	Transportation Cost Savings	Accident Reductions	Vehicle Emission Reductions	Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE	Year	Transportation Cost Savings	Accident Reductions	Vehicle Emission Reductions	Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJ OPENS	ANNUAL RETURNS ON INVESTMENT	
Construction Period							Construction Period							2018	(\$10,000,000)	
2018				\$0	\$9,615,385	(\$9,615,385)	2018				\$0	\$10,000,000	(\$10,000,000)		2019	(\$105,000,000)
2019				\$0	\$97,078,402	(\$97,078,402)	2019				\$0	\$105,000,000	(\$105,000,000)		2020	(\$105,000,000)
2020				\$0	\$93,344,618	(\$93,344,618)	2020				\$0	\$105,000,000	(\$105,000,000)		2021	\$25,496,232
2021				\$0	\$0	\$0	2021				\$0	\$0	\$0		2022	\$23,108,428
2022				\$0	\$0	\$0	2022				\$0	\$0	\$0		2023	\$28,473,300
2023				\$0	\$0	\$0	2023				\$0	\$0	\$0		2024	\$33,840,926
2024				\$0	\$0	\$0	2024				\$0	\$0	\$0		2025	\$39,211,389
2025				\$0	\$0	\$0	2025				\$0	\$0	\$0		2026	\$44,584,771
Project Open							Project Open							2027	\$49,961,158	
2021	\$18,878,536	\$744,264	\$2,171,485	\$21,794,286	\$0	\$21,794,286	2021	\$22,085,217	\$870,684	\$2,540,331	\$25,496,232	\$0	\$25,496,232	\$25,496,232	2028	\$46,540,048
2022	\$22,123,419	\$879,650	\$2,565,791	\$25,568,860	\$6,838,434	\$18,730,427	2022	\$26,916,522	\$1,070,229	\$3,121,677	\$31,108,428	\$8,000,000	\$23,108,428	\$48,604,660	2029	\$51,137,191
2023	\$25,090,768	\$1,003,521	\$2,928,668	\$29,022,957	\$6,790,899	\$22,242,058	2023	\$31,747,826	\$1,269,774	\$3,705,639	\$36,723,300	\$8,250,000	\$28,473,300	\$77,077,959	2030	\$55,737,710
2024	\$27,797,133	\$1,116,562	\$3,261,929	\$32,175,624	\$6,717,673	\$25,457,950	2024	\$36,579,130	\$1,469,319	\$4,292,477	\$42,340,926	\$8,500,000	\$33,840,926	\$110,918,885	2031	\$60,341,705
2025	\$30,258,199	\$1,219,423	\$3,567,295	\$35,044,914	\$6,849,281	\$28,195,636	2025	\$41,410,435	\$1,668,864	\$4,882,090	\$47,961,389	\$8,750,000	\$39,211,389	\$150,130,274	2032	\$64,949,276
2026	\$32,488,833	\$1,312,719	\$3,846,397	\$37,647,949	\$6,576,212	\$31,071,737	2026	\$46,241,739	\$1,868,409	\$5,474,622	\$53,584,771	\$9,000,000	\$44,584,771	\$194,715,045	2033	\$69,560,526
2027	\$34,503,118	\$1,397,036	\$4,100,783	\$40,000,937	\$6,498,927	\$33,502,009	2027	\$51,073,043	\$2,067,954	\$6,070,160	\$59,211,158	\$9,250,000	\$49,961,158	\$244,676,203	2034	\$74,175,560
2028	\$36,314,398	\$1,472,924	\$1,384,776	\$36,402,547	\$6,417,860	\$29,984,687	2028	\$55,904,348	\$2,267,439	(\$2,131,799)	\$56,040,048	\$9,500,000	\$46,540,048	\$291,216,251	2035	\$78,794,488
2029	\$37,935,309	\$1,540,909	(\$1,446,258)	\$38,029,960	\$6,333,414	\$31,696,546	2029	\$60,735,652	\$2,467,044	(\$2,315,506)	\$60,887,191	\$9,750,000	\$51,137,191	\$342,353,442	2036	\$83,417,419
2030	\$39,377,815	\$1,601,484	(\$1,498,934)	\$39,480,365	\$6,245,970	\$33,234,395	2030	\$65,566,957	\$2,666,589	(\$2,495,835)	\$65,737,710	\$10,000,000	\$55,737,710	\$388,091,152	2037	\$88,044,470
2031	\$40,653,242	\$1,655,121	(\$1,543,412)	\$40,764,951	\$6,155,894	\$34,609,057	2031	\$70,396,251	\$2,866,134	(\$2,672,690)	\$70,591,705	\$10,250,000	\$60,341,705	\$458,432,858	2038	\$92,675,757
2032	\$41,772,307	\$1,702,263	(\$1,580,265)	\$41,894,305	\$6,063,488	\$35,830,816	2032	\$75,229,565	\$3,065,679	(\$2,845,968)	\$75,443,276	\$10,500,000	\$64,949,276	\$523,382,134	2039	\$97,311,400
2033	\$42,745,153	\$1,743,330	(\$1,610,037)	\$42,878,446	\$5,969,093	\$36,909,353	2033	\$80,060,870	\$3,265,224	(\$3,015,568)	\$80,310,526	\$10,750,000	\$69,560,526	\$592,942,660	2040	\$101,951,523
2034	\$43,581,371	\$1,778,720	(\$1,633,237)	\$43,726,854	\$5,872,990	\$37,853,864	2034	\$84,892,174	\$3,464,770	(\$3,181,383)	\$85,175,560	\$11,000,000	\$74,175,560	\$667,118,220	2041	\$0
2035	\$44,290,032	\$1,808,809	(\$1,650,350)	\$44,448,491	\$5,775,449	\$38,673,042	2035	\$89,723,478	\$3,664,315	(\$3,343,305)	\$90,044,488	\$11,250,000	\$78,794,488	\$745,312,707	2042	\$0
2036	\$44,879,711	\$1,833,952	(\$1,661,829)	\$45,051,834	\$5,676,723	\$39,375,111	2036	\$94,554,783	\$3,863,860	(\$3,501,223)	\$94,917,419	\$11,500,000	\$83,417,419	\$829,330,127	2043	\$0
2037	\$45,368,513	\$1,854,485	(\$1,668,104)	\$45,544,894	\$5,577,048	\$39,967,845	2037	\$99,386,087	\$4,063,405	(\$3,855,021)	\$99,794,470	\$11,750,000	\$88,044,470	\$917,374,597	2044	\$0
2038	\$45,734,093	\$1,870,726	(\$1,669,579)	\$45,935,239	\$5,476,643	\$40,458,596	2038	\$104,217,391	\$4,262,950	(\$3,804,584)	\$104,675,757	\$12,000,000	\$92,675,757	\$1,010,050,354	2045	\$0
2039	\$46,013,685	\$1,882,974	(\$1,666,635)	\$46,230,023	\$5,375,712	\$40,854,311	2039	\$109,048,696	\$4,462,495	(\$3,949,790)	\$109,561,400	\$12,250,000	\$97,311,400	\$1,107,361,754		
2040	\$46,204,115	\$1,891,512	(\$1,659,631)	\$46,435,997	\$5,274,442	\$41,161,554	2040	\$113,880,000	\$4,662,040	(\$4,090,517)	\$114,451,523	\$12,500,000	\$101,951,523	\$1,209,313,276		
Total	\$745,999,749	\$30,310,383	\$1,769,303	\$778,079,435	\$316,314,549	\$461,764,886	Total	\$1,359,652,174	\$55,327,237	(\$10,916,135)	\$1,404,063,276	\$414,750,000	\$989,313,276		Internal Rate of Return	16.73%

Overview of Monetized Benefit Calculations

- Analysis worksheets estimate monetized benefits from data in 1) Project Information and 2) Model Inputs
- Benefit estimates are linked to the Final Calculations worksheet
- Life-Cycle Benefits, Life-Cycle Costs, and all other BCA metrics are linked to the Results page.

Shipper Cost Savings

Accident Savings

Emission Savings

This sheet calculates emissions benefits for modal diversion, drayage, and terminal efficiency. It includes formulas for various emission metrics and a summary table for different modes and years.

Year	No DUAL	DUAL	No DUAL	DUAL	No DUAL	DUAL	No DUAL	DUAL	No DUAL	DUAL	Present Value
2018	0	0	0	0	0	0	0	0	0	0	\$0
2019	0	0	0	0	0	0	0	0	0	0	\$0
2020	0	0	0	0	0	0	0	0	0	0	\$0
2021	0	0	0	0	0	0	0	0	0	0	\$0
2022	0	0	0	0	0	0	0	0	0	0	\$0
2023	0	0	0	0	0	0	0	0	0	0	\$0
2024	0	0	0	0	0	0	0	0	0	0	\$0
2025	0	0	0	0	0	0	0	0	0	0	\$0
2026	0	0	0	0	0	0	0	0	0	0	\$0
2027	0	0	0	0	0	0	0	0	0	0	\$0
2028	0	0	0	0	0	0	0	0	0	0	\$0
2029	0	0	0	0	0	0	0	0	0	0	\$0
Total											\$0

Final Calculations

This sheet performs the final calculations before presenting the summary results. Both net present value and internal rate of return on investment are calculated.

Year	Transportation Cost Savings	Accident Reductions	Vehicle Emission Reductions	Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
2018	\$0	\$0	\$0	\$0	\$0	\$0
2019	\$0	\$0	\$0	\$0	\$0	\$0
2020	\$0	\$0	\$0	\$0	\$0	\$0
2021	\$0	\$0	\$0	\$0	\$0	\$0
2022	\$0	\$0	\$0	\$0	\$0	\$0
2023	\$0	\$0	\$0	\$0	\$0	\$0
2024	\$0	\$0	\$0	\$0	\$0	\$0
2025	\$0	\$0	\$0	\$0	\$0	\$0
2026	\$0	\$0	\$0	\$0	\$0	\$0
2027	\$0	\$0	\$0	\$0	\$0	\$0
2028	\$0	\$0	\$0	\$0	\$0	\$0
2029	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$0	\$0	\$0	\$0	\$0	\$0

Year	Transportation Cost Savings	Accident Reductions	Vehicle Emission Reductions	Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS FROM OPENS	Years After Construction Begins	ANNUAL RETURNS ON INVESTMENT
2018	\$0	\$0	\$0	\$0	\$0	0%	\$0	2018	0%
2019	\$0	\$0	\$0	\$0	\$0	0%	\$0	2019	0%
2020	\$0	\$0	\$0	\$0	\$0	0%	\$0	2020	0%
2021	\$0	\$0	\$0	\$0	\$0	0%	\$0	2021	0%
2022	\$0	\$0	\$0	\$0	\$0	0%	\$0	2022	0%
2023	\$0	\$0	\$0	\$0	\$0	0%	\$0	2023	0%
2024	\$0	\$0	\$0	\$0	\$0	0%	\$0	2024	0%
2025	\$0	\$0	\$0	\$0	\$0	0%	\$0	2025	0%
2026	\$0	\$0	\$0	\$0	\$0	0%	\$0	2026	0%
2027	\$0	\$0	\$0	\$0	\$0	0%	\$0	2027	0%
2028	\$0	\$0	\$0	\$0	\$0	0%	\$0	2028	0%
2029	\$0	\$0	\$0	\$0	\$0	0%	\$0	2029	0%
Total	\$0	\$0	\$0	\$0	\$0	0%	\$0		0%

3) Results

INVESTMENT ANALYSIS SUMMARY RESULTS

	Total	Over 20 Years	Average Annual
Life-Cycle Costs (mil. \$)	\$316.3	\$746.0	\$37.3
Life-Cycle Benefits (mil. \$)	\$778.1	\$782.4	\$39.1
Net Present Value (mil. \$)	\$461.8	\$36.4	\$1.8
Benefit / Cost Ratio:	2.5		
Rate of Return on Investment:	16.7%		
Payback Period:	6 years		

	Total	Over 20 Years	Average Annual
Shipper Cost Savings	\$746.0	\$746.0	\$37.3
Modal Diversion and Freight Network Improvements	\$36.4	\$36.4	\$1.8
Transload and Operational Efficiency Improvements	\$30.3	\$30.3	\$1.5
Accident Cost Savings	\$1.8	\$1.8	\$0.1
Emission Cost Savings	\$778.1	\$778.1	\$38.9
TOTAL BENEFITS	\$778.1	\$782.4	\$39.1

Should benefit-cost results include:

1) Shipper Costs? (y/n)	<input checked="" type="checkbox"/> Y
2) Accident Costs? (y/n)	<input checked="" type="checkbox"/> Y
3) Vehicle Emissions? (y/n)	<input checked="" type="checkbox"/> Y

	Tons	Value (mil. \$)
	Total Over 20 Years	Average Annual
CO Emissions Saved	339	\$0.0
CO ₂ Emissions Saved	439,543	\$12.3
NO _x Emissions Saved	-479	-\$9.6
PM ₁₀ Emissions Saved	-10	-\$0.1
PM _{2.5} Emissions Saved	11	\$0.0
SO _x Emissions Saved	9	\$1.0
VOC Emissions Saved	40	\$0.1

03

Benefits in Cal-B/C IF

Calculations

Intermediate calculations for several benefit categories based on the data in:

1) Project Information:

- Annual Shipments (vehicles per year) = Annual Volume (units per year) / Volume per Vehicle, by mode and shipment type

Calculated for Base and Forecast years, in No Build and Build scenarios

District: HQ		EA: <input type="text"/>				
PROJECT: Hypothetical Project		PPND: <input type="text"/>				
1A PROJECT DATA						
Project Location (enter 1 for So. Cal., 2 for No. Cal., or 3 for rural) <input type="text" value="1"/>						
Current Year <input type="text" value="2017"/>						
Year Project Development Begins <input type="text" value="2018"/>						
Year Project Opens (Year 1) <input type="text" value="2021"/>						
1E HIGHWAY ACCIDENT DATA						
Actual Historical Accident Data						
		Count	Rate			
Total Accidents During Reporting Period		<input type="text" value="0.846"/>	0.846			
Fatal Accidents		<input type="text" value="0.006"/>	0.006			
Injury Accidents		<input type="text" value="0.29"/>	0.29			
Property Damage Only Accidents		<input type="text" value="0.55"/>	0.55			
Vehicle-Miles Traveled During Reporting Period		<input type="text"/>				
1B FREIGHT CAPACITY						
Average Bulk/Breakbulk Shipments (Short Tons)						
		No Build	Build			
Freight Trucks		<input type="text" value="25"/>	<input type="text" value="25"/>			
Average Short Tons per Truck		<input type="text" value="400"/>	<input type="text" value="400"/>			
Average Trip Distance (Miles, 1-Way)		<input type="text"/>	<input type="text"/>			
Freight Rail		<input type="text"/>	<input type="text"/>			
Average Short Tons per Railcar		<input type="text" value="100"/>	<input type="text" value="100"/>			
Average Number of Railcars per Train		<input type="text" value="90"/>	<input type="text" value="90"/>			
Average Trip Distance (Miles, 1-Way)		<input type="text" value="450"/>	<input type="text" value="450"/>			
Average Container Shipments (TEUs)						
		No Build	Build			
Freight Trucks		<input type="text"/>	<input type="text"/>			
Average Number of TEUs per Truck		<input type="text"/>	<input type="text"/>			
Average Trip Distance (Miles, 1-Way)		<input type="text"/>	<input type="text"/>			
Freight Rail		<input type="text"/>	<input type="text"/>			
Average Number of TEUs per Railcar		<input type="text"/>	<input type="text"/>			
Average Number of Railcars per Train		<input type="text"/>	<input type="text"/>			
Average Trip Distance (Miles, 1-Way)		<input type="text"/>	<input type="text"/>			
Average Short Tons per TEU		<input type="text" value="10"/>	<input type="text" value="10"/>			
1F FREIGHT SHIPPING COSTS						
Shipper Costs						
Bulk/Breakbulk Shipping Costs (Current Year Total Rates)		No Build	Build			
Per Truckload		<input type="text" value="\$2,200"/>	<input type="text" value="\$2,200"/>			
Per Carload		<input type="text" value="\$2,700"/>	<input type="text" value="\$2,700"/>			
Container Shipping Costs (Current Year Total Rates)						
Per TEU Moved by Truck		<input type="text" value="\$0"/>	<input type="text" value="\$0"/>			
Per TEU Moved by Rail		<input type="text" value="\$0"/>	<input type="text" value="\$0"/>			
Annual Increase in Shipper Costs (Net of Inflation)						
Long-Haul Truck Shipments		<input type="text" value="0.0%"/>	<input type="text" value="0.0%"/>			
Rail Shipments		<input type="text" value="0.0%"/>	<input type="text" value="0.0%"/>			
1C FREIGHT VOLUMES BY MODE						
Annual Bulk/Breakbulk Shipments (Short Tons)						
Current Year						
Total Tons Shipped by Truck		<input type="text" value="0"/>	<input type="text" value="0"/>			
Total Tons Shipped by Rail		<input type="text" value="1,000,000"/>	<input type="text" value="1,000,000"/>			
Total Tons Shipped		<input type="text" value="1,000,000"/>	<input type="text" value="1,000,000"/>			
Base Year (2021)						
		No Build	Build			
Total Tons Shipped by Truck		<input type="text" value="347,826"/>	<input type="text" value="0"/>			
Total Tons Shipped by Rail		<input type="text" value="1,000,000"/>	<input type="text" value="1,347,826"/>			
Total Tons Shipped		<input type="text" value="1,347,826"/>	<input type="text" value="1,347,826"/>			
Forecast Year (2040)						
Total Tons Shipped by Truck		<input type="text" value="2,000,000"/>	<input type="text" value="0"/>			
Total Tons Shipped by Rail		<input type="text" value="1,000,000"/>	<input type="text" value="3,000,000"/>			
Total Tons Shipped		<input type="text" value="3,000,000"/>	<input type="text" value="3,000,000"/>			
1G TRANSLOAD OPERATIONS DATA						
Transload Operations						
Proportion of Bulk/Breakbulk Volumes Transloaded		Truck Volumes	Rail Volumes			
Base Year (2021)		<input type="text" value="0%"/>	<input type="text" value="100%"/>			
Forecast Year (2040)		<input type="text" value="0%"/>	<input type="text" value="100%"/>			
Proportion of Container Volumes Transloaded per Year						
Base Year (2021)		<input type="text" value="0%"/>	<input type="text" value="100%"/>			
Forecast Year (2040)		<input type="text" value="0%"/>	<input type="text" value="100%"/>			
Transload Cost per Short Ton		No Build	Build			
		<input type="text" value="\$8.00"/>	<input type="text" value="\$5.00"/>			
Transload Cost per TEU		<input type="text" value="\$0.00"/>	<input type="text" value="\$0.00"/>			
Annual Increase in Transload Costs (Net of Inflation)						
Bulk/Breakbulk (Short Tons)		<input type="text" value="0.0%"/>	<input type="text" value="0.0%"/>			
Containers (TEU)		<input type="text" value="0.0%"/>	<input type="text" value="0.0%"/>			
1I PROJECT COSTS (enter costs in thousands)						
DIRECT PROJECT COSTS						
Year	INITIAL COSTS			SUBSEQUENT COSTS		
	Project Support	R / W	Construction	Maint./Op.	Rehab.	Mitig.
Construction Period						
2018	<input type="text" value="\$10,000"/>					
2019	<input type="text" value="\$5,000"/>		<input type="text" value="\$100,000"/>			
2020	<input type="text" value="\$5,000"/>		<input type="text" value="\$100,000"/>			
2021						
2022						
2023						
2024						
2025						
2026						
Project Open						
2021				<input type="text" value="\$8,000"/>		
2022				<input type="text" value="\$8,250"/>		
2023				<input type="text" value="\$8,500"/>		
2024				<input type="text" value="\$8,750"/>		
2025				<input type="text" value="\$9,000"/>		
2026				<input type="text" value="\$9,250"/>		
2027				<input type="text" value="\$9,500"/>		
2028				<input type="text" value="\$9,750"/>		
2029				<input type="text" value="\$10,000"/>		
2030				<input type="text" value="\$10,250"/>		
2031				<input type="text" value="\$10,500"/>		
2032				<input type="text" value="\$10,750"/>		
2033				<input type="text" value="\$11,000"/>		
2034				<input type="text" value="\$11,250"/>		
2035				<input type="text" value="\$11,500"/>		
2036				<input type="text" value="\$11,750"/>		
2037				<input type="text" value="\$12,000"/>		
2038				<input type="text" value="\$12,250"/>		
2039				<input type="text" value="\$12,500"/>		
2040				<input type="text" value="\$12,750"/>		
Total	<input type="text" value="\$20,000"/>	<input type="text" value="\$0"/>	<input type="text" value="\$200,000"/>	<input type="text" value="\$207,500"/>	<input type="text" value="\$0"/>	

Project Benefits in Cal-B/C IF

Shipper Cost Savings

- Modal Diversion Cost Savings
- Transload Cost Savings
- Drayage Cost Savings
- Terminal Efficiency Cost Savings

- Shipper Cost Savings by year are linked to the Final Calculations worksheet in "Transportation Cost Savings"

Transportation Cost Savings

This sheet calculates total shipper cost benefits for m

Formulas:

Annual Shipments = Volume by Mode / Volume per Vehicle
 (trucks / trains) / yr (tons / TEUs) / yr (tons / TEUs) / (truck / train)

Transload Shipments = Ann. Shipments x % of Shipments Transloaded
 (trucks / trains) / yr (trucks / trains) / yr % of (trucks / trains) transload

Drayage Shipments = Vol. by Mode x % of Ship. Drayed / Vol. per Truck
 (trucks / yr) (tons / TEUs) / yr % of volume drayed / yr (tons / TEU)

Annual Delay = Delay per Veh. x Growth in Delay per Veh.
 hrs / year hrs / (truck / train) % growth in delay hrs / (truck / train)

Modal Diversion Costs - Bulk/Breakbulk (Short Tons)

Year	TRUCKLOADS PER YEAR (shipments/yr)		TRAINLOADS PER YEAR (shipments/yr)	
	No Build	Build	No Build	Build
2021	13,913	0	111	
2022	17,391	0	111	
2023	20,870	0	111	
2024	24,348	0	111	
2025	27,826	0	111	
2026	31,304	0	111	
2027	34,783	0	111	
2028	38,261	0	111	
2029	41,739	0	111	
2030	45,217	0	111	
2031	48,696	0	111	
2032	52,174	0	111	
2033	55,652	0	111	
2034	59,130	0	111	
2035	62,609	0	111	
2036	66,087	0	111	
2037	69,565	0	111	
2038	73,043	0	111	
2039	76,522	0	111	
Total				

SUMMARY OF SHIPPING COST BENEFITS

Year	FREIGHT					Present Value of Shipping Cost Benefits	Constant Dollars
	Modal Diversion Bulk/Breakbulk Costs	Modal Diversion Container Costs	Transload Costs	Drayage Costs	Terminal Efficiency Costs		
2021	\$18,136,715	\$0	(\$631,812)	\$1,373,633	\$0	\$18,878,536	\$22,085,217
2022	\$21,798,936	\$0	(\$964,871)	\$1,289,353	\$0	\$22,123,419	\$26,916,522
2023	\$25,152,619	\$0	(\$1,271,376)	\$1,209,525	\$0	\$25,090,768	\$31,747,826
2024	\$28,216,079	\$0	(\$1,552,876)	\$1,133,930	\$0	\$27,797,133	\$36,579,130
2025	\$31,006,680	\$0	(\$1,810,841)	\$1,062,360	\$0	\$30,258,199	\$41,410,435
2026	\$33,540,880	\$0	(\$2,046,666)	\$994,618	\$0	\$32,488,833	\$46,241,739
2027	\$35,834,273	\$0	(\$2,261,671)	\$930,516	\$0	\$34,503,118	\$51,073,043
2028	\$37,901,635	\$0	(\$2,457,110)	\$869,874	\$0	\$36,314,398	\$55,904,348
2029	\$39,756,960	\$0	(\$2,634,170)	\$812,519	\$0	\$37,935,309	\$60,735,652
2030	\$41,413,500	\$0	(\$2,793,975)	\$758,290	\$0	\$39,377,815	\$65,566,957
2031	\$42,883,802	\$0	(\$2,937,591)	\$707,030	\$0	\$40,653,242	\$70,398,261
2032	\$44,179,741	\$0	(\$3,068,026)	\$658,592	\$0	\$41,772,307	\$75,229,565
2033	\$45,312,555	\$0	(\$3,180,236)	\$612,834	\$0	\$42,745,153	\$80,060,870
2034	\$46,292,874	\$0	(\$3,281,125)	\$569,621	\$0	\$43,581,371	\$84,892,174
2035	\$47,130,755	\$0	(\$3,369,548)	\$528,826	\$0	\$44,290,032	\$89,723,478
2036	\$47,835,702	\$0	(\$3,446,317)	\$490,326	\$0	\$44,879,711	\$94,554,783
2037	\$48,416,702	\$0	(\$3,512,195)	\$454,006	\$0	\$45,358,513	\$99,386,087
2038	\$48,882,247	\$0	(\$3,567,908)	\$419,754	\$0	\$45,734,093	\$104,217,391
2039	\$49,240,359	\$0	(\$3,614,140)	\$387,465	\$0	\$46,013,685	\$109,048,696
Total	\$782,431,627	\$0	(\$52,051,989)	\$15,620,112	\$0	\$745,999,749	\$1,359,652,174

Project Benefits in Cal-B/C IF

Shipper Cost Savings – Modal Diversion

- Function (annual volume, volume per vehicle, shipping cost) by mode and shipment type
- Transportation Cost (\$ per year) = Annual Shipments (vehicles per year) x Shipment Cost (\$ per vehicle) x Growth in Shipment Cost
- Modal Diversion Cost Savings = No Build Cost – Build Cost Transportation Costs, by mode and shipment type

Transportation Cost Savings

This sheet calculates total shipper cost benefits for modal diversion, drayage, terminal efficiency and transload operations.

Formulas:

Annual Shipments = Volume by Mode / Volume per Vehicle (trucks / trains) / yr (tons / TEUs) / yr (tons / TEUs) / (truck / train)	Modal Diversion Costs = Ann. Shipments x Shipment Cost x Growth in Shipment Cost \$/ year (trucks / trains) / yr \$ / (truck / train) % growth in \$ / (truck / train)
Transload Shipments = Ann. Shipments x % of Shipments Transloaded (trucks / trains) / yr (trucks / trains) / yr % of (trucks / trains) transloaded / yr	Transload Cost = Transload Shipments x Unit Cost x Growth in Unit Cost \$/ year (trucks / trains) / yr \$ / (ton / TEU) % growth in \$ / (ton / TEU)
Drayage Shipments = Vol. by Mode x % of Ship. Drayed / Vol. per Truck trucks / yr (tons / TEUs) / yr % of volume drayed / yr (tons / TEUs) / truck	Drayage Cost = Drayage Shipments x Drayage Cost x Growth in Drayage Cost \$/ year trucks / yr \$ / truck % growth in \$ / truck
Annual Delay = Delay per Veh. x Growth in Delay per Veh. hrs / year hrs / (truck / train) % growth in delay hrs / (truck / train)	Terminal Eff. Cost = Transload Shipments x Ann. Delay x Op. Cost x Growth in Op. Cost \$/ year (trucks / trains) / yr hrs / yr \$ / hr delay % growth in \$ / hr delay

FREIGHT BENEFITS

Modal Diversion Costs - Bulk/Breakbulk (Short Tons)

Year	TRUCKLOADS PER YEAR (shipments/yr)		TRAINLOADS PER YEAR (shipments/yr)		TRUCK COST (\$/truck)		RAIL COST (\$/train)		MODAL DIVERSION BENEFIT (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	Truck	Rail		
2021	13,913	0	111	160	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$30,608,696	-\$3,391,304	\$21,217,331	\$18,136,715
2040	80,000	0	111	333	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$176,000,000	-\$54,000,000	\$122,000,000	\$49,438,613
2022	17,391	0	111	169	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$38,260,870	-\$11,739,130	\$26,521,739	\$21,798,936
2023	20,870	0	111	169	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$45,913,043	-\$14,086,957	\$31,826,087	\$25,152,619
2024	24,348	0	111	179	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$53,565,217	-\$16,434,783	\$37,130,435	\$28,216,079
2025	27,826	0	111	188	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$61,217,391	-\$18,782,609	\$42,434,783	\$31,006,680
2026	31,304	0	111	198	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$68,869,565	-\$21,130,435	\$47,739,130	\$33,540,880
2027	34,783	0	111	208	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$76,521,739	-\$23,478,261	\$53,043,478	\$35,834,273
2028	38,261	0	111	217	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$84,173,913	-\$25,826,087	\$58,347,826	\$37,901,635
2029	41,739	0	111	227	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$91,826,087	-\$28,173,913	\$63,652,174	\$39,756,960
2030	45,217	0	111	237	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$99,478,261	-\$30,521,739	\$68,956,522	\$41,413,500
2031	48,696	0	111	246	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$107,130,435	-\$32,869,565	\$74,260,870	\$42,883,802
2032	52,174	0	111	256	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$114,782,609	-\$35,217,391	\$79,565,217	\$44,179,741
2033	55,652	0	111	266	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$122,434,783	-\$37,565,217	\$84,869,565	\$45,312,555
2034	59,130	0	111	275	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$130,086,957	-\$39,913,043	\$90,173,913	\$46,292,874
2035	62,609	0	111	285	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$137,739,130	-\$42,260,870	\$95,478,261	\$47,130,755
2036	66,087	0	111	295	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$145,391,304	-\$44,608,696	\$100,782,609	\$47,835,702
2037	69,565	0	111	304	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$153,043,478	-\$46,956,522	\$106,086,957	\$48,416,702
2038	73,043	0	111	314	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$160,695,652	-\$49,304,348	\$111,391,304	\$48,882,247
2039	76,522	0	111	324	\$2,200.00	\$2,200.00	\$243,000.00	\$243,000.00	\$168,347,826	-\$51,652,174	\$116,695,652	\$49,240,359
Total												\$782,431,627

Navigation: 2) Model Inputs | 3) Results | Shipper Costs | Accident Costs | Emissions | Final Calculations | PARAMETERS

Project Benefits in Cal-B/C IF

Shipper Cost Savings – Transload Costs

- Function (annual volume, transloaded portion, transload costs) by shipment type
 - Transload Shipments (units per year) = Annual Volume (units per year) x % of Volume Transloaded per year
 - Transload Cost (\$ per year) = Transload Shipments x Unit Cost (\$ per unit) x Growth in Unit Cost
 - Transload Cost Savings = No Build Cost – Build Cost, by shipment type
 - Transload Benefit will be negative if shipments are diverted from truck to freight rail

Transportation Cost Savings

This sheet calculates total shipper cost benefits for modal diversion, drayage, terminal efficiency and transload operations.

Formulas:

Annual Shipments = Volume by Mode / Volume per Vehicle (trucks / trains) / yr (tons / TEUs) / yr (tons / TEUs) / (truck / train)	Modal Diversion Costs = Ann. Shipments x Shipment Cost x Growth in Shipment Cost \$/ year (trucks / trains) / yr \$ / (truck / train) % growth in \$ / (truck / train)
Transload Shipments = Ann. Shipments x % of Shipments Transloaded (trucks / trains) / yr (trucks / trains) / yr % of (trucks / trains) transloaded / yr	Transload Cost = Transload Shipments x Unit Cost x Growth in Unit Cost \$/ year (trucks / trains) / yr \$ / (ton / TEU) % growth in \$ / (ton / TEU)
Drayage Shipments = Vol. by Mode x % of Ship. Drayed / Vol. per Truck trucks / yr (tons / TEUs) / yr % of volume drayed / yr (tons / TEUs) / truck	Drayage Cost = Drayage Shipments x Drayage Cost x Growth in Drayage Cost \$/ year trucks / yr \$ / truck % growth in \$ / truck
Annual Delay = Delay per Veh. x Growth in Delay per Veh. hrs / year hrs / (truck / train) % growth in delay hrs / (truck / train)	Terminal Eff. Cost = Transload Shipments x Ann. Delay x Op. Cost x Growth in Op. Cost \$/ year (trucks / trains) / yr hrs / yr \$ / hr delay % growth in \$ / hr delay

FREIGHT BENEFITS

Transload Costs

Year	BULK/BREAKBULK (short tons/yr)		CONTAINERS (TEUs/yr)		BULK/BREAKBULK COST (\$/ton)		CONTAINER COST (\$/TEU)		TRANSLOAD BENEFIT (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	Bulk/Breakbulk	Containers		
2021	1,000,000	1,347,826	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$739,130	\$0	(\$739,130)	(\$631,812)
2040	1,000,000	3,000,000	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$9,000,000	\$0	(\$9,000,000)	(\$3,651,537)
2022	1,000,000	1,434,783	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$1,173,913	\$0	(\$1,173,913)	(\$984,871)
2023	1,000,000	1,521,739	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$1,608,696	\$0	(\$1,608,696)	(\$1,271,376)
2024	1,000,000	1,608,696	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$2,043,478	\$0	(\$2,043,478)	(\$1,552,876)
2025	1,000,000	1,695,652	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$2,478,261	\$0	(\$2,478,261)	(\$1,810,841)
2026	1,000,000	1,782,609	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$2,913,043	\$0	(\$2,913,043)	(\$2,046,666)
2027	1,000,000	1,869,565	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$3,347,826	\$0	(\$3,347,826)	(\$2,261,671)
2028	1,000,000	1,956,522	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$3,782,609	\$0	(\$3,782,609)	(\$2,457,110)
2029	1,000,000	2,043,478	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$4,217,391	\$0	(\$4,217,391)	(\$2,634,170)
2030	1,000,000	2,130,435	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$4,652,174	\$0	(\$4,652,174)	(\$2,793,975)
2031	1,000,000	2,217,391	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$5,086,957	\$0	(\$5,086,957)	(\$2,937,591)
2032	1,000,000	2,304,348	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$5,521,739	\$0	(\$5,521,739)	(\$3,066,026)
2033	1,000,000	2,391,304	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$5,956,522	\$0	(\$5,956,522)	(\$3,180,236)
2034	1,000,000	2,478,261	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$6,391,304	\$0	(\$6,391,304)	(\$3,281,125)
2035	1,000,000	2,565,217	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$6,826,087	\$0	(\$6,826,087)	(\$3,369,548)
2036	1,000,000	2,652,174	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$7,260,870	\$0	(\$7,260,870)	(\$3,446,317)
2037	1,000,000	2,739,130	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$7,695,652	\$0	(\$7,695,652)	(\$3,512,195)
2038	1,000,000	2,826,087	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$8,130,435	\$0	(\$8,130,435)	(\$3,567,908)
2039	1,000,000	2,913,043	0	0	\$6.00	\$5.00	\$0.00	\$0.00	-\$8,565,217	\$0	(\$8,565,217)	(\$3,614,140)
Total												(\$52,051,989)

Navigation: 1) Project Information 2) Model Inputs 3) Results Shipper Costs Accident Costs Emissions Final Calculations PARAMETERS

Project Benefits in Cal-B/C IF

Shipper Cost Savings – Drayage Costs

- Function (annual volume, volume per vehicle, drayed portion, drayage costs) by shipment type
- Drayage Shipments (trucks per year) = Annual Volume (units per year) x % of Volume Drayed per year / Volume per Vehicle
- Drayage Cost (\$ per year) = Drayage Shipments x Drayage Cost (\$ per truck) x Growth in Drayage Cost
- Drayage Cost Savings = No Build Cost – Build Cost

Transportation Cost Savings

This sheet calculates total shipper cost benefits for modal diversion, drayage, terminal efficiency and transload operations.

Formulas:

Annual Shipments = Volume by Mode / Volume per Vehicle $(\text{trucks / trains}) / \text{yr} \quad (\text{tons} / \text{TEUs}) / \text{yr} \quad (\text{tons} / \text{TEUs}) / (\text{truck / train})$	Modal Diversion Costs = Ann. Shipments x Shipment Cost x Growth in Shipment Cost $\$/\text{year} \quad (\text{trucks / trains}) / \text{yr} \quad \$/ (\text{truck / train}) \quad \%$ growth in $\$/ (\text{truck / train})$
Transload Shipments = Ann. Shipments x % of Shipments Transloaded $(\text{trucks / trains}) / \text{yr} \quad (\text{trucks / trains}) / \text{yr} \quad \%$ of (trucks / trains) transloaded / yr	Transload Cost = Transload Shipments x Unit Cost x Growth in Unit Cost $\$/\text{year} \quad (\text{trucks / trains}) / \text{yr} \quad \$/ (\text{ton / TEU}) \quad \%$ growth in $\$/ (\text{ton / TEU})$
Drayage Shipments = Vol. by Mode x % of Ship. Drayed / Vol. per Truck $\text{trucks} / \text{yr} \quad (\text{tons} / \text{TEUs}) / \text{yr} \quad \%$ of volume drayed / yr (tons / TEUs) / truck	Drayage Cost = Drayage Shipments x Drayage Cost x Growth in Drayage Cost $\$/\text{year} \quad \text{trucks} / \text{yr} \quad \$/ \text{truck} \quad \%$ growth in $\$/ \text{truck}$
Annual Delay = Delay per Veh. x Growth in Delay per Veh. $\text{hrs} / \text{year} \quad \text{hrs} / (\text{truck / train}) \quad \%$ growth in delay hrs / (truck / train)	Terminal Eff. Cost = Transload Shipments x Ann. Delay x Op. Cost x Growth in Op. Cost $\$/\text{year} \quad (\text{trucks / trains}) / \text{yr} \quad \text{hrs} / \text{yr} \quad \$/ \text{hr delay} \quad \%$ growth in $\$/ \text{hr delay}$

FREIGHT BENEFITS

Drayage Costs

Year	NUMBER OF TRUCKS (trucks/yr)		DRAYAGE COST (\$/truck)		DRAYAGE BENEFIT (\$/yr)	Constant Dollars	Present Value
	No Build	Build	No Build	Build			
2021	40,000	53,913	\$55.00	\$11.00	\$1,606,957	\$1,606,957	\$1,373,633
2040	40,000	120,000	\$55.00	\$11.00	\$880,000	\$880,000	\$357,039
2022	40,000	57,391	\$55.00	\$11.00	\$1,568,696	\$1,568,696	\$1,289,353
2023	40,000	60,870	\$55.00	\$11.00	\$1,530,435	\$1,530,435	\$1,209,525
2024	40,000	64,348	\$55.00	\$11.00	\$1,492,174	\$1,492,174	\$1,133,930
2025	40,000	67,826	\$55.00	\$11.00	\$1,453,913	\$1,453,913	\$1,062,360
2026	40,000	71,304	\$55.00	\$11.00	\$1,415,652	\$1,415,652	\$994,618
2027	40,000	74,783	\$55.00	\$11.00	\$1,377,391	\$1,377,391	\$930,516
2028	40,000	78,261	\$55.00	\$11.00	\$1,339,130	\$1,339,130	\$869,874
2029	40,000	81,739	\$55.00	\$11.00	\$1,300,870	\$1,300,870	\$812,519
2030	40,000	85,217	\$55.00	\$11.00	\$1,262,609	\$1,262,609	\$758,290
2031	40,000	88,696	\$55.00	\$11.00	\$1,224,348	\$1,224,348	\$707,030
2032	40,000	92,174	\$55.00	\$11.00	\$1,186,087	\$1,186,087	\$658,592
2033	40,000	95,652	\$55.00	\$11.00	\$1,147,826	\$1,147,826	\$612,834
2034	40,000	99,130	\$55.00	\$11.00	\$1,109,565	\$1,109,565	\$569,621
2035	40,000	102,609	\$55.00	\$11.00	\$1,071,304	\$1,071,304	\$528,826
2036	40,000	106,087	\$55.00	\$11.00	\$1,033,043	\$1,033,043	\$490,326
2037	40,000	109,565	\$55.00	\$11.00	\$994,783	\$994,783	\$454,006
2038	40,000	113,043	\$55.00	\$11.00	\$956,522	\$956,522	\$419,754
2039	40,000	116,522	\$55.00	\$11.00	\$918,261	\$918,261	\$387,465
Total							\$15,620,112

1) Project Information 2) Model Inputs 3) Results **Shipper Costs** Accident Costs Emissions Final Calculations **PARAMETERS**

Project Benefits in Cal-B/C IF

Shipper Cost Savings – Terminal Efficiency

- Function (annual volume, volume per vehicle, transloaded portion, delay time, delay cost) by mode and shipment type
 - Transload Shipments (vehicles per year) = Annual Volume (units per year) / Volume per Vehicle x % of Volume Transloaded per year
 - Annual Delay (hours per year) = Transload Shipments (vehicles) x Delay per Vehicle (hour per vehicle) x Growth in Delay
 - Terminal Efficiency Cost (\$ per year) = Annual Delay x Operating Cost (\$ per hour) x Growth in Operating Cost
 - Terminal Efficiency Cost Savings = No Build Cost – Build Cost, by mode

Transportation Cost Savings

This sheet calculates total shipper cost benefits for modal diversion, drayage, terminal efficiency and transload operations.

Formulas:

Annual Shipments = Volume by Mode / Volume per Vehicle (trucks / trains) / yr (tons / TEUs) / yr (tons / TEUs) / (truck / train)	Modal Diversion Costs = Ann. Shipments x Shipment Cost x Growth in Shipment Cost \$/ year (trucks / trains) / yr \$ / (truck / train) % growth in \$ / (truck / train)
Transload Shipments = Ann. Shipments x % of Shipments Transloaded (trucks / trains) / yr (trucks / trains) / yr % of (trucks / trains) transloaded / yr	Transload Cost = Transload Shipments x Unit Cost x Growth in Unit Cost \$/ year (trucks / trains) / yr \$ / (ton / TEU) % growth in \$ / (ton / TEU)
Drayage Shipments = Vol. by Mode x % of Ship. Drayed / Vol. per Truck trucks / yr (tons / TEUs) / yr % of volume drayed / yr (tons / TEUs) / truck	Drayage Cost = Drayage Shipments x Drayage Cost x Growth in Drayage Cost \$/ year trucks / yr \$ / truck % growth in \$ / truck
Annual Delay = Delay per Veh. x Growth in Delay per Veh. hrs / year hrs / (truck / train) % growth in delay hrs / (truck / train)	Terminal Eff. Cost = Transload Shipments x Ann. Delay x Op. Cost x Growth in Op. Cost \$/ year (trucks / trains) / yr hrs / yr \$ / hr delay % growth in \$ / hr delay

FREIGHT BENEFITS

Terminal Efficiency Costs

Year	TRUCK DELAY TIME (hrs/yr)		RAIL DWELL TIME (hrs/yr)		TRUCK OPERATING COST (\$/hr)		RAIL OPERATING COST (\$/hr)		EFFICIENCY BENEFITS (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	Truck	Rail		
2021	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2040	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2022	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2023	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2024	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2025	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2026	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2027	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2028	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2029	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2030	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2031	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2032	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2033	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2034	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2035	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2036	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2037	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2038	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
2039	0	0	0.0	0.0	\$0.00	\$0.00	\$0.00	\$0.00	\$0	\$0	\$0	\$0
Total												\$0

1) Project Information 2) Model Inputs 3) Results Shipper Costs Accident Costs Emissions Final Calculations PARAMETERS

Project Benefits in Cal-B/C IF

Accident Reduction Benefits

- From Modal Diversion and reduced Drayage VMT
- Function (volume, distance, accident rates and costs) by mode and shipment type
 - Annual Vehicle-Miles Traveled (VMT) = Annual Shipments (vehicles per year) x Distance (miles per trip)
 - Truck Accident Cost (\$ per year) = Annual Truck VMT x Accident Rate (per mile) x Accident Cost by accident type
 - Rail Accident Cost (\$ per year) = Annual Rail VMT x Accident Cost per Mile
 - Accident Cost Savings = No Build Cost – Build Cost
- Accident Reduction Benefits by year are linked to the Final Calculations worksheet

Accident Reduction Benefits

This sheet calculates accident benefits for modal diversion and drayage.

Formulas:

Vehicle Miles Traveled = Dist. Traveled x No. of Vehicles
(truck / train)-miles / yr miles / trip (trucks / trains) / yr

Rail Acc. Cost = Train-Miles x Acc. Cost/Mile
\$ / yr train-miles / yr \$ / mile

Truck Acc. Cost = (Truck-Miles x Rate x Acc. Cost) by Acc. Type
\$ / yr truck-miles / yr acc / mile \$ / acc

Rail Acc. Cost/Mile from PARAMETERS

FREIGHT BENEFITS

Modal Diversion Costs - Bulk/Breakbulk (Short Tons)

Year	TRUCK VMT (veh-miles/yr)		RAIL VMT (veh-miles/yr)		TRUCK ACCIDENT COSTS (\$/yr)		RAIL ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build		
2021	11,130,435	0	100,000	134,783	\$1,260,934	\$0	\$1,312,290	\$1,768,739	\$804,485	\$687,677
2040	64,000,000	0	100,000	300,000	\$7,250,368	\$0	\$1,312,290	\$3,936,870	\$4,625,788	\$1,876,804
2022	13,913,043	0	100,000	143,478	\$1,576,167	\$0	\$1,312,290	\$1,882,851	\$1,005,606	\$826,535
2023	16,635,652	0	100,000	152,174	\$1,891,400	\$0	\$1,312,290	\$1,996,963	\$1,206,727	\$953,634
2024	19,478,261	0	100,000	160,870	\$2,206,634	\$0	\$1,312,290	\$2,111,075	\$1,407,843	\$1,069,849
2025	22,260,870	0	100,000	169,565	\$2,521,867	\$0	\$1,312,290	\$2,225,187	\$1,608,970	\$1,175,658
2026	25,043,478	0	100,000	178,261	\$2,837,101	\$0	\$1,312,290	\$2,339,300	\$1,810,091	\$1,271,746
2027	27,826,087	0	100,000	186,957	\$3,152,334	\$0	\$1,312,290	\$2,453,412	\$2,011,212	\$1,368,703
2028	30,608,696	0	100,000	195,652	\$3,467,567	\$0	\$1,312,290	\$2,567,524	\$2,212,333	\$1,437,090
2029	33,391,304	0	100,000	204,348	\$3,782,801	\$0	\$1,312,290	\$2,681,636	\$2,413,455	\$1,507,437
2030	36,173,913	0	100,000	213,043	\$4,098,034	\$0	\$1,312,290	\$2,795,748	\$2,614,576	\$1,570,246
2031	38,956,522	0	100,000	221,739	\$4,413,267	\$0	\$1,312,290	\$2,909,860	\$2,815,697	\$1,625,395
2032	41,739,130	0	100,000	230,435	\$4,728,501	\$0	\$1,312,290	\$3,023,973	\$3,016,818	\$1,675,132
2033	44,521,739	0	100,000	239,130	\$5,043,734	\$0	\$1,312,290	\$3,138,085	\$3,217,939	\$1,718,084
2034	47,304,348	0	100,000	247,826	\$5,358,968	\$0	\$1,312,290	\$3,252,197	\$3,419,061	\$1,755,254
2035	50,086,957	0	100,000	256,522	\$5,674,201	\$0	\$1,312,290	\$3,366,309	\$3,620,182	\$1,787,024
2036	52,869,565	0	100,000	265,217	\$5,989,434	\$0	\$1,312,290	\$3,480,421	\$3,821,303	\$1,813,753
2037	55,652,174	0	100,000	273,913	\$6,304,668	\$0	\$1,312,290	\$3,594,533	\$4,022,424	\$1,835,782
2038	58,434,783	0	100,000	282,609	\$6,619,901	\$0	\$1,312,290	\$3,708,646	\$4,223,546	\$1,853,434
2039	61,217,391	0	100,000	291,304	\$6,935,135	\$0	\$1,312,290	\$3,822,758	\$4,424,667	\$1,867,012
Total										\$29,666,908

Navigation: 2) Model Inputs | 3) Results | Shipper Costs | **Accident Costs** | Emissions | Final Calculations | PARAMETERS

Project Benefits in Cal-B/C IF

Emission Reduction Benefits – Rail

- From Modal Diversion and Terminal Efficiency (reduced idling)
- Function (volume, distance, emission rates and cost) by emissions type
 - Annual Rail Tons = (TEU Volume (per year by rail) / Avg. Tons per TEU) + Ton Volume (per year by rail)
 - Annual Rail Ton-Miles = Ann. Rail Tons / Tons per Train x Distance (miles per trip)
 - Annual Gallons Consumed = Rail Ton-Miles / Fuel Efficiency (ton-miles per gallon)
 - Rail Emissions Cost (\$ per year) = Annual Gallons x Emission Rate (ton per mile) x Cost per Ton
 - Idle Emissions Cost (\$ per year) = Dwell time (hours per year) x Idle Fuel Efficiency (gallons per hour) x Emission Rate (ton per mile) x Cost per Ton

Emission Reduction Benefits

This sheet calculates emissions benefits for modal diversion, drayage, and terminal efficiency

Formulas:

Truck-Miles Traveled = Dist. Traveled x No. of Trucks	Truck Em. Cost = (Truck-Miles x Rate x Cost/Ton) by Em. Type
truck-miles / yr	\$/ yr
Tons by Rail = TEU Volume / Avg. Tons per TEU + Bulk/Breakbulk Vol.	Rail Em. Cost = (Gal. Consumed x Rate x Cost/Ton) by Em. Type
tons / yr	\$/ yr
Gallons Consumed = Tons by Rail x Dist. Traveled / Fuel Efficiency	Idle Em. Cost = (Dwell x Idle Fuel x Rate x Cost/Ton) by Em. Type
gallons / yr by rail	\$/ yr

Modal Diversion - Rail

Year	BULK/BREAKBULK TON-MILES (ton-miles/yr)		CONTAINER TON-MILES (ton-miles/yr)		GALLONS OF DIESEL CONSUMED (gallons/yr)		BULK/BREAKBULK EMISSIONS (\$/yr)		CONTAINER EMISSIONS (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	No Build	Build		
2021	450,000,000	606,521,739	0	0	1,923,077	2,591,973	\$5,173,244	\$6,972,633	\$0	\$0	(\$1,799,389)	(\$1,538,125)
2040	450,000,000	1,350,000,000	0	0	1,923,077	5,769,231	\$5,579,760	\$16,739,279	\$0	\$0	(\$11,159,520)	(\$4,527,711)
2022	450,000,000	645,652,174	0	0	1,923,077	2,759,197	\$5,191,042	\$7,448,017	\$0	\$0	(\$2,256,975)	(\$1,855,069)
2023	450,000,000	684,782,609	0	0	1,923,077	2,926,421	\$5,209,196	\$7,927,037	\$0	\$0	(\$2,717,841)	(\$2,147,950)
2024	450,000,000	723,913,043	0	0	1,923,077	3,093,645	\$5,227,713	\$8,409,799	\$0	\$0	(\$3,182,088)	(\$2,418,124)
2025	450,000,000	763,043,478	0	0	1,923,077	3,260,870	\$5,246,600	\$8,896,409	\$0	\$0	(\$3,649,809)	(\$2,666,880)
2026	450,000,000	802,173,913	0	0	1,923,077	3,428,094	\$5,265,865	\$9,386,978	\$0	\$0	(\$4,121,112)	(\$2,895,439)
2027	450,000,000	841,304,348	0	0	1,923,077	3,595,318	\$5,285,616	\$9,881,617	\$0	\$0	(\$4,596,101)	(\$3,104,961)
2028	450,000,000	880,434,783	0	0	1,923,077	3,762,542	\$5,305,559	\$10,380,442	\$0	\$0	(\$5,074,883)	(\$3,296,547)
2029	450,000,000	919,565,217	0	0	1,923,077	3,929,766	\$5,326,004	\$10,883,572	\$0	\$0	(\$5,567,569)	(\$3,471,241)
2030	450,000,000	958,695,652	0	0	1,923,077	4,096,990	\$5,346,857	\$11,391,130	\$0	\$0	(\$6,044,273)	(\$3,630,034)
2031	450,000,000	997,826,087	0	0	1,923,077	4,264,214	\$5,368,127	\$11,903,238	\$0	\$0	(\$6,535,111)	(\$3,773,864)
2032	450,000,000	1,036,956,522	0	0	1,923,077	4,431,438	\$5,389,823	\$12,420,026	\$0	\$0	(\$7,020,203)	(\$3,903,622)
2033	450,000,000	1,076,086,957	0	0	1,923,077	4,598,662	\$5,411,952	\$12,941,625	\$0	\$0	(\$7,529,673)	(\$4,020,154)
2034	450,000,000	1,115,217,391	0	0	1,923,077	4,765,886	\$5,434,524	\$13,468,169	\$0	\$0	(\$8,033,645)	(\$4,124,258)
2035	450,000,000	1,154,347,826	0	0	1,923,077	4,933,110	\$5,457,548	\$13,999,797	\$0	\$0	(\$8,542,249)	(\$4,216,694)
2036	450,000,000	1,193,478,261	0	0	1,923,077	5,100,334	\$5,481,032	\$14,536,650	\$0	\$0	(\$9,055,618)	(\$4,298,180)
2037	450,000,000	1,232,608,696	0	0	1,923,077	5,267,558	\$5,504,986	\$15,078,874	\$0	\$0	(\$9,573,889)	(\$4,369,398)
2038	450,000,000	1,271,739,130	0	0	1,923,077	5,434,783	\$5,529,418	\$15,626,617	\$0	\$0	(\$10,097,199)	(\$4,430,990)
2039	450,000,000	1,310,869,565	0	0	1,923,077	5,602,007	\$5,554,340	\$16,180,034	\$0	\$0	(\$10,625,694)	(\$4,483,569)
Total												(\$69,172,809)

Project Benefits in Cal-B/C IF

Emission Reduction Benefits – Truck

- From Modal Diversion and reduced Drayage VMT
- Function (volume, distance, emission rates and cost) by emissions type
 - Annual Truck VMT = Annual Shipments (vehicles per year) x Distance (miles per trip)
 - Truck Emissions Cost (\$ per year) = Truck VMT x Emission Rate (ton per mile, per speed) x Cost per Ton
 - Emissions Benefits = No Build Cost – Build Cost in Rail Emissions Cost, Idle Emissions Cost, & Truck Emissions Cost, by emissions type
- Emissions Reduction Benefits by year are linked to the Final Calculations worksheet

Emission Reduction Benefits

This sheet calculates emissions benefits for modal diversion, drayage, and terminal efficiency

Formulas:

Truck-Miles Traveled = Dist. Traveled x No. of Trucks	Truck Em. Cost = (Truck-Miles x Rate x Cost/Ton) by Em. Type
truck-miles / yr miles / trip trucks / yr	\$ / yr truck-miles / yr ton / mi \$ / ton
Tons by Rail = TEU Volume / Avg. Tons per TEU x Bulk/Breakbulk Vol.	Rail Em. Cost = (Gal. Consumed x Rate x Cost/Ton) by Em. Type
tons / yr TEUs shipped by rail / yr tons / TEU	\$ / yr gallons / yr by rail ton / gal. \$ / ton
Gallons Consumed = Tons by Rail x Dist. Traveled / Fuel Efficiency	Idle Em. Cost = (Dwell x Idle Fuel x Rate x Cost/Ton) by Em. Type
gallons / yr by rail tons / yr miles / trip ton-miles / gallon	\$ / yr hrs / yr gallons / hr ton / gal. \$ / ton

Modal Diversion - Truck

Year	BULK/BREAKBULK VMT (veh-miles/yr)		CONTAINER VMT (veh-miles/yr)		AVERAGE SPEED (mph)		BULK/BREAKBULK EMISSIONS (\$/yr)		CONTAINER EMISSIONS (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	No Build	Build		
2021	11,130,435	0	0	0	50.0	50.0	\$4,118,065	\$0	\$0	\$0	\$4,118,065	\$3,520,139
2040	64,000,000	0	0	0	50.0	50.0	\$7,016,448	\$0	\$0	\$0	\$7,016,448	\$2,546,758
2022	13,913,043	0	0	0	50.0	50.0	\$5,161,672	\$0	\$0	\$0	\$5,161,672	\$4,242,518
2023	16,696,652	0	0	0	50.0	50.0	\$6,211,253	\$0	\$0	\$0	\$6,211,253	\$4,308,844
2024	19,478,261	0	0	0	50.0	50.0	\$7,266,986	\$0	\$0	\$0	\$7,266,986	\$5,522,312
2025	22,260,870	0	0	0	50.0	50.0	\$8,329,052	\$0	\$0	\$0	\$8,329,052	\$6,085,956
2026	25,043,478	0	0	0	50.0	50.0	\$9,397,637	\$0	\$0	\$0	\$9,397,637	\$6,602,655
2027	27,826,087	0	0	0	50.0	50.0	\$10,472,933	\$0	\$0	\$0	\$10,472,933	\$7,075,138
2028	30,608,696	0	0	0	50.0	50.0	\$2,871,392	\$0	\$0	\$0	\$2,871,392	\$1,865,201
2029	33,391,304	0	0	0	50.0	50.0	\$3,171,819	\$0	\$0	\$0	\$3,171,819	\$1,981,109
2030	36,173,913	0	0	0	50.0	50.0	\$3,473,666	\$0	\$0	\$0	\$3,473,666	\$2,083,737
2031	38,956,522	0	0	0	50.0	50.0	\$3,795,146	\$0	\$0	\$0	\$3,795,146	\$2,191,602
2032	41,739,130	0	0	0	50.0	50.0	\$4,118,482	\$0	\$0	\$0	\$4,118,482	\$2,286,847
2033	44,521,739	0	0	0	50.0	50.0	\$4,449,899	\$0	\$0	\$0	\$4,449,899	\$2,375,838
2034	47,304,348	0	0	0	50.0	50.0	\$4,789,632	\$0	\$0	\$0	\$4,789,632	\$2,458,869
2035	50,086,957	0	0	0	50.0	50.0	\$5,137,917	\$0	\$0	\$0	\$5,137,917	\$2,536,220
2036	52,869,565	0	0	0	50.0	50.0	\$5,495,001	\$0	\$0	\$0	\$5,495,001	\$2,608,161
2037	55,652,174	0	0	0	50.0	50.0	\$5,861,135	\$0	\$0	\$0	\$5,861,135	\$2,674,946
2038	58,434,783	0	0	0	50.0	50.0	\$6,236,577	\$0	\$0	\$0	\$6,236,577	\$2,736,819
2039	61,217,391	0	0	0	50.0	50.0	\$6,621,590	\$0	\$0	\$0	\$6,621,590	\$2,794,016
Total												\$69,403,745

04

Project Costs in Cal-B/C IF

Project Cost Inputs

- All project costs are entered in Section 1I in the Project Information worksheet, in seven columns
- Project costs should be entered as incremental costs
 - Incremental costs are difference between No Build and Build scenarios
- Project costs must be entered in constant dollars, in same year as economic parameters used for benefit calculations (current year in Cal-B/C is 2016)
- Project costs must be entered in thousands of dollars (\$1,000)

11 PROJECT COSTS (enter costs in thousands of dollars)

Year	DIRECT PROJECT COSTS						Other Agency Cost Savings	Total Costs (in dollars)	
	INITIAL COSTS			SUBSEQUENT COSTS				Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.	Mitigation			
Construction Period									
2018	\$10,000							\$10,000,000	\$9,615,385
2019	\$5,000		\$100,000					\$105,000,000	\$97,078,402
2020	\$5,000		\$100,000					\$105,000,000	\$93,344,618
2021								\$0	\$0
2022								\$0	\$0
2023								\$0	\$0
2024								\$0	\$0
2025								\$0	\$0
2026								\$0	\$0
Project Open									
2021				\$8,000				\$8,000,000	\$6,838,434
2022				\$8,250				\$8,250,000	\$6,780,899
2023				\$8,500				\$8,500,000	\$6,717,673
2024				\$8,750				\$8,750,000	\$6,649,281
2025				\$9,000				\$9,000,000	\$6,576,212
2026				\$9,250				\$9,250,000	\$6,498,927
2027				\$9,500				\$9,500,000	\$6,417,860
2028				\$9,750				\$9,750,000	\$6,333,414
2029				\$10,000				\$10,000,000	\$6,245,970
2030				\$10,250				\$10,250,000	\$6,155,884
2031				\$10,500				\$10,500,000	\$6,063,488
2032				\$10,750				\$10,750,000	\$5,969,093
2033				\$11,000				\$11,000,000	\$5,872,990
2034				\$11,250				\$11,250,000	\$5,775,449
2035				\$11,500				\$11,500,000	\$5,676,723
2036				\$11,750				\$11,750,000	\$5,577,048
2037				\$12,000				\$12,000,000	\$5,476,643
2038				\$12,250				\$12,250,000	\$5,375,712
2039				\$12,500				\$12,500,000	\$5,274,442
2040				\$12,750				\$12,750,000	\$5,173,011
Total	\$20,000	\$0	\$200,000	\$207,500	\$0	\$0	\$0	\$427,500,000	\$321,487,560

Project Cost Inputs

- Year 1 (current year) is represented by the “Year Project Development Begins” entry in Section 1A under the “Construction Period” header
- Costs must be entered for each year of construction
 - Defined by entry in Section 1A, from “Year Project Development Begins” to one year before “Year Project Opens”
- Following construction, the project opens and O&M & rehabilitation costs may be input for the duration of the project operating period
- Year 1 (Base Year) is represented by the “Year Project Opens” entry in Section 1A under the “Project Open” header

11 PROJECT COSTS (enter costs in thousands of dollars)

Year	DIRECT PROJECT COSTS					Mitigation	Other Agency Cost Savings	Total Costs (in dollars)	
	INITIAL COSTS			SUBSEQUENT COSTS				Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
2018	\$10,000							\$10,000,000	\$9,615,385
2019	\$5,000		\$100,000					\$105,000,000	\$97,078,402
2020	\$5,000		\$100,000					\$105,000,000	\$93,344,618
2021								\$0	\$0
2022								\$0	\$0
2023								\$0	\$0
2024								\$0	\$0
2025								\$0	\$0
2026								\$0	\$0
Project Open									
2021				\$8,000				\$8,000,000	\$6,838,434
2022				\$8,250				\$8,250,000	\$6,780,899
2023				\$8,500				\$8,500,000	\$6,717,673
2024				\$8,750				\$8,750,000	\$6,649,281
2025				\$9,000				\$9,000,000	\$6,576,212
2026				\$9,250				\$9,250,000	\$6,498,927
2027				\$9,500				\$9,500,000	\$6,417,860
2028				\$9,750				\$9,750,000	\$6,333,414
2029				\$10,000				\$10,000,000	\$6,245,970
2030				\$10,250				\$10,250,000	\$6,155,884
2031				\$10,500				\$10,500,000	\$6,063,488
2032				\$10,750				\$10,750,000	\$5,969,093
2033				\$11,000				\$11,000,000	\$5,872,990
2034				\$11,250				\$11,250,000	\$5,775,449
2035				\$11,500				\$11,500,000	\$5,676,723
2036				\$11,750				\$11,750,000	\$5,577,048
2037				\$12,000				\$12,000,000	\$5,476,643
2038				\$12,250				\$12,250,000	\$5,375,712
2039				\$12,500				\$12,500,000	\$5,274,442
2040				\$12,750				\$12,750,000	\$5,173,011
Total	\$20,000	\$0	\$200,000	\$207,500	\$0	\$0	\$0	\$427,500,000	\$321,487,560

Project Costs – Direct Project Costs

Initial Costs

- Project support (e.g., preliminary engineering, design, management costs)
- Right-of-way acquisition costs
- Construction costs

No initial project costs should be incurred after the project opens

Cal-B/C assumes all construction funding is expended by opening day

11 PROJECT COSTS (enter costs in thousands of dollars)

Year	DIRECT PROJECT COSTS			SUBSEQUENT COSTS		Mitigation	Other Agency Cost Savings	Total Costs (in dollars)	
	Project Support	R / W	Construction	Maint./ Op.	Rehab.			Constant Dollars	Present Value
Construction Period									
2018	\$10,000							\$10,000,000	\$9,615,385
2019	\$5,000		\$100,000					\$105,000,000	\$97,078,402
2020	\$5,000		\$100,000					\$105,000,000	\$93,344,618
2021								\$0	\$0
2022								\$0	\$0
2023								\$0	\$0
2024								\$0	\$0
2025								\$0	\$0
2026								\$0	\$0
Project Open									
2021				\$8,000				\$8,000,000	\$6,838,434
2022				\$8,250				\$8,250,000	\$6,780,899
2023				\$8,500				\$8,500,000	\$6,717,673
2024				\$8,750				\$8,750,000	\$6,649,281
2025				\$9,000				\$9,000,000	\$6,576,212
2026				\$9,250				\$9,250,000	\$6,498,927
2027				\$9,500				\$9,500,000	\$6,417,860
2028				\$9,750				\$9,750,000	\$6,333,414
2029				\$10,000				\$10,000,000	\$6,245,970
2030				\$10,250				\$10,250,000	\$6,155,884
2031				\$10,500				\$10,500,000	\$6,063,488
2032				\$10,750				\$10,750,000	\$5,969,093
2033				\$11,000				\$11,000,000	\$5,872,990
2034				\$11,250				\$11,250,000	\$5,775,449
2035				\$11,500				\$11,500,000	\$5,676,723
2036				\$11,750				\$11,750,000	\$5,577,048
2037				\$12,000				\$12,000,000	\$5,476,643
2038				\$12,250				\$12,250,000	\$5,375,712
2039				\$12,500				\$12,500,000	\$5,274,442
2040				\$12,750				\$12,750,000	\$5,173,011
Total	\$20,000	\$0	\$200,000	\$207,500	\$0	\$0	\$0	\$427,500,000	\$321,487,560

Project Costs – Direct Project Costs

Subsequent Costs

- Maintenance and operating costs
- Rehabilitation costs

These costs are incurred after the project is constructed and open for service

11 PROJECT COSTS (enter costs in thousands of dollars)

Year	DIRECT PROJECT COSTS			SUBSEQUENT COSTS		Mitigation	Other Agency Cost Savings	Total Costs (in dollars)	
	Project Support	R / W	Construction	Maint./ Op.	Rehab.			Constant Dollars	Present Value
Construction Period									
2018	\$10,000							\$10,000,000	\$9,615,385
2019	\$5,000		\$100,000					\$105,000,000	\$97,078,402
2020	\$5,000		\$100,000					\$105,000,000	\$93,344,618
2021								\$0	\$0
2022								\$0	\$0
2023								\$0	\$0
2024								\$0	\$0
2025								\$0	\$0
2026								\$0	\$0
Project Open									
2021				\$8,000				\$8,000,000	\$6,838,434
2022				\$8,250				\$8,250,000	\$6,780,899
2023				\$8,500				\$8,500,000	\$6,717,673
2024				\$8,750				\$8,750,000	\$6,649,281
2025				\$9,000				\$9,000,000	\$6,576,212
2026				\$9,250				\$9,250,000	\$6,498,927
2027				\$9,500				\$9,500,000	\$6,417,860
2028				\$9,750				\$9,750,000	\$6,333,414
2029				\$10,000				\$10,000,000	\$6,245,970
2030				\$10,250				\$10,250,000	\$6,155,884
2031				\$10,500				\$10,500,000	\$6,063,488
2032				\$10,750				\$10,750,000	\$5,969,093
2033				\$11,000				\$11,000,000	\$5,872,990
2034				\$11,250				\$11,250,000	\$5,775,449
2035				\$11,500				\$11,500,000	\$5,676,723
2036				\$11,750				\$11,750,000	\$5,577,048
2037				\$12,000				\$12,000,000	\$5,476,643
2038				\$12,250				\$12,250,000	\$5,375,712
2039				\$12,500				\$12,500,000	\$5,274,442
2040				\$12,750				\$12,750,000	\$5,173,011
Total	\$20,000	\$0	\$200,000	\$207,500	\$0	\$0	\$0	\$427,500,000	\$321,487,560

Project Costs – Mitigation and Other Agency Cost Savings

Mitigation

- Costs to protect communities and the environment from negative impacts
- May include wetland and community preservation, sound walls to reduced highway noise

Other Agency Cost Savings

- Represents any savings to the agency due to efficiency improvements

11 PROJECT COSTS (enter costs in thousands of dollars)

Year	DIRECT PROJECT COSTS					Mitigation	Other Agency Cost Savings	Total Costs (in dollars)	
	INITIAL COSTS			SUBSEQUENT COSTS				Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
2018	\$10,000							\$10,000,000	\$9,615,385
2019	\$5,000		\$100,000					\$105,000,000	\$97,078,402
2020	\$5,000		\$100,000					\$105,000,000	\$93,344,618
2021								\$0	\$0
2022								\$0	\$0
2023								\$0	\$0
2024								\$0	\$0
2025								\$0	\$0
2026								\$0	\$0
Project Open									
2021				\$8,000				\$8,000,000	\$6,838,434
2022				\$8,250				\$8,250,000	\$6,780,899
2023				\$8,500				\$8,500,000	\$6,717,673
2024				\$8,750				\$8,750,000	\$6,649,281
2025				\$9,000				\$9,000,000	\$6,576,212
2026				\$9,250				\$9,250,000	\$6,498,927
2027				\$9,500				\$9,500,000	\$6,417,860
2028				\$9,750				\$9,750,000	\$6,333,414
2029				\$10,000				\$10,000,000	\$6,245,970
2030				\$10,250				\$10,250,000	\$6,155,884
2031				\$10,500				\$10,500,000	\$6,063,488
2032				\$10,750				\$10,750,000	\$5,969,093
2033				\$11,000				\$11,000,000	\$5,872,990
2034				\$11,250				\$11,250,000	\$5,775,449
2035				\$11,500				\$11,500,000	\$5,676,723
2036				\$11,750				\$11,750,000	\$5,577,048
2037				\$12,000				\$12,000,000	\$5,476,643
2038				\$12,250				\$12,250,000	\$5,375,712
2039				\$12,500				\$12,500,000	\$5,274,442
2040				\$12,750				\$12,750,000	\$5,173,011
Total	\$20,000	\$0	\$200,000	\$207,500	\$0	\$0	\$0	\$427,500,000	\$321,487,560

Project Costs – Total Costs

Total Costs

- Calculated automatically based on entry in previous seven columns of cost data
 - Constant Dollars column sums all costs spent in each year
 - Present Value column discounts costs spent in each year using the Real Discount Rate (Parameters sheet)
- Values are in total dollars (not in thousands of dollars)

11 PROJECT COSTS (enter costs in thousands of dollars)

Year	DIRECT PROJECT COSTS					Mitigation	Other Agency Cost Savings	Total Costs (in dollars)	
	INITIAL COSTS			SUBSEQUENT COSTS				Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
2018	\$10,000							\$10,000,000	\$9,615,385
2019	\$5,000		\$100,000					\$105,000,000	\$97,078,402
2020	\$5,000		\$100,000					\$105,000,000	\$93,344,618
2021								\$0	\$0
2022								\$0	\$0
2023								\$0	\$0
2024								\$0	\$0
2025								\$0	\$0
2026								\$0	\$0
Project Open									
2021				\$8,000				\$8,000,000	\$6,838,434
2022				\$8,250				\$8,250,000	\$6,780,899
2023				\$8,500				\$8,500,000	\$6,717,673
2024				\$8,750				\$8,750,000	\$6,649,281
2025				\$9,000				\$9,000,000	\$6,576,212
2026				\$9,250				\$9,250,000	\$6,498,927
2027				\$9,500				\$9,500,000	\$6,417,860
2028				\$9,750				\$9,750,000	\$6,333,414
2029				\$10,000				\$10,000,000	\$6,245,970
2030				\$10,250				\$10,250,000	\$6,155,884
2031				\$10,500				\$10,500,000	\$6,063,488
2032				\$10,750				\$10,750,000	\$5,969,093
2033				\$11,000				\$11,000,000	\$5,872,990
2034				\$11,250				\$11,250,000	\$5,775,449
2035				\$11,500				\$11,500,000	\$5,676,723
2036				\$11,750				\$11,750,000	\$5,577,048
2037				\$12,000				\$12,000,000	\$5,476,643
2038				\$12,250				\$12,250,000	\$5,375,712
2039				\$12,500				\$12,500,000	\$5,274,442
2040				\$12,750				\$12,750,000	\$5,173,011
Total	\$20,000	\$0	\$200,000	\$207,500	\$0	\$0	\$0	\$427,500,000	\$321,487,560

Project Costs – Total Costs

Total Costs

- Calculated automatically based on entry in previous seven columns of cost data
- Project costs (in constant dollars and present value) for each year are linked to the Final Calculations worksheet

PROJECT COSTS (enter costs in thousands of dollars)

Year	DIRECT PROJECT COSTS					Mitigation	Other Agency Cost Savings	Total Costs (in dollars)	
	Project Support	R / W	Construction	Maint./ Op.	Rehab.			Constant Dollars	Present Value
Construction Period									
2018	\$10,000							\$10,000,000	\$9,615,385
2019	\$5,000		\$100,000					\$105,000,000	\$97,078,402
2020	\$5,000		\$100,000					\$105,000,000	\$93,344,618
2021								\$0	\$0
2022								\$0	\$0
2023								\$0	\$0
2024								\$0	\$0
2025								\$0	\$0
2026								\$0	\$0
Project Open									
2027								\$8,000,000	\$6,838,434
2028								\$8,250,000	\$6,780,899
2029								\$8,500,000	\$6,717,673
2030								\$8,750,000	\$6,649,281
2031								\$9,000,000	\$6,576,212
2032								\$9,250,000	\$6,498,927
2033								\$9,500,000	\$6,417,860
2034								\$9,750,000	\$6,333,414
2035								\$10,000,000	\$6,245,970
2036								\$10,250,000	\$6,155,884
2037								\$10,500,000	\$6,063,488
2038								\$10,750,000	\$5,969,093
2039								\$11,000,000	\$5,872,990
2040								\$11,250,000	\$5,775,449
2041								\$11,500,000	\$5,676,723
2042								\$11,750,000	\$5,577,048
2043								\$12,000,000	\$5,476,643
2044								\$12,250,000	\$5,375,712
2045								\$12,500,000	\$5,274,442
2046								\$12,750,000	\$5,173,011
2047								\$13,000,000	\$5,070,420
2048								\$13,250,000	\$4,966,680
2049								\$13,500,000	\$4,861,791
2050								\$13,750,000	\$4,755,754
Total								\$427,500,000	\$321,487,560

Final Calculations
This sheet performs the final calculations before presenting the summary results.
Both net present value and internal rate of return on investment are calculated.

NET PRESENT VALUE CALCULATION

Year	Transportation Cost Savings	Accident Reductions	Vehicle Emission Reductions	Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
Construction Period						
2018				\$0	\$3,615,385	(\$3,615,385)
2019				\$0	\$97,078,402	(\$97,078,402)
2020				\$0	\$93,344,618	(\$93,344,618)
2021				\$0	\$0	\$0
2022				\$0	\$0	\$0
2023				\$0	\$0	\$0
2024				\$0	\$0	\$0
2025				\$0	\$0	\$0
2026				\$0	\$0	\$0
Project Open						
2027	\$18,878,536	\$744,264	\$2,171,485	\$21,794,286	\$0	\$21,794,286
2028	\$22,123,419	\$879,650	\$2,565,791	\$25,568,860	\$6,838,434	\$18,730,427
2029	\$25,090,768	\$1,003,521	\$2,928,668	\$29,022,957	\$6,780,899	\$22,242,058
2030	\$27,797,133	\$1,116,562	\$3,261,929	\$32,175,624	\$6,717,673	\$25,457,950
2031	\$30,256,199	\$1,219,423	\$3,567,295	\$35,044,917	\$6,649,281	\$28,395,636
2032	\$32,488,833	\$1,312,719	\$3,846,397	\$37,647,949	\$6,576,212	\$31,071,737
2033	\$34,503,118	\$1,397,036	\$4,100,783	\$40,000,937	\$6,498,927	\$33,502,010
2034	\$36,314,398	\$1,472,924	\$4,339,776	\$42,127,100	\$6,417,860	\$35,709,240
2035	\$37,936,309	\$1,540,909	\$4,556,250	\$44,032,960	\$6,333,414	\$37,700,546
2036	\$39,377,915	\$1,601,484	\$4,750,934	\$45,730,335	\$6,245,970	\$39,484,365
2037	\$40,653,242	\$1,655,121	\$4,924,412	\$47,232,775	\$6,155,884	\$41,076,891
2038	\$41,772,307	\$1,702,363	\$5,078,446	\$48,553,116	\$6,063,488	\$42,489,628
2039	\$42,745,153	\$1,743,300	\$5,213,037	\$49,701,590	\$5,969,093	\$43,732,500
2040	\$43,581,371	\$1,778,720	\$5,329,237	\$50,689,328	\$5,872,990	\$44,816,338
2041	\$44,290,032	\$1,808,809	\$5,428,350	\$51,527,191	\$5,775,449	\$45,751,742
2042	\$44,879,711	\$1,833,952	\$5,501,834	\$52,225,597	\$5,676,723	\$46,548,874
2043	\$45,358,513	\$1,854,485	\$5,559,104	\$52,792,102	\$5,577,048	\$47,215,054
2044	\$45,734,093	\$1,870,726	\$5,603,579	\$53,238,398	\$5,476,643	\$47,761,755
2045	\$46,013,695	\$1,882,974	\$5,636,635	\$53,593,304	\$5,375,712	\$48,215,592
2046	\$46,204,115	\$1,891,512	\$5,659,631	\$53,865,258	\$5,274,442	\$48,589,816
Total	\$745,999,749	\$30,310,383	\$1,769,303	\$778,079,435	\$316,314,549	\$461,764,886

INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK

Year	Transportation Cost Savings	Accident Reductions	Vehicle Emission Reductions	Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	INTERNAL RATE OF RETURN
Construction Period						
2018				\$0	\$10,000,000	(\$10,000,000)
2019				\$0	\$105,000,000	(\$105,000,000)
2020				\$0	\$105,000,000	(\$105,000,000)
2021				\$0	\$0	\$0
2022				\$0	\$0	\$0
2023				\$0	\$0	\$0
2024				\$0	\$0	\$0
2025				\$0	\$0	\$0
2026				\$0	\$0	\$0
Project Open						
2027	\$22,085,217	\$870,684	\$2,540,331	\$25,496,232	\$0	\$25,496,232
2028	\$26,916,522	\$1,070,229	\$3,121,677	\$31,108,428	\$8,000,000	\$23,108,428
2029	\$31,747,826	\$1,269,774	\$3,705,699	\$36,723,300	\$8,250,000	\$28,473,300
2030	\$36,579,130	\$1,469,319	\$4,292,477	\$42,340,926	\$8,500,000	\$33,840,926
2031	\$41,410,435	\$1,668,864	\$4,882,090	\$47,961,389	\$8,750,000	\$39,211,389
2032	\$46,241,739	\$1,868,409	\$5,474,622	\$53,584,771	\$9,000,000	\$44,584,771
2033	\$51,073,043	\$2,067,954	\$6,070,160	\$59,211,158	\$9,250,000	\$49,961,158
2034	\$55,904,348	\$2,267,499	\$6,673,799	\$64,835,646	\$9,500,000	\$55,335,646
2035	\$60,735,652	\$2,467,044	\$7,283,438	\$70,466,134	\$9,750,000	\$60,711,134
2036	\$65,566,957	\$2,666,589	\$7,894,077	\$76,103,623	\$10,000,000	\$66,103,623
2037	\$70,398,261	\$2,866,134	\$8,504,716	\$81,747,111	\$10,250,000	\$71,497,111
2038	\$75,229,565	\$3,065,679	\$9,115,355	\$87,406,600	\$10,500,000	\$76,901,600
2039	\$80,060,870	\$3,265,224	\$9,726,000	\$93,072,094	\$10,750,000	\$82,327,094
2040	\$84,892,174	\$3,464,770	\$10,336,645	\$98,743,589	\$11,000,000	\$87,743,589
2041	\$89,723,478	\$3,664,315	\$10,947,290	\$104,410,084	\$11,250,000	\$93,160,084
2042	\$94,554,783	\$3,863,860	\$11,557,935	\$110,077,579	\$11,500,000	\$98,577,579
2043	\$99,386,087	\$4,063,405	\$12,168,580	\$115,745,074	\$11,750,000	\$103,995,074
2044	\$104,217,391	\$4,262,950	\$12,779,225	\$121,412,569	\$12,000,000	\$109,412,569
2045	\$109,048,696	\$4,462,495	\$13,389,870	\$127,080,064	\$12,250,000	\$114,830,064
2046	\$113,879,999	\$4,662,040	\$14,000,515	\$132,747,559	\$12,500,000	\$120,247,559
Total	\$1,959,652,174	\$55,327,237	(\$10,916,135)	\$1,904,063,276	\$414,750,000	\$389,313,276

ANNUAL RETURNS ON INVESTMENT

Year	ANNUAL RETURNS ON INVESTMENT
2018	(\$10,000,000)
2019	(\$105,000,000)
2020	(\$105,000,000)
2021	\$25,496,232
2022	\$23,108,428
2023	\$28,473,300
2024	\$33,840,926
2025	\$39,211,389
2026	\$44,584,771
2027	\$49,961,158
2028	\$55,335,646
2029	\$60,711,134
2030	\$66,103,623
2031	\$71,497,111
2032	\$76,901,600
2033	\$82,327,094
2034	\$87,743,589
2035	\$93,160,084
2036	\$98,577,579
2037	\$103,995,074
2038	\$109,412,569
2039	\$114,830,064
2040	\$120,247,559
2041	\$0
2042	\$0
2043	\$0
2044	\$0
2045	\$0

Internal Rate of Return **16.73%**

Project Costs



Project Costs in Final Calculations

- Project Costs are combined with Project Benefits estimates (in constant dollars and present value) in the Final Calculations worksheet to calculate all BCA metrics
- BCA metrics are linked to the Results page

Final Calculations

Final Calculations
This sheet performs the final calculations before presenting the summary results. Both net present value and internal rate of return on investment are calculated.

A NET PRESENT VALUE CALCULATION							B INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD							
Year	Transportation Cost Savings	Accident Reductions	Vehicle Emission Reductions	Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE	Year	Transportation Cost Savings	Accident Reductions	Vehicle Emission Reductions	Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJ OPENS
Construction Period							Construction Period							
2018				\$0	\$3,615,385	(\$3,615,385)	2018				\$0	\$10,000,000	(\$10,000,000)	
2019				\$0	\$97,078,402	(\$97,078,402)	2019				\$0	\$105,000,000	(\$105,000,000)	
2020				\$0	\$93,344,618	(\$93,344,618)	2020				\$0	\$105,000,000	(\$105,000,000)	
2021				\$0	\$0	\$0	2021				\$0	\$0	\$0	
2022				\$0	\$0	\$0	2022				\$0	\$0	\$0	
2023				\$0	\$0	\$0	2023				\$0	\$0	\$0	
2024				\$0	\$0	\$0	2024				\$0	\$0	\$0	
2025				\$0	\$0	\$0	2025				\$0	\$0	\$0	
Project Open							Project Open							
2021	\$18,878,536	\$744,264	\$2,171,495	\$21,794,286	\$6,838,434	\$21,794,286	2021	\$22,085,217	\$870,684	\$2,540,331	\$25,496,232	\$0	\$25,496,232	\$25,496,232
2022	\$22,123,419	\$879,650	\$2,565,791	\$25,568,860	\$6,838,434	\$18,730,427	2022	\$26,916,522	\$1,070,229	\$3,121,677	\$31,108,428	\$8,000,000	\$23,108,428	\$48,604,660
2023	\$25,090,768	\$1,003,521	\$3,268,668	\$29,022,957	\$6,780,899	\$22,242,058	2023	\$31,747,826	\$1,269,774	\$3,705,699	\$36,723,300	\$8,250,000	\$28,473,300	\$77,077,959
2024	\$27,797,133	\$1,116,562	\$3,261,929	\$32,175,624	\$6,717,673	\$25,457,950	2024	\$36,579,100	\$1,469,319	\$4,282,477	\$42,284,926	\$8,500,000	\$33,840,926	\$110,918,885
2025	\$30,258,199	\$1,219,423	\$3,567,295	\$35,044,917	\$6,649,281	\$28,395,636	2025	\$41,410,435	\$1,668,864	\$4,882,090	\$47,961,389	\$8,750,000	\$39,211,389	\$150,130,274
2026	\$32,488,833	\$1,312,719	\$3,846,397	\$37,647,949	\$6,576,212	\$31,071,737	2026	\$46,241,739	\$1,868,409	\$5,474,622	\$53,584,771	\$9,000,000	\$44,584,771	\$194,715,045
2027	\$34,503,118	\$1,397,036	\$4,100,783	\$40,000,937	\$6,498,527	\$33,502,009	2027	\$51,073,043	\$2,067,954	\$6,070,160	\$59,211,158	\$9,250,000	\$49,961,158	\$244,676,203
2028	\$36,216,398	\$1,472,924	\$4,324,776	\$42,004,098	\$6,421,860	\$35,582,238	2028	\$55,904,348	\$2,267,499	\$6,711,799	\$63,044,046	\$9,500,000	\$53,544,046	\$291,216,251
2029	\$37,836,309	\$1,540,909	\$4,514,293	\$43,901,511	\$6,346,414	\$37,555,097	2029	\$60,735,652	\$2,467,044	\$7,358,506	\$68,000,602	\$9,750,000	\$58,250,602	\$342,353,442
2030	\$39,377,815	\$1,601,484	\$4,680,365	\$46,659,664	\$6,261,970	\$40,397,694	2030	\$65,566,957	\$2,666,589	\$7,995,035	\$73,538,577	\$10,000,000	\$63,538,577	\$398,031,152
2031	\$40,853,242	\$1,655,121	\$4,834,412	\$48,342,775	\$6,178,884	\$42,163,891	2031	\$70,398,261	\$2,866,134	\$8,627,690	\$80,241,705	\$10,250,000	\$69,991,705	\$458,432,858
2032	\$42,274,507	\$1,702,263	\$4,968,265	\$50,004,035	\$6,083,488	\$43,920,547	2032	\$75,229,565	\$3,065,679	\$9,258,968	\$84,448,276	\$10,500,000	\$73,948,276	\$523,382,134
2033	\$43,645,153	\$1,743,330	\$5,087,037	\$52,475,520	\$5,989,093	\$46,486,427	2033	\$80,060,870	\$3,265,224	\$9,904,142	\$90,000,226	\$10,750,000	\$79,250,226	\$592,942,660
2034	\$44,971,371	\$1,778,720	\$5,198,237	\$54,948,328	\$5,882,990	\$49,065,338	2034	\$84,892,174	\$3,464,770	\$10,553,313	\$95,345,944	\$11,000,000	\$84,345,944	\$667,118,220
2035	\$46,258,032	\$1,808,809	\$5,298,350	\$57,364,991	\$5,775,449	\$51,589,542	2035	\$89,723,478	\$3,664,315	\$11,207,528	\$100,044,488	\$11,250,000	\$88,794,488	\$745,912,707
2036	\$47,500,711	\$1,833,952	\$5,388,412	\$59,722,075	\$5,661,223	\$54,060,852	2036	\$94,554,783	\$3,863,860	\$11,861,103	\$111,415,883	\$11,500,000	\$99,915,883	\$823,330,127
2037	\$48,714,511	\$1,854,485	\$5,474,894	\$62,029,889	\$5,547,048	\$56,482,841	2037	\$99,386,087	\$4,063,405	\$12,514,608	\$123,000,492	\$11,750,000	\$111,250,492	\$917,374,597
2038	\$49,900,093	\$1,870,726	\$5,558,579	\$64,288,398	\$5,423,823	\$58,864,575	2038	\$104,217,391	\$4,262,950	\$13,167,584	\$135,000,925	\$12,000,000	\$123,000,925	\$1,010,050,354
2039	\$46,015,685	\$1,882,974	\$5,642,635	\$61,541,294	\$5,300,742	\$56,240,552	2039	\$109,048,696	\$4,462,495	\$13,824,790	\$148,873,491	\$12,250,000	\$136,623,491	\$1,107,361,754
2040	\$46,204,115	\$1,891,512	\$5,728,631	\$63,824,258	\$5,174,442	\$58,649,816	2040	\$113,890,000	\$4,662,040	\$14,490,517	\$163,380,517	\$12,500,000	\$150,880,517	\$1,209,315,278
Total	\$745,999,749	\$30,310,383	\$1,769,303	\$778,079,435	\$316,314,549	\$461,764,886	Total	\$1,359,652,174	\$56,327,237	(\$10,916,135)	\$1,404,063,276	\$414,750,000	\$989,313,276	

3) Results

INVESTMENT ANALYSIS SUMMARY RESULTS

Life-Cycle Costs (mil. \$)	\$316.3	Total Over 20 Years	\$746.0	Average Annual	\$37.3
Life-Cycle Benefits (mil. \$)	\$778.1	Modal Diversion and Freight Network Improvements	\$782.4		\$39.1
Net Present Value (mil. \$)	\$461.8	Transload and Operational Efficiency Improvements	-\$36.4		-\$1.8
Benefit / Cost Ratio:	2.5	Accident Cost Savings	\$30.3		\$1.5
Rate of Return on Investment:	16.7%	Emission Cost Savings	\$1.8		\$0.1
Payback Period:	6 years	TOTAL BENEFITS	\$778.1		\$38.9

Should benefit-cost results include:

1) Shipper Costs? (y/n)	<input checked="" type="checkbox"/> Y
2) Accident Costs? (y/n)	<input checked="" type="checkbox"/> Y
3) Vehicle Emissions? (y/n)	<input checked="" type="checkbox"/> Y

Includes value for CO₂e

EMISSIONS REDUCTION

	Total Over 20 Years	Average Annual	Total Over 20 Years	Average Annual
CO Emissions Saved	339	17	\$0.0	\$0.0
CO ₂ Emissions Saved	439,543	21,977	\$12.3	\$0.6
NO _x Emissions Saved	-479	-24	-\$9.6	-\$0.5
PM ₁₀ Emissions Saved	-10	-1	-\$2.1	-\$0.1
PM _{2.5} Emissions Saved	11	1		
SO _x Emissions Saved	9	0	\$1.0	\$0.0
VOC Emissions Saved	40	2	\$0.1	\$0.0

Internal Rate of Return: **16.73%**

05

Conclusion

In this module, you learned...

- What project costs are included in Cal-B/C IF
- What benefit categories are automatically estimated in the Cal-B/C IF
- How each benefit category is estimated and monetized based on the data input
- How benefit estimates connect from the analysis sheets, through the Final Calculation sheet, to the Results sheet

What's Next?

- Start an analysis!
 - **Module 7e: How to Start a Cal-B/C IF Analysis**
- There are other versions of this module for the other Cal-B/C tools:
 - **Module 6a: Understanding Project Benefits and Costs in Cal-B/C Sketch, Corridor, and Park and Ride (PnR)**
 - **Module 6c: Understanding Project Benefits and Costs in Cal-B/C Active Transportation**