Appendix K

Key Assumptions for the Alternative Analysis

Appendix K: Key Assumptions for the Alternative Analysis

This appendix contains the key assumptions for the alternative analysis presented in Chapter 5 of the EIR. The following tables are enclosed

- Table K-1: Project and No Project Capital costs. The Project costs were estimated by Caltrain. The No Project capital costs were estimated by ICF based on assumed rolling stock replacement amounts and using data on Caltrans 2013 procurement of new Tier 4 diesel locomotives and Caltrans 2012 procurement of passenger coaches.
- Table K-2: This table presents assumes rolling stock for all alternatives.
- Table K-3: This table presents data on initial acceleration and deceleration for alternatives. As discussed in Chapter 5, Alternatives, initial acceleration is not the only factor for train performance. Presentation of acceleration time to 79 mph is shown in Chapter 5 which gives a better idea of train performance.
- Table K-4: This table presents data on fuel consumption (diesel/electricity) by alternative and assumed fuel prices for the purpose of estimating fuel costs presented in Chapter 5, Alternatives.
- Table K-5: This table presents assumptions on ridership for the alternative analysis. Although the non-electrification alternatives could not match the performance of the Proposed Project EMUs, so the purposes of the EIR analysis only it was assumed that the non-electrification alternatives would have the same ridership in 2020. For 2040, the alternatives that could not reach the Transbay Transit Center (TTC), including the Tier 4 Diesel Locomotive Alternative and the DMU Alternative, ridership was assumed to be lower than the Proposed Project by doing a scaling analysis to derive a rough estimate of the potential ridership loss by not reaching TTC. It is important to note that the Proposed Project 2040 prototypical schedule only assumed 2 Caltrain trains per peak hour to TTC, which was an assumption for the EIR only and the project would not limit the number of trains to TTC. With more trains to TTC, then the ridership lost due to alternatives that could not reach TTC would be higher relative to the Proposed Project.
- Table K-6: This table presents the estimated rolling stock cost per unit for the No Project Alternative. As shown, unit costs are based on 2012 and 2013 procurements by Caltrans.
- Table K-7: This table presents construction estimates for several electrification projects in the United Kingdom. The Great Western project is employing a factory train for OCS construction in many areas.
- References: The references used in Appendix K are listed.

Table K-1: Project and No Project Capital Costs, 2020

	Infrastructure	Vehicles	Total	Notes
No Project	$0	$317,684,000	$317,684,000	New locomotive cost based on Caltrans T4 Diesel Locomotive procurement costs. New carriages cost based on Caltrans new carriage pro curement cost. See Table K-6.
Proposed Project	$950,000,000 to $958,000,000	$524,000,000 to $573,000,000	$1,474,000,000 to $1,531,000,000	Based on capital cost from Caltrain, November 6, 2014.

Table K-2: Rolling Stock Amounts

Condition	Description	Old Diesel Loco	New Diesel Loco	Old Carriages	New carriages	Multiple Units	Notes	Source
Existing	All diesel	29		118			Existing Fleet	Existing Fleet
No Project (2020)	Mixed T4DL and existing	9	16	45	73		LTK 2014 for Locos	LTK 2014 for Locos
Project (2020)	Mixed EMUs and existing	9		45		96		2014 DEIR
DMU (2020)	Mixed DMUs and existing	9		45		120	# DMUs = 125% of EMUs based on 8 car consist vs. 6 car	ICF assumption
Dual Mode MU (2020)	Mixed Dual-Mode MUs and existing	9		45		160	# Dual-Mode MUs = 167% of EMUs based on 10 car consist vs. 6 car	ICF assumption
T4 SH (2020)	Mixed T4DL and existing	9	18	45	88		120% of NP carriages (114/92)	LTK 2014 for Locos; ICF assumption for coaches
T4 DH (2020)	Mixed T4DL and existing	9	35	45	88		120% of NP carriages (114/92)	LTK 2014 for Locos; ICF assumption for coaches
Full EMU (2040)	EMUs - SJ - SF Diesel - Gilroy - SJ		6		31	144	EMUs = 138 to 150; used mid-range	2014 DEIR
No Project (2040)	All Tier 4 (SH)		25		118		Total replacement	LTK for Locos; Coaches same as existing
DMU (2040)	DMUs - SJ - SF Diesel - Gilroy - SJ		6		31	180	# DMUs = 125% of EMUs based on 8 car consist vs. 6 car	ICF assumption
Dual Mode MU (2020)	Dual-Mode MUs - SJ - SF Diesel - Gilroy - SJ		6		31	240	# Dual-Mode MUs = 167% of EMUs based on 10 car consist vs. 6 car	ICF assumption
T4 SH (2040)	All Tier 4 (SH)		27		146		120% of NP carriages (114/92)	LTK 2014 for Locos; ICF assumption for coaches
T4 DH (2020)	All Tier 4 (SH)		44		146		120% of NP carriages (114/92)	LTK 2014 for Locos; ICF assumption for coaches

Rolling Stock Details

	Diesel Loco length	MU/Carriage Length	Seats	Passenger Cars	Passenger Seats	Consist Length	Notes
Existing	70	85	124	5	620	495	Carriage seats vary from 108 to 148; locos range from 56 to 70
No Project	70	85	124	5	620	495	Carriage seats vary from 108 to 148; locos range from 56 to 70
EMU		90	100	6	600	540	Caltrain 2011
DMU		85	78	8	624	680	Caltrain 2011
Dual-Mode MU		60	60	10	600	600	Coradia Polyvalent
T4DL-SH	72	85	124	5	620	497	Existing carriage specs; Siemens T4DL
T4DL-DH	144	85	124	5	620	569	Existing carriage specs; Siemens T4DL

Existing Carriages

Model	#	Type	Manufacturer	Year	Seats	Amenities	Total Seats
800-3825	26	Gallery Trailer	Nippon Sharyo	1985 (a)	142	Luggage Racks	3692
3826-3835	10	Gallery Trailer	Nippon Sharyo	1985 (a)	108	Bike capacity: 40	1080
3836-3841	6	Gallery Trailer	Nippon Sharyo	1985 (a)	148	--	888
3842-3851	10	Gallery Trailer	Nippon Sharyo	1986 (a)	148	--	1480
3852-3865	14	Gallery Trailer	Nippon Sharyo	2000	120	Bathroom, wheelchair space	1680
4000-4020	21	Gallery Cab (Bike)	Nippon Sharyo	1985	97	Bike capacity: 40, bathroom	2037
4021-4026	6	Gallery Cab (Bike)	Nippon Sharyo	2000	78	Bike capacity: 40, wheelchair space, bathroom	468
112-118	7	Bi-Level Cab (Bike)	Bombardier	2002	114	Bike capacity: 24, ADA compliant, bathroom	798
219	1	Bi-Level Cab (Bike)	Bombardier	2002	127	Bike capacity: 24, ADA compliant, bathroom	127
220-230 (b)	9	Bi-Level Trailer	Bombardier	2002	144	ADA compliant, bathroom	1296
119-120	2	Bi-level Cab (Bike)	Bombardier	2008	114	Bike capacity: 24,	228
231-236	6	Bi-level trailer	Bombardier	2008	140	ADA compliant, bathroom	840
All	118			Avg capacity	124		14614

All (pass)	71				139		9876
All (bike)	47				101		4738
Nippon (pass)	56				138		7740
Nippon (bike)	37				97		3585
Nippon (3/2 pass/bike)					**608**		
Bombardier (pass)	15				142		2136
Bombardier (bike)	10				115		1153
Bombardier (3/2 pass/bike)					**658**		

Source: Caltrain. No date. Commuter Fleet. Caltrain website

Table K-3: Acceleration and Deceleration Data

	Acceleration	Deceleration	Source	Notes
Existing	0.5		Mass. EOT 2008	Deceleration unknown
No Project	1.1	1.8	LTK 2014 (accel); Siemens 2014 (decel.)	
EMU	2.1	2.0	LTK 2012 (accel.); LTK 2014 (decel.)	
DMU	1.8		Stadler 2009	LTK says decel same as EMUs
Dual-Mode MU	1.7		Agility 2009	LTK says decel same as EMUs
T4DL-SH	1.1	1.8	LTK 2014 (accel); Siemens 2014 (decel)	
T4DL-DH	2.1	1.8	LTK 2014 (accel); Siemens 2014 (decel)	Alternative would used mix of SH and DH.

NOTE: As described in Chapter 5, Alternatives, initial acceleration is not the sole predictor of performance. As discussed in Chapter 5, acceleration and deceleration over an entire service route and range of speeds are critical in determining service performance.

Table K-4: Fuel Costs

Condition	Description	Diesel Fuel Consumption (gal/yr)	Electricity (kWh/yr)	Diesel Cost	Electricity Cost	Total Fuel	Compared to Project
	Units	gallons/year	kwH/year				
Existing	All diesel	4,452,984	3,945,021	$20,525,556	$373,910	$20,899,466	$8,071,122
No Project	All diesel - mixed T4/Existing	5,599,784	3,945,021	$25,811,609	$373,910	$26,185,518	$13,357,174
Project (2020)	9 diesel locomotives 96 EMUs 45 trailer cars	1,073,711	83,131,139	$4,949,157	$7,879,188	$12,828,344	$0
DMU (2020)	9 diesel locomotives 96 DMUs 45 trailer cars	6,914,109	5,246,878	$31,869,851	$497,300	$32,367,151	$19,538,807
T4 SH (2020)	All diesel - mixed T4/Existing	6,548,883	5,246,878	$30,186,379	$497,300	$30,683,680	$17,855,335
T4 DH (2020)	All diesel - mixed T4/Existing	9,184,914	5,246,878	$42,336,884	$497,300	$42,834,184	$30,005,840
Cumulative (2040)	6 diesel locomotives (T4) 138 to 150 EMUs 31 trailer cars	146,615	104,855,697	$905,158	$12,714,473	$13,619,631	$0
No Project (2040)	All Tier 4 (SH)	5,725,108	3,945,021	$35,345,125	$478,361	$35,823,486	$22,203,855
DMU (2040)	6 diesel locomotives (Tr) 138 to 150 DMUs 31 trailer cars	7,184,064	5,246,878	$44,352,286	$636,220	$44,988,506	$31,368,875
T4 SH (2040)	All Tier 4 (SH)	6,575,679	5,246,878	$40,596,299	$636,220	$41,232,519	$27,612,888
T4 DH (2020)	All Tier 4 (SH)	9,208,950	5,246,878	$56,853,336	$636,220	$57,489,556	$43,869,925

Cost Assumptions	Price-2019	Today	Inflator - 2019	Inflator 2040
Diesel	$4.61	$4.04	114%	153%
Electricity	$0.09	$0.10	95%	121%

	Price - 2040	Source Diesel -EIA: on road diesel price on 09/22/14 http://www.eia.gov/petroleum/gasdiesel/		Note: Electricity amounts are for Caltrain consumption and do not include transmission and distribution losses (which were included in the air quality/greenhouse gas emissions analysis and the energy analysis).
Diesel	$6.17	Electricity: BART electricity cost 2014 http://www.bart.gov/sites/default/files/docs/Questions%20Responses%20%26%20Clarifications%20-%208-6-14%20final%20w%20attachments.pdf	Source: Source: U.S. Energy Information Agency, 2013 Annual Energy Outlook. Values for transportation fuels. Available: http://www.eia.gov/forecasts/aeo/pdf/0383(2013).pdf	
Electricity	$0.12			

NOTE: Fuel consumption estimates are preliminary. Further project planning may take into account additional factors in estimating potential project fuel consumption. However, the methodology for estimating fuel consumption was consistent for the No Project Alternative, the Proposed Project, and the other analyzed alternatives and thus conclusions in this EIR related to energy consumption, air quality, GHG emissions are done on a reasonable basis based on available information at the time of preparation of the EIR.

Table K-5: Ridership Assumptions

Condition	Schedule	Ridership multiplier Compared to Project Increase over No Project	Ridership	Compared to project	Notes	Source
Existing	Existing	NA	47,100	-22,800		EIR, Appendix I, VTA Model
No Project	Same as Existing	NA	57,400	-12,500		EIR, Appendix I, VTA Model
Project (2020)	Project	NA	69,900	0		EIR, Appendix I, VTA Model
DMU/DMMU (2020)	Same as Project	100%	69,900	0	Slower than EMUs	ICF Assumption
T4 SH (2020)	Same as Project	100%	69,900	0	Slower than EMUs	ICF Assumption
T4 DH (2020)	Same as Project	100%	69,900	0	Slightly slower than EMUs	ICF Assumption
No Project (2040)	Same as existing	NA	83,900	-27,200		EIR, Appendix I, VTA Model
Cumulative (2040)	Project	NA	111,100	0		EIR, Appendix I, VTA Model
DMU (2040)	Same as Project	80%	105,747	-5,353	Can't reach TTC	ICF Assumption
DMMU (2040)	Same as Project	100%	111,100	0	Can reach TTC	ICF Assumption
T4 SH (2040)	Same as Project	80%	105,747	-5,353	Can't reach TTC	ICF Assumption
T4 DH (2040)	Same as Project	80%	105,747	-5,353	Can't reach TTC	ICF Assumption

Estimate of TTC Difference					
	2020 NP	2020 P	2040 NP	2040 P (with TTC)	Source
Transbay Terminal				8,527	EIR, Appendix I, VTA Model
SF 4th and King	12,347	13,692	15,891	14,529	EIR, Appendix I, VTA Model
SF total	12,347	13,692	15,891	23,056	EIR, Appendix I, VTA Model
System	57,047	69,151	83,815	111,427	EIR, Appendix I, VTA Model
System Increase over NP		12,104		27,612	EIR, Appendix I, VTA Model
System P/NP		121%		133%	Calculation
System P/NP - SF only		111%		145%	Calculation
Potential SF 2040 without TTC using 2020 P/NP rate for SF and scaling up from 2040 NP				17,622	ICF Assumption
TTC increase in SF for P/NP				5,434	Calculation; only based on 2 trains per peak hour to TTC
TTC/System ridership for P				5%	Calculation
TTC/System increase for P				**20%**	Calculation

Table K-6: Rolling Stock Costs, No Project

Diesel Locomotive Costs

Item	Order	#	Unit Cost	Pass seats/unit	Standees/unit	Cost/Pass	Cost/Seat	Cost/Unit	Buyer	Notes	Source
Tier 4 Diesel Locomotive	$45,000,000	6	$7,500,000	NA	NA	NA	NA	$7,500,000	Caltrans	Caltrans multi-state procurements from Siemens ($45 million for 6 units)	http://www.dot.ca.gov/hq/paffairs/news/pressrel/14pr022.htm
Tier 4 Diesel Locomotive	$150,000,000	20	$7,500,000	NA	NA	NA	NA	$7,500,000	Metrolink	Approximately $150 million ofor 20 locomotives.	http://www.metrolinktrains.com/news/news_item/news_id/899.html

Passenger Coach Cost Data

Item	Order	#	Unit Cost	Pass seats/unit	Standees/unit	Cost/Pass	Cost/Seat	Cost/Unit	Buyer	Notes	Source
Passenger Coach	$352,000,000	130	$2,708,000	NA	NA	NA	NA	$2,708,000	Caltrans	Caltrans 2012 procurement of Nippon Sharyo bilevel coaches (132 coaches for $352 million).	http://www.nipponsharyousa.com/tp121106.htm
Passenger Coach									SEPTA	SEPTA 2014 estimates $2.5 to $3 million for bi-level coaches:	http://planphilly.com/articles/2014/01/29/septa-may-purchase-bi-level-coaches

Table K-7: Factory Train Construction Costs

	Cost (UK Pounds)	Cost (US$)	Date	Miles	Cost/Mile	Notes	Source
UK Programme	£2,000,000,000	$3,260,000,000	2/4/2014	2,000	$1,630,000	HOPS being used on Great Western; not certain on other lines.	http://www.networkrailmediacentre.co.uk/News-Releases/Network-Rail-chooses-suppliers-to-deliver-2bn-programme-to-electrify-railway-across-Britain-1fc2.aspx
Great Western	£700,000,000	$1,141,000,000	3/27/2012	650	$1,755,385	Maidenhead to Briston and Cardiff, along with routes to Newbury and Oxford.	http://www.railwaygazette.com/news/infrastructure/single-view/view/amey-awarded-great-western-electrification-contract.html

Conversion	Units	Date
1.63	Pounds to Dollars	2/4/2014

References	Links
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U.S. Energy Information Agency. 2014. Gasoline and Diesel Fuel Update. On-road diesel price on 09/22/14	http://www.eia.gov/petroleum/gasdiesel/