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Washington State DOT's Ultra High-Speed Ground Transportation Business Case Analysis (UHSGT) is a promotional brochure riddled with serious errors and misstatements

By Thomas A. Rubin, CPA, CMA, CMC, CIA, CGFM, CFM

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POLICY BRIEF

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By Thomas A. Rubin, CPA, CMA, CMC, CIA, CGFM, CFM
October 2020

Key Findings

1. *The term "Ultra High-Speed Ground Transportation (UHSGT)" was invented by Washington State Department of Transportation (WSDOT), perhaps in an attempt to give the Vancouver, B.C.-to-Seattle high speed rail proposal the appearance of being unique, and to distinguish it from California's disastrous High-Speed Rail project. However, it does not meet WSDOT's own criterion of >250 mph minimum speed for a UHSGT system.*
2. *The prime contractor for the UHSGT report, a firm called WSP, stands to gain from the project. To date, WSP has won $666 million for work on California High Speed Rail, which is in deep trouble, with WSP currently under investigation.*
3. *The report has numerous errors and misstatements; all make UHSGT look better. These repeated, one-sided errors call the quality and reliability of the entire report into question.*
4. *The UHSGT report presents that adding a lane in each direction to I-5 would cost $195 million/lane mile – over 65 times the $3 million/lane mile for the original Interstate Highway System (both in 2018 dollars).*
5. *Adding two lanes to I-5 would carry well over double the passenger-miles of high-speed rail on weekdays in the Seattle Metro area as the entire proposed UHSGT project.*
6. *The report substantially understates travel times for UHSGT, claiming much of Vancouver, B.C. can be reached from Portland in two hours, while saying elsewhere that travel time could be two hours and 45 minutes.*
7. *The report claims the Cascadia corridor has the second highest employment of 15 large Canadian and U.S. areas. However, the comparison is meaningless because it compares the entire Vancouver-Seattle-Portland corridor to individual metropolitan areas, and falsely overstates regional employment by 40 percent.*
8. *The report neglects major technical problems, cost overruns, funding shortfalls, and delays that are common in such projects, suggesting all will go well. Remarkably, one similar project offered as a model came in 80 percent over budget and opened a year late, while another model project is 70 percent over budget and seven years late.*
9. *There is no mention whatsoever of the many significant problems with California High Speed Rail – the project most similar to UHSGT – or with many troubled major capital projects in Washington state.*

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Introduction

This paper is a critique of Ultra-High-Speed Ground Transportation Business Case Analysis – Final Report,[1] prepared in July 2019 by WSP for the Washington State Department of Transportation (WSDOT) (hereinafter "*UHSGT*" in italics; "UHSGT" in plain text will be used to refer to the concept of UHSGT and the system being proposed for construction and operation).

There are many serious problems with this report. We will get into several specifics in more detail below, but the first problem is that many of the pages are unnumbered, including Chapters 1-7, almost all of the main section. In order to assist readers of this document in finding the specific elements of *UHSGT* we are referring to, we will reference the "PDF" page number in the document from the web site, and provide the section number and title that will precede the specific element.

This study was prepared prior to the recent COVID-19 public health emergency, as was our analysis thereof. Undoubtedly, the economic and taxation impacts of this crisis will have significant negative impacts on the financial prospects for this project, as well as the rest of the two states and the province involved, their local governments, their business entities, and the residents thereof.

WSDOT doesn't meet its own minimum speed criterion for UHSGT

A Google search for the term, "ultra-high-speed ground transportation," produced no results other than those for the Cascadia project. A search for "ultra-high-speed rail" produced little more and nothing on point.

1 WSP, Ultra-High-Speed Ground Transportation Business Case Analysis – Final Report, Washington State Department of Transportation, July 2019, https://www.wsdot.wa.gov/sites/default/files/2019/07/12/Ultra-High-Speed-Ground-Transportation-Study-Business-Case-Analysis-Full-Report-with-Appendices-2019.pdf.

The WSDOT website has a page called, "What is ultra-high-speed ground transportation (UHSGT)?"[2] The lead is, "In this study, ultra-high-speed is defined as a maximum operating speed of >250 miles per hour (mph)…Three technologies could potentially meet the operating speed requirement for UHSGT."

Immediately following this, two of the three workable technologies presented are Maglev (shown with a maximum design speed of 375 mph) and Hyperloop (shown with a maximum design speed of 760 mph). The third, "High-speed rail (steel wheel)" is shown with a maximum design speed of 250 mph. There is an obvious error here, as ultra-high-speed ground transportation is defined as operating at speeds greater than 250 mph. It does not meet the ">250 mph" criterion.

UHSGT itself does not have a specific definition of "Ultra-High-Speed Ground Transportation" as such. The closest appears to be in §2.5, "Technology options" (PDF page 47): "The corridor planning process largely worked on the assumption of deploying conventional HSR [high speed rail] technology, producing hypothetical routes and timetables with design speeds of approximately 220 mph (350 kph) to reflect the best available practices of conceptual planning and design."

This *UHSGT* definition of high-speed rail, focusing on the 220-mph maximum design speed, is consistent with the bulk of the professional literature. According to a paper published by UIC (Union Inter Des Chemins Fer/International Union of Railways), "There is no single standard definition of HSR (nor even a standard usage of the term; sometimes it is called 'high speed' and sometimes 'very high speed')."[3] The same paper then goes on to begin its HSR definition process by offering the European Union definition of "New or special dedicated lines designed for speeds above 250 km/h" (155 mph)." Other sources, including the U.S. Department of Transportation (USDOT), use 150 mph as the minimum qualifying speed for HSR on new rail infrastructure. [4]

Immediately following the UHSGT §2.5 paragraph cited above, there is a discussion of Hyperloop (which is presented with "some proponents suggest speeds could exceed 500 mph) and Maglev (presented as "At between 200 mph to 400 mph …"). These two-and-one-half pages constitute the entire discussion of rail modes with speeds over 220 mph in the main section of the report. From the §2.5 statement above and the almost complete absence of any further discussion of any technology beyond conventional HSR, it is obvious that there is no serious consideration of anything but conventional HSR in the Vancouver-Portland corridor.

From this, we can conclude that this is a study of what is widely and generally known as "High Speed Rail" – and nothing beyond.

What is more important, however, is that the maximum speed for steel wheel HSR in *UHSGT* is 220 mph, so the system that is being presented therein does not satisfy the only existing criterion for UHSGT, that of WSDOT, for >250 mph operating speed.

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2 WSDOT, "What is ultra-high-speed ground transportation (UHSGT)?, accessed December 3, 2019, https://www.wsdot.wa.gov/planning/studies/ultra-high-speed-travel/what-is-it.

3 Aurélie Jenanno, Derek Plamer, and Ceri James, High Speed Rail and Sustainability, November 2011, UIC, page 9, file:///C:/Users/Thomas%20A%20Rubin/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/High%20Speed%20Rail%20Sustainability%20UIC%202011%20(1).pdf.

4 U.S. DOT/Federal Railroad Administration (FRA), "High Speed Intercity Passenger Rail (HSIPR) Program," accessed December 13, 2019, https://cms8.fra.dot.gov/passenger-rail/high-speed-rail/high-speed-intercity-passenger-rail-hsipr-program.

Therefore, Ultra-High-Speed Ground Transportation Business Case Analysis does not discuss Ultra-High-Speed Ground Transportation, but something that is too slow to qualify for this distinction.

Again, while this could be dismissed as something that could have been fixed with the change of a few words, the point is that a report that contains so many simple errors on a project of this size and importance raises many questions. How can readers and decision-makers have confidence on more technical matters that individual readers cannot possibly be expected to have the experience and specialized skills, let alone the data and analytical tools, to be able to meaningfully review it?

"Ultra" is simply not a term that is in general use in this context in the transportation industry; it has no meaning to practitioners. We can only speculate that Ultra-High-Speed Ground Transportation is used here, rather than the standard "HSR" – to show that what is being proposed for Cascadia is ultra-special and different than another similar, failing rail project in California.

UHSGT is a promotional document, not an independent, unbiased analysis

UHSGT is, in its essence, a promotional document and, as such, has a number of erroneous, questionable, and gratuitous statements that this study will analyze and refute.

WSP, the author, is a large, multinational architectural/engineering and planning firm. From its web site, "2019 – WSP is ranked 1st once again in the transportation sector in Engineering News-Record's annual list of top 225 international design firms." In 2014, the former Parsons Brinckerhoff, long one of the largest such firms in the U.S. and the world, merged into WSP.[5]

WSP is listed as one of the sponsors of the Cascadia Rail Summit, a major promotional event for UHSGT.[6] The usual practice in such conferences is that, to be listed as a sponsor, you pay to become a sponsor.

If UHSGT goes forward, then WSP will, presumably, be in a very good position to compete for, and perhaps win, professional services work that could be in the range of tens or hundreds of millions of dollars, or more. If UHSGT does not go forward, there will be no such work. WSP is clearly interested in seeing that it does go forward, to the extent it is willing to put up its own money to promote it.

This raises the question: should WSP's work on UHSGT be considered independent and unbiased? Can decision-makers rely upon WSP's work being fair and complete in making a go/no-go decision?

5 WSP, "Who We Are, OUR STORY," accessed December 15, 2019, https://www.wsp.com/en-GL/who-we-are/our-story.

6 US High Speed Rail Association/Microsoft, "Cascadia Rail Summit – Transforming the Pacific Northwest," accessed December 15, 2019, http://www.ushsr.com/events/seattle2019.html.

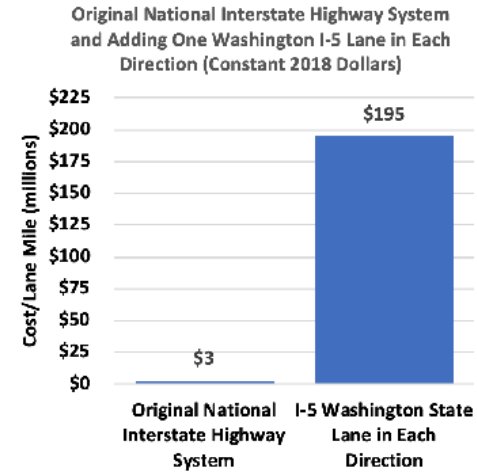
Comparing costs and benefits of UHSGT and adding two lanes to Interstate 5 through Washington State

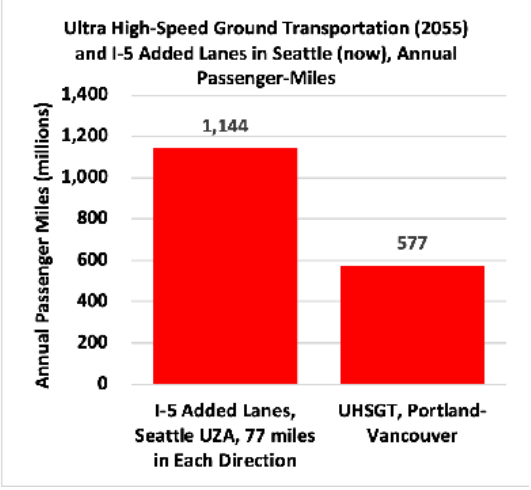
Comparison of cost

In the second paragraph of the Executive Summary (PDF page 10), the report shows "The 2017-2018 Feasibility Study projected annual ridership of 1.7 million to 2.1 million in 2035, and estimated capital costs ranging from $24 billion to $42 billion (2017)."[7]

On the following page, the report states "WSDOT estimated that adding a lane in each direction of US Interstate 5 through the state would cost approximately $108 billion in 2018 dollars." For one lane in each direction of the 277 miles of I-5 in Washington State,[8] that would be $195 million per lane-mile.

The key intended take-away is, obviously, that the cost of adding high-speed rail is shown to be significantly less than adding additional capacity on I-5.





(Above right graph, UHSGT PM is for the total system, Portland-Vancouver, for 365 days in 2055; the I-5 days is for 77 miles in each direction in the Seattle urbanized area, for the 255 working weekdays in 2017.)

We will not attempt to review the accuracy of the I-5 capital cost projection (nor the *UHSGT* cost projection at this point), but we will note that the initial cost of construction of the entire Interstate Highway system, in the same 2018 dollars, was $529 billion.[9]

For 1997 (the year after the original Interstate Highway System (IHS) was officially completed), the Federal Highway Administration (FHWA) reported 46,806 IHS centerline miles;[10] backing out about 2,900 miles of IHS toll roads[11] that were constructed through other funding, we're left with approximately 44,000 IHS miles

9 Al Neuharth (June 22, 2006), "Traveling Interstates is our Sixth Freedom". USA Today. June 22, 20006, Archived from the original on August 19, 2012. Accessed December 13, 2019.

The 2006 cost of $425 billion was adjusted by the national Consumer Price Index, U.S. Department of Labor Bureau of Labor Statistics, "Consumer Price Index Data from 1913 to 2019," accessed December 13, 2019, https://www.usinflationcalculator.com/inflation/consumer-price-index-and-annual-percent-changes-from-1913-to-2008/.

10 FHWA, Highway Statistics 1997, "Public Road Length – 1997" (Table HM-12), accessed December 14, 2019,https://www.fhwa.dot.gov/ohim/hs97/hm12.pdf.

11 FHWA, "Highway History," "Why Does the Interstate System Including Toll Facilities;" accessed December 14, 2019, https://www.fhwa.dot.gov/infrastructure/tollroad.cfm.

paid for by the above cost. If we assume that each centerline mile of IHS is the minimum two lanes in each direction (many were and are wider), then the original construction cost of the Interstate Highway System was approximately $3.0 million per lane-mile.

Therefore, the WSDOT projected cost for adding a lane on I-5 throughout the state would be approximately 65 times the inflation-adjusted cost per lane mile of the original IHS.

While it is certainly expensive to expand freeways, particularly urban freeways and where bridges, urban land acquisition, and major modifications to interchanges would be required, WSDOT's suggested average of $195 million construction cost per lane-mile for the entire length of the I-5 corridor within the state, which includes many miles in suburban and rural areas, requires additional information and explanation from WSDOT in order to be acceptable.

Comparison of use

In WSP's report, the highest performing and most optimistic alignment scenario shows slightly under $300 million in "(s)ystem-level revenue forecasts," which in this context means farebox revenues, in 2055, the final year of projection (Figure 62).[12]

On the following page, the report states, "All of the revenue forecasts have been developed on the basis of a $0.52 fare per mile across the entire system." Dividing $300 million in fare revenue by $0.52 per passenger-mile produces 577 million annual passenger miles for the best performing year in the forecast.

Using the latest available FHWA data,[13] the Seattle Urbanized Area (UZA) average daily traffic per freeway lane was 17,438 vehicle-miles in 2017. Multiplied by the 1.67 national average vehicle occupancy for the same year,[14] that amounts to 29,121 daily passenger miles per lane mile. The Seattle UZA stretches along 77 miles,[15,16] (which would mean 154 new lane miles) of I-5 from Everett in the North to Dupont in the South. If the average daily miles of travel on two added lanes of I-5 would be equal to the 2017 level, they would carry approximately 4.5 million passenger miles per working weekday (29,121 x 77 x 2). So, for 255 working weekdays per year alone, the 77 miles of two extra I-5 lanes in the Seattle UZA would carry about 1.144 billion

12 Appendix D, Ridership and Revenue Forecasts, July 2019, page 51, PDF page 289.

In another example of how this study would have benefited from closer proofreading and editing, the figure numbers in this Appendix do not match between the text and the graphics. Figure 62 is the number on graph itself; in the preceding sentence in the text, it is referred to as Figure 20.

From several other such discontinuities, it appears that the order of appearance of certain sections of the report was moved around and the changes to the figure numbers in the text and on the figures themselves were not adjusted to both be in the proper order and to match up between the text and the graphic. Therefore, we will refer to all Tables and Figures by the number on the graphic proper.

13 FHWA, Highway Statistics 2017, "Urbanized Areas 2017 – Selected Characteristics" (Table HM-72), accessed December 14, 2019, https://www.fhwa.dot.gov/policyinformation/statistics/2017/pdf/hm72.pdf.

14 FHWA, National Household Travel Survey 2017, "2017 Summary Statistics for Demographic Characteristics and Travel, accessed December 14, 2019, https://nhts.ornl.gov/.

15 Census Reporter, Seattle, WA Urbanized Area map, accessed December 14, 2019, https://censusreporter.org/profiles/40000US80389-seattle-wa-urbanized-area/.

16 WSDOT, op cite.

passenger miles annually. This is nearly double the total passenger miles projected for UHSGT for the full 310 miles between Vancouver and Portland[17] for the full year.

When weekend and holiday travel, and travel both north and south of the Seattle UZA on the other 200 miles of I-5 are considered, there would be far more passenger travel on two added I-5 lanes in Washington State, almost certainly well over three times the passenger-miles calculated for UHSGT above. Of course, the proper comparison would also exclude the UHSGT travel in Oregon and British Columbia from the comparison.

In addition, there would be freight utilization of the added freeway lanes. The increased mobility and economic value this added goods movement capacity would bring to the Puget Sound region, as well as the larger Cascadia region, the West Coast of Canada and the U.S., and both of these nations and Mexico is also worthy of note.

We are unaware of any proposal, from any party, to add two lanes to the entire 277-mile length of I-5 within Washington State. There is no citation for the WSDOT I-5 cost projection (a search of the WSDOT web site found no mention of such a projection, nor did a general web search – other than WSDOT Secretary Roger Millar using this figure in an oral presentation at the Cascadia Rail Summit[18]), so it is difficult to understand the context or the purpose of such a projection, let alone how the calculation was performed.

What should be obvious, however, is that while both I-5 expansion and UHSGT could be important for long-distance passenger travel in the Cascadia Corridor, the main uses of I-5 are for local passenger travel, plus both local and long-distance goods movement. Additional capacity on I-5 would serve both purposes as it moves exceedingly more people, and is of vital importance for freight movement, which, at most, would be a minor component of UHSGT utilization.

WSDOT's comparison is not useful

When such a comparison is done, it should be done properly – and not as a "straw man" being set up with an extremely expensive cost and not any mention of benefits. The use and value of these systems to the public cannot be separated from cost, which is why an accurate, data-driven comparison is so important. What WSP and WSDOT have stated represents advocacy rather than unbiased findings.

Even if one accepts WSDOT's stated costs for the added I-5 freeway lanes without question, the capital cost per passenger mile for the additional I-5 freeway lanes would actually be lower than the capital cost for UHSGT.

Finally, while such an expansion of I-5 would be extremely challenging – as if anyone had actually proposed it – the technical, financial, and project management risks of UHSGT are all significantly higher because it is entering unknown planning, design, construction, and finance territory.

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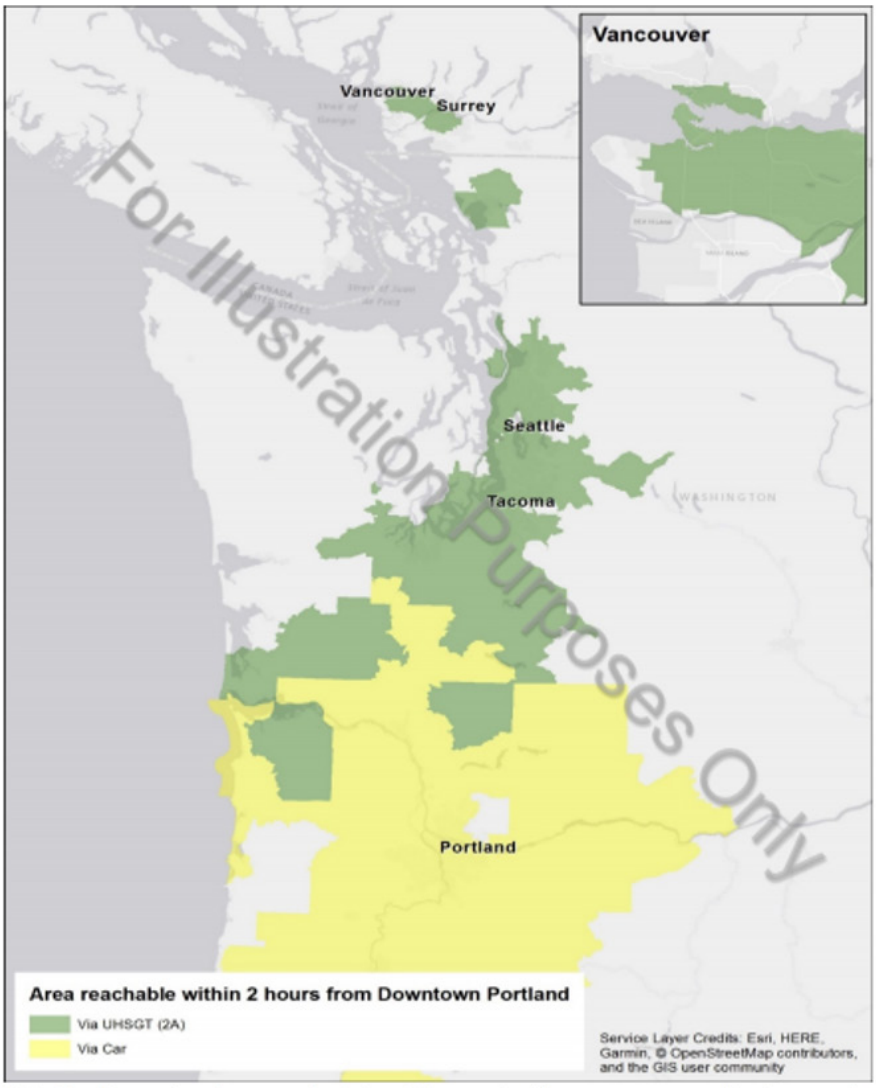
17 *UHSGT*, pp. vi (PDF 14); Appendix B, page 11 (PDF page 141; Appendix D, pp. 1 and 8 (PDF pp. 239 and 246). Section 2.6.1, "Operating and maintenance cost projections," Page 42, PDF page 50, has 305 miles. Since 310 miles appears four times and 305 once, we went with 310. This conflict is another example of an error that should have been caught in editing and proofreading.

18 "Washington officials lay out case for 'game-changing' bullet train linking Vancouver, Seattle, Portland," CBC/ Associated Press, November 12, 2019, https://www.cbc.ca/news/canada/british-columbia/rail-advocates-push-for-bullet-train-vancouver-seattle-portland-1.5356535.

Figure 9: Areas Within Two Hours Travel of Portland, OR; Seattle, WA; and Vancouver, BC; by UHSGT and Auto



Note: Graphics are based on approximate travel times—actual times may vary according to a more developed service plan or stopping patterns or changes in highway congestion.

Glaring and frequent errors in the report diminish its credibility and utility

Time-savings

The key proposed benefit for UHSGT is time-savings, best illustrated by the following map (PDF page 58, §3.3, "A better-connected megaregion"):

There is no way to interpret the above other than that a UHSGT rider starting in Portland can access large areas of Vancouver, Surrey, North Vancouver, and other nearby communities in southwestern mainland British Columbia in two hours or less.

Table 6: Average Total Journey Duration using Selected Mode for the Major Travel Segment (hours:minutes)

City Pair	UHSGT (Proposed)	Auto (Current Conditions)	Air (Current Average)
Seattle – Vancouver	1:45	3:30	3:00
Seattle – Portland	1:30	3:00	2:30
Portland – Vancouver	2:45	5:30	3:30
Bellingham – Seattle	1:00	2:30	3:00
Everett – Portland	1:45	4:00	2:30
Tacoma – Vancouver	2:15	4:00	3:00
Olympia Yelm – Portland	1:15	2:00	NA
Bellingham – Olympia	1:15	3:30	NA

Note: Journey duration assumes 30-minute access/egress time to travel to/from airports and rail/UHSGT stations. Air trips also have 60-minute check in and security time. A 30-minute delay was assumed for international UHSGT, air, and auto crossings.

Now, consider the following table (§2.4, "UHSGT ridership demand," PDF page 43):

(Red oval highlight added. Based on the data presented in Appendix D, "Ridership and Revenue Forecasts," Tables 65-73 – Table numbers on the graphs proper, not from the text – it appears that the Seattle-Vancouver, Seattle-Portland, and Portland-Vancouver "UHSGT (Proposed)" times above are based on express service between Vancouver and Portland with only one stop, at Seattle; all other times above are for "local" service that will stop at all stations.)

In the above table, the travel time between Portland and Vancouver is clearly shown as two hours and 45 minutes – which appears to be incompatible with the under two hours shown in Figure 9.

There is no explanation or reconciliation of this conflict in the report.

Moreover, the "30-minute access/egress time to…UHSGT stations" appears questionable for the very large area shown in the Figure 9 "under two hours" map. Note, for example, that most or all of North Vancouver, plus the waterside areas going approximately three miles west of the North Van SeaBus Terminal to include part of West Vancouver, is shown as included in this coverage. If we split the 30-minute access/egress time in two, that would infer that someone arriving at the Vancouver UHSGT station would step out of the train, proceed on foot to the nearby Vancouver SeaBus terminal, wait for a ferry, board the ferry, ride it to North Van, leave the SeaBus terminal, and then access points in North Van that appear to be right out to the city limits and beyond in under 15 minutes.

UHSGT is a preliminary planning (or advocacy) document, not a detailed design, so the locations of the stations and terminals are not yet determined. To make the best possible case for a fast connection, we will assume that the Vancouver terminus

of UHSGT will be co-located with the Skytrain/West Coast Express Waterfront station, which would produce a relatively short and fast walk to the Vancouver SeaBus Terminal. We choose the final destination for our traveler as North Vancouver City Hall, which is approximately a mile from the North Van SeaBus Terminal. Using Google Maps Transit,[19] the travel time – walk-SeaBus-walk-Bus Line 229 (Lynn Valley)-walk – is a minimum of 28 minutes, and that assumes no wait time for the ferry at the Vancouver SeaBus Terminal. Even if our hypothetical traveler has a North Van destination within a short walking distance from the SeaBus Terminal and the transit connections are absolutely perfect, 15 minutes is impossible. For destinations further than the North Van central business district, the total 30 minutes allowed for both access and egress at both ends of the trip will certainly be exceeded for this one end of the trip alone.

Even with all extreme best case assumptions, the "under two hours" time from Portland to Vancouver would be possible only for the express service and then only to and from points measured in blocks from the two terminal stations, and not many of those, and then only if the border crossing formalities can be performed on the train. With a 30-minute boarding crossing delay, three hours from origin to destination would be possible for travel from downtown Portland to downtown Vancouver, but not much further than walking, easy bicycling or drop-off distance from both terminals.

UHSGT population and employment representations are highly unusual

Perhaps the most prominent justification for UHSGT is to facilitate regional economic growth (through faster and more consistent personal travel times). For example, the report estimates "that as many as 160,000 permanent new jobs in the wider economy could be unlocked by UHSGT, generating as much as $355 billion in additional economic activity."

We will not examine these data, but we will note that these are "gross" projections – in other words, these are the estimated increases compared to the no project base case. What is not examined is the "net" increase. Instead of these funds being devoted to UHSGT, if they had instead been utilized for other projects (which could include transportation infrastructure) – or the taxes and user fees collected had been left in the pockets of the taxpayers and travelers to use as they see fit – what would have been the differences in employment and economic activity?

UHSGT *employment and population comparisons are badly flawed and misrepresent key data*

We will first look at how the report grossly overstates the employment in the corridor and makes the inappropriate comparison of population and (overstated) employment in the entire three-major metropolitan area corridor to individual metropolitan areas in Canada and the U.S.

The table below is a reproduction of the table from PDF page 29, §1.2, "Cascadia megaregion background." No data from the original has been changed, but we have added the right-hand column and the final, "Totals less Cascadia" row at the bottom.

19 TransLink, "Trip Planner," accessed December 16, 201https://new.translink.ca/trip-planner.

Metropolitan Area	Employment (2018, Ranked Order)	Population (2018)	Population Ranking of All Metros		Employment as Percent of Population
New York-Newark-Jersey City, USA	9,835,600	19,979,477	1		49.2%
Cascadia	**6,596,900**	**9,068,178**			72.7%
Los Angeles-Long Beach-Anaheim, CA	6,163,000	13,291,486	2		46.4%
Chicago-Naperville-Elgin, IL	3,781,500	9,498,716	3		39.8%
Dallas-Fort Worth-Arlington, TX	3,433,700	7,539,711	4		45.5%
Toronto, CAN	3,353,000	6,341,935	6		52.9%
Houston-The Woodlands-Sugar Land, TX	3,083,400	6,997,384	5		44.1%
Philadelphia-Camden-Wilmington, PA-NY-DE	2,940,500	6,096,372	9		48.2%
Atlanta-Sandy Springs-Roswell, GA	2,787,100	5,949,951	10		46.8%
Washington, DC-Arlington-Alexandria, VA	2,706,600	6,249,950	7		43.3%
Miami-Fort Lauderdale-West Palm Beach, FL	2,682,000	6,198,782	8		43.3%
San Francisco-Oakland-Hayward, CA	2,440,200	4,729,484	13		51.6%
Montreal, CAN	2,187,100	4,255,541	16		51.4%
Phoenix-Mesa-Scottsdale, AZ	2,107,900	4,857,962	12		43.4%
Detroit-Warren-Dearborn, MI	2,032,100	4,326,442	15		47.0%
Totals Less ***Cascadia***	49,533,700	106,313,193			46.6%

Table 2: Employment and Population by Metropolitan Area in North America, 2018

First, we look at the representation for the *Cascadia* employment as a percentage of population. For the other 14 areas presented, employment as a percentage of population had a range from 39.8 percent to 52.9 percent, a mean of 46.6 percent, and a standard deviation of 3.75 percent. The incredibly high 72.7 percent reported for *Cascadia* is 6.96 standard deviations above the mean, which has a likelihood of occurring of slightly less than one in 400 billion. To say that this was an innocent error would be questionable – but, without the calculated percentage column that we added, it isn't likely that many people would notice this obvious impossibility.

The data from *UHSGT* Table 1 below shows employment as a percent of population for the three major metro areas in *Cascadia* as 52.5 percent – applying this to the *Cascadia* population of 9,068,178 produces employment of 4,758,037 – down 28 percent from what the UHSGT sponsors erroneously posted in Table 2 above.

The following table reproduces the table from PDF page 27, §1.2, "Cascadia megaregion background." No data from the original has been changed; we added the rows at the bottom beginning with "'Actual' Total" (to correct the error in the original).

City Center	Population, City	Population, Metro Area	Total Employment, Metro Area	Total Employment Growth (MSA) 2010-2017	Population Growth (City) 2010-2017
Vancouver, BC	631,486	2,463,431	1,276,900	7.99%	4.6%
Seattle, WA	724,745	3,867,046	2,051,300	20.5%	18.7%
Portland, OR	647,805	2,451,560	1,279,700	16.14%	10.7%
Total	**2,004,036**	**8,782,037**	**4,258,884**	**15.59%**	**11.4%**
"Actual" Total			4,607,900		
Difference between Total and "Actual" Total			349,016		
Percentage difference			7.6%		
Cascadia Metropolitan Area from Table 2		9,068,178	6,596,900		
				Employment as % of Population	
Non-Major Metropolitan Area Using Table 2 Data		286,141	2,338,016	817%	
Non-Major Metropolitan Area Using "Actual" Data		286,141	1,989,000	695%	

Table 1 data, first four lines, through "Total," is directly from *Ultra-High-Speed Ground Transportation*, unchanged. There is an error in the Table 1 total for "Total Employment."

Table 1: Summary Statistics of Major Metropolitan Centers in the Cascadia Megaregion

The first problem is that the sum of the "Total Employment" column, shown as 4,258,884, is understated by 349,016, or 7.6 percent. Again, that an error of this type could appear in a report and not be discovered in the review process is disconcerting.

Using the correct sum, for the three main Metropolitan areas in the Cascadia region, employment as a percentage of population is 52.5 percent, the second highest of the 15 areas in Table 2 – but far short of the 72.7 percent shown in Table 2. However, that the data was available to the authors of this table but, somehow, the table two pages later had grossly incorrect data, which made the UHSGT project appear far more "needed" and likely to succeed, further raises questions of how this misrepresentation came to be.

As shown in the rows we added to Table 1 above, there is a difference between the populations in Tables 1 and 2 in *UHSGT* which is likely due to the population of the smaller Metro areas in the corridor being included in Table 2 but not Table 1. The population for the Olympia-Tumwater Metro Area is 280,588,[20] 98 percent of the difference of 286,141. There are two other U.S. Metro Areas in the corridor, that are not shown with stations, Longview, at 106,910 and Mount Vernon-Anacortes, at 125,619.[21] Evidently, these two were not included in the total Cascadia corridor population.

20 UHSGT cites U.S. Census Bureau for the two tables being discussed, evidently the Annual Estimates of the Resident Population, April 1, 2017, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

21 *Ibid*.

Therefore, for Cascadia, we have three main Metro areas (including one in Canada) and one smaller Metro Area.

To compare a corridor over 300 miles long with individual Metropolitan areas is improper – particularly since the purpose of UHSGT is to recommend a high-speed rail line connecting the separated metro areas in this corridor.

A better comparison – in fact, the only comparison worth making – is to multi-Metro area corridors.

Comparison to California's high-speed rail corridor

The obvious one to start with is the California High Speed Rail (CaHSR) corridor. For our current purposes, looking at both the CaHSR Phase 1 corridor – which excludes the future plans to build to Sacramento and Riverside/San Bernardino to San Diego, and then the entire proposed network – the population[22] of the corridor comparable to Cascadia would include:

Los Angeles-Long Beach-Anaheim Metro Area	13,291,486
San Francisco-Oakland-Hayward Metro Area	4,729,484
San José Sunnyvale-Santa Clara Metro Area	1,999,107
Fresno Metro Area	994,400
Bakersfield Metro Area	896,764
Stockton-Lodi Metro Area	752,660
Modesto Metro Area	549,815
Visalia-Porterville Metro Area	465,861
Merced Metro Area	274,765
Madera Metro Area	157,672
Subtotal for HSR Phase 1	**24,112,014**
Riverside-San Bernardino-Ontario Metro Area	4,622,361
San Diego-Carlsbad Metro Area	3,343,364
Sacramento-Roseville-Arden-Arcade Metro Area	2,345,210
Grand Total	**34,422,949**

This is an actual, real corridor comparable to Cascadia – with more than over two-and-one-half times the population of Cascadia for the first line and almost four times the population for the full system. Indeed, the Phase 2 Metro Areas, with 10.3 million combined population, have more population than Cascadia's 9.1 million.

Other comparable corridors would start with the BOSWASH corridor, from Boston through New York City, Philadelphia, and Baltimore down to Washington, DC; southeast Florida/central Florida-Gulf Coast (Miami-Dade, Broward, and Palm

22 Census, Annual Population Estimates (2018 PEP, PEPANNRES), 2018, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

Beach Counties through Orlando to Tampa); the Texas triangle corridors (Dallas/Fort Worth-Houston-Austin-San Antonio), several corridors radiating around Chicago (to Detroit, Cleveland, Indianapolis, Saint Louis, Milwaukee-Twin Cities), and Atlanta-Charlotte-Raleigh-Washington.

In total, without the improper comparison of a corridor to metropolitan areas and the vastly overstated Cascadia employment, Cascadia would not be the second largest area in the table; in fact, it would not even make the top ten.

Even if some of these misrepresentations could be disregarded as errors, that this schedule was even conceived at all in this way is surprising.

Risks – including cost overruns, scope changes, funding shortfalls, delays, political pressures, and project management failures

Megaprojects have a long and unfortunate history of failing to meet the original promises of their proponents, including what are frequently multiple problems.

To the credit of the authors of *UHSGT*, there are useful discussions of the political and related problems that can occur and recommendations for political and project management structures to help avoid such problems.[23] We strongly urge anyone who reads *UHSGT* to study these sections closely.

WSP highlights delayed and over-budget projects as models Washington should emulate

There is totally insufficient discussion of the magnitude and frequency of the risks of such projects, even to the extent of presenting as model projects to be imitated two that had major problems: "This approach would build on that being used to deliver the Gordie Howe International Bridge linking the US and Canada and lessons learned from the successfully delivered Channel Tunnel between the United Kingdom and France."[24]

While the development of the international governance agreement to construct and operate these projects is certainly worthy of note for the development of a similar structure for UHSGT, should the project progress that far, this presentation tends to make it appear to the uninformed reader that both of these projects were successful in satisfying the promises of the project promoters. This is inaccurate and misleading.

The Howe Bridge is now one year into construction and currently scheduled for completion in 2024[25] – 11 years after the original projected 2013 opening date.[26] The costs have gone up and down from the 2008 estimate of $1.847 billion[27] (U.S. dollars, all following costs in Canadian dollars; $1.847 U.S. was $2.227 billion Canadian at

23 §6.7, "A modern delivery approach can be used for UHSGT," pp. 61-62, PDF pp. 69-70 and Chapter 6, "Deliverability and Technical Case," pp. 81-87, PDF pp. 89-95.

24 Executive Summary, "UHSGT can be successfully achieved using a modern delivery approach," page xi.

25 CBC News Windsor, "$3.8B to build Gordie Howe bridge, complete by end of 2024," September 28, 2018, https://www.cbc.ca/news/canada/windsor/gordie-howe-bridge-construction-1.4842489.

26 Michigan Department of Transportation, Press Release, "Federal government approves new Detroit-Windsor border crossing system, January 15, 2009, https://web.archive.org/web/20110816005742/http://partnershipborderstudy.com/pdf/2009-01-15_MDOTPressReleaseforDRICRODApproval.pdf.

27 U.S. Department of Transportation/Federal Highway Administration and Michigan Department of Transportation, "Final Environmental Impact Statement and Final Section 4(f) Evaluation – The Detroit River International Crossing Study," December 2008, Executive Summary, page ES-59, https://web.archive.org/web/20120307202311/http://www.partnershipborderstudy.com/pdf/FEIS/Summary.pdf.

that time[28]) to reported costs starting at $1 billion in 2010[29] to $2.2 billion in 2011[30] back down to $1 billion[31] or $2 billion[32] in 2012 to $3.8 billion (not including $1.9 billion for 30-years of operations and maintenance) in 2018,[33] with at least five more years of construction – and potential new problems – yet to come.

However, for the English Channel Tunnel (Chunnel), consider the following from Bent Flyvbjerg, the dean of international megaproject management analysis:

> *"As a case in point, consider the Channel Tunnel, the longest underwater rail tunnel in Europe, connecting Britain and France. This project was originally promoted as highly beneficial both economically and financially. At the initial public offering, Eurotunnel, the private owner of the tunnel, tempted investors by telling them that 10 per cent "would be a reasonable allowance for the possible impact of unforeseen circumstances on construction costs" In fact, capital costs went 80 per cent over budget, and financing costs 140 per cent. Revenues started at a dismal 10 percent of those forecast, eventually growing to half of the forecast. As a consequence, the project has proved financially non-viable, with an internal rate of return on the investment that is negative, at -14.5 percent, with a total loss to Britain of $US17.8 billion."*[34]

The projected five years of construction to opening wound up being six, a 20 percent schedule overage.[35]

We find it remarkable that WSDOT and WSP would submit these two projects as models to be emulated for UHSGT. Were the authors, and those that reviewed *UHSGT* prior to release, somehow unaware of the history of these projects – or did they assume that no one that would read *UHSGT* would know of, or research, their history?

One thing that must be clearly understood is that the current state of preliminary planning for UHSGT is far less developed than those for the Chunnel and the Howe Bridge when the original projections reported above were made.

While it is very common for megaprojects to experience large overruns and other problems between the approval of environmental clearance documents (such as a Final Environmental Impact Statement [FEIS] required under the National Environmental Policy Act [NEPA] and a Final Environmental Impact Report [FEIR] required under the California Environmental Quality Act [CEQA]), or the original project budgets, to project completion, it is more common for the change from the original planning

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28 Converted at 1.2058:1 Canadian:US rate on December 17, 2008, Currency Exchange Rate Widget, accessed December 28, 2019, http://exchangerateusd.com/historicalexchangerate/2008-12-17#.Xf-8X3dFzZ4.

29 Dave Battagello, "New Detroit crossing seven years away," Winsor Star, April 12, 2013, https://windsorstar.com/news/local-news/first-vehicle-expected-to-cross-dric-bridge-in-2020.

30 Daniel Tencer, "Canada-U.S. Trade: Michigan Senate Committee Kills New Boarder Crossing," The Huffington Post Canada, October 21, 2011, https://www.huffingtonpost.ca/2011/10/21/canada-us-trade-windsor-detroit-bridge_n_1023927.html.

31 CBC News Windsor, "$1B Windsor-Detroit bridge deal struck," June 15, 2012, https://www.cbc.ca/news/canada/windsor/1b-windsor-detroit-bridge-deal-struck-1.1141713.

32 Bill Mann, "Second bridge at Detroit-Windsor? It's about time," Bill Mann's Canada, June 14, 2012, https://www.marketwatch.com/story/second-bridge-at-detroit-windsor-its-about-time-2012-06-14.

33 CBC News Windsor 2018, Op. Cit.

34 "The never-ending growth of megaprojects," Financial Review, July 27, 2017, https://www.wsdot.wa.gov/sites/default/files/2019/07/12/Ultra-High-Speed-Ground-Transportation-Study-Business-Case-Analysis-Full-Report-with-Appendices-2019.pdf.

35 Dan Robinson, "Delayed construction projects in the UK: Crossrail isn't the first to be late and over budget," NS Business, August 31, 2018, https://www.ns-businesshub.com/transport/delayed-construction-projects-in-the-uk-crossrail//.

estimates to the FEIS, FEIR, or similar document to be as large or even larger. Consider the following examples, the first two Los Angeles light rail lines (inflation adjustment for constant dollars via CPI-U,[36] construction mid-point years for Blue and Green Lines 1987 and 1992, respectively):[37,38,39,40,41,42]

CHANGES IN PROJECT COST AND PERCENTAGE CHANGES						
	Millions of Dollars			Percentage Change		
Project/ Dollars	Original	FEIS	Final	Original to FEIS	FEIS to Final	Original to Final
Blue Line Current $	$125[37]	$399[38]	$864[39]	219%	117%	591%
Blue Line Constant $	$125	$333	$673	166%	102%	538%
Green Line Current $	$174[40]	$707[41]	$842[42]	306%	19%	384%
Green Line Constant $	$174	$579	$643	233%	11%	269%

This type of overrun has also occurred in Washington State. For Sound Transit, besides the following detailed discussion of Central Link, the East Link budget increased $225 million before construction began,[43] Lynnwood Link is running $500 million over budget and is expected to be finished six months late,[44] and Federal Way Link is $460 million over budget.[45]

It would be very easy to provide example after example of similar megaprojects that have failed to provide the benefits claimed by their proponents and have been significantly over budget and delayed in delivery. However, rather than taking up the limited space available for this paper for that, we will, instead do three things:

43 Mariya Frost, “”Sound Transit is $225 million over budget on East Link before construction has even begun,” March 23, 2017, Washington Policy Center, https://www.washingtonpolicy.org/publications/detail/sound-transit-is-225-million-over-budget-on-east-link-before-construction-has-even-begun

44 Mariya Frost, “Staggering $500 million cost overrun on Lynnwood Link,” August 29, 2017, Washington Policy Center, https://www.washingtonpolicy.org/publications/detail/staggering-500-million-cost-overrun-on-lynnwood-link

45 Mariya Frost, “Sound Transit reports Federal Way Link is $460 million over budget,” July 27, 2018, Washington Policy Center, https://www.washingtonpolicy.org/publications/detail/sound-transit-reports-federal-way-link-is-460-million-over-budget

- Direct readers to a sampling of easy-to-read seminal papers on megaproject planning, finance, design, and construction management;
- Provide a historical analysis of the California High Speed Rail project as Appendix A;
- List some of the recent non-UHSGT megaprojects, and their shortcomings, in the Cascadia corridor as Appendix B;

Megaproject failure papers that all decision-makers should review

The following papers demand the attention of all UHSGT decision-makers (the first two are the initial chapters of books; the full books are strongly recommended):

- "Introduction: The Iron Law of Megaproject Management"[46]
- *Megaprojects and Risk – An Anatomy of Ambition*, Chapter 1, "The megaprojects paradox"[47]
- Renia Ehrenfeucht, "Megaprojects and Risk: A Conversation with Bent Flyvbjerg[48]

Summary of Appendix 1: California High Speed Rail

Of all the Megaprojects in the world, the one that most closely matches UHSGT is the California High Speed Rail project. Both are steel wheel HSR with designed top operating speeds of 220 mph,[49] both are located primarily or entirely in the US in "Left Coast" states with all the considerations that go with that, both have corridors with significant terrain challenges, both have much of their operating alignments proposed for dense urban and suburban communities that are largely already built-out, and both are looking at similar financing sources.

In addition, WSP, the author of *UHSGT*, has been the major professional services provider to CaHSR - "WSP has been helping shape high-speed rail in California from the earliest feasibility studies in the 1990s to the latest business plans in 2014 (sic[50]). The firm is now serving as the Authority's Rail Delivery Partner (RDP), a seven-year engagement from the planning and preliminary design phase to project delivery and operations."[51] A Los Angeles Times article valued WSP's CaHSR contracts as $666.4

46 Bent Flyvbjerg, 2017, "Introduction: The Iron Law of Megaproject Management," in Bent Flyvbjerg, ed., The Oxford Handbook of Megaproject Management (Oxford: Oxford University Press), Chapter 1, pp. 1-18; URL for print version: http://bit.ly/2bctWZt; for this chapter, file:///C:/Users/Thomas%20A%20Rubin/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/SSRN-id2742088%20(1).pdf

47 Bent Flyvbjerg, Nils Bruzelius, and Werner Rothengatter, Cambridge University Press, 2003, https://arxiv.org/ftp/arxiv/papers/1303/1303.7404.pdf

48 Critical Planning, Summer 2004, pp. 51-62, file:///C:/Users/Thomas%20A%20Rubin/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/SSRN-id2278321%20(1).pdf

49 For CaHSR, CaHSRA, 2018 Business Plan, June 1, 2018, pp. 61 and 67, https://www.hsr.ca.gov/docs/about/business_plans/2018_BusinessPlan.pdf

50 The latest CaHSR Business Plan is dated 2018 (Ibid.)and the Plan proper has no author listed; WSP is the named author of at least one major support document, the Capital Cost Basis of Estimate Report, June 1, 2018,https://www.hsr.ca.gov/docs/about/business_plans/2018_Business_Plan_Basis_of_Estimate.pdf

This misstatement is likely due to a failure to update the WSP website.

51 WSP, "What We Do/Shaping Communities Nationwide/CALIFORNIA-HIGH-SPEED-RAIL," https://www.wsp.com/en-US/projects/california-high-speed-rail

million.[52] WSP (at the time, Parsons-Brinkerhoff prior to being acquired) also had a major role in the Sound Transit Smart Move and Central Link planning, design, and execution, as noted in Appendix B.

There are many obvious differences between CaHSR and the proposed UHSGT version of HSR; however, many of the specific challenges and issues that have been encountered for CaHSR are exactly the types of what can be expected for Washington's proposal for HSR if and when it may go forward.

In fact, the UHSGT proponents must become exceedingly knowledgeable as to the California High-Speed Rail program because of its long list of problems, which could very possibly cause it to be severely truncated or even totally abandoned. It will be constantly cited as strong evidence that UHSGT promoters should not be given credibility because many of the key players had major roles in California.

With these close parallels in mind between CaHSR and UHSGT, below are the big lessons that those in the Cascadia corridor can learn from their cousins to the south.

- In order to sell CaHSR to the voters, its proponents decided it was necessary to include strong guarantees about not beginning any construction without very strong feasibility studies passing independent expert and state review, no governmental operating subsidies, and travel time guarantees. These commitments – which the State Legislature is not able to change without returning to the voters – have posed and are continuing to pose many significant legal problems for CaHSR.

- California has no current plan to complete CaHSR or even Phase 1 from San Francisco to Los Angeles. In his first State-of-the-State Address in February 2019, incoming Governor Gavin Newsom announced, "Right now, there simply isn't a path to get from Sacramento to San Diego, let alone from San Francisco to L.A." He did not halt all CaHSR work, but he did announce that while he would continue to pursue funding to complete the entire original project, there were no current plans to do any construction beyond the Central Valley.

- Although the 2002 authorizing legislation stated, "(t)he initial network from San Francisco and the Bay Area to Southern California could be in limited operation in 2008," the most recent (2019) update is that testing of HSR between Merced to Bakersfield in the California Central Valley will occur in 2028; all plans for construction beyond these points are no longer operative. There has been significant schedule slippage, cost overruns, and other problems on CaHSR construction contracts.

- The original budget for the entire proposed system, including the Sacramento and San Diego sections, was $45 billion, but there is no current budget for the entire system. For the San Francisco-Los Angeles Phase 1 segment, costs have increased from $32.7-$33.6 to $80.3 billion, well over doubling. To say the least, the $80.3 billion is far from guaranteed.

52 Ralph Vartabedian, "How California's faltering high-speed rail project was 'captured' by costly consultants," Los Angeles Times, April 26, 2019, https://www.latimes.com/local/california/la-me-california-high-speed-rail-consultants-20190426-story.html

- One of the reasons for the cost increases has been "route creep;" connecting Sacramento in the North to San Diego in the South along the I-5 corridor, along with an additional segment from the Central Valley to San Francisco. It would be approximately 600 miles of track, but the total current fully-built-out estimate is approximately 800 miles. The additional 200 miles is due to decisions to serve additional cities.

- These round-about routes and the difficulties of building full-speed HSR though highly developed urban and suburban areas make the legally mandated travel times, particularly San Francisco to San Diego in three hours and 30 minutes or less, and San Francisco to Los Angeles in two hours and 40 minutes or less, quite difficult. Even for non-stop trains, these travel times will require average travel speeds that appear highly questionable when the necessary slow sections of track, passing slower trains, and other common operating conditions are properly considered.

- The original plan called for extensive Public-Private Partnerships (P3) for the design, build, finance, operation, and maintenance of CaHSR, with the private parties taking on major parts of the risk in order to gain the eventual profits, originally projected at $1 billion per year, when the system was in operation. Despite years of intense efforts all over the world to engage such partnerships, not a single such arrangement has even been offered for what the California High-Speed Rail Authority (CaHSRA) wants to build, leaving the taxpayers to cover the entire costs – which keep increasing. Any proposal that UHSGT will be financed largely by private sector partners should be compared to the total failure of CaHSR to deliver on this.

- The original financial plan anticipated major federal funding for CaHSR. While CaHSR was ultimately awarded $3.48 billion of the original $8 billion for "High-Speed Rail/Intercity Passenger Rail" in the American Recovery and Reinvestment Act of 2009 by the Obama Administration, together with permission to draw down the federal funds to cover 100 percent of the early construction costs without the required local match, the Trump Administration canceled a grant for $926.6 million and is investigating clawing back the Federal funds expended to date ($2.55 billion through January 31, 2019) for alleged failure to perform to the grant contract terms. The State of California is fighting these claw-back attempts. There is no current proposal for more Federal funding for HSR.

- Due to the inability to attract public-private partnership funds or the originally hoped-for levels of federal and other funding, California has allocated cap-and-trade funds received from the sale of Greenhouse Gas (GHG) emission allowances. As of the date of preparation of this paper, cap-and-trade funds accounted for almost half of all committed funds (as high as 57 percent if federal funds are not retained). The California cap-and-trade program was originally passed in 2006 as part of package of actions to assist the state in reducing its 2020 level of GHG emissions back to 1990 levels, with the expectations that the revenues the State received from such sales would go for programs that would assist towards achieving that 2020 target.

However, the top of the range for GHG savings from CaHSR Phase 1 operations is currently projected at approximately 0.3 percent of the 1990 statewide emissions. The cost of this reduction is $143 to $195 per Metric Ton of Carbon Dioxide equivalent from the cap-and-trade fund expenditures alone. As this cost does not include the other major funding to be used for CaHSR, and even this partial cost is well over the generally-accepted reasonable cost for GHG emission reduction of $50, it does not appear that CaHSR can be a very cost-effective means of reducing GHG emissions. In fact, given that the above calculation reduction does not include the significant GHG emissions of CaHSR construction (the International Union of Railways estimates a five-year breakeven point for GHG after operations begin), and that no plan exists for completion of Phase 1, a strong argument can be made that California is using cap-and-trade revenues to increase GHG emissions in the current day without any workable plan to ever recover those emissions, or the billions of dollars of GHG reduction funds used to create them.

Summary of Appendix 2: The History of Megaprojects in the Cascadia Corridor

The history of construction megaprojects, including many transportation ones, in the Cascadia corridor, gives significantly more cause for concern, including:

- **I-5 Columbia River Crossing Bridge** – The Interstate Bridge over the Columbia River between Portland, Oregon and Vancouver, Washington consists of near-twin spans dating from 1917 and 1958. It had been a major bottleneck for many years, including being named Oregon's worst traffic choke point in 2010 while the planning for the replacement bridge was underway. The I-5 Bridge and the I-210 Bridge approximately seven miles away are the only two Columbia River crossings in a total of approximately 90 road miles on the Oregon side to the next bridges up- and downstream.

  There were very significant differences between the large number of interested parties, including those with the decision-making power to kill any plan. The Oregon interests – who were opposed to increasing road capacity – insisted on light rail on the bridge as their price for agreeing to the bridge going forward. This and other design elements raised the costs to $3.2-3.7 billion, more than could be financed by available road user fee and transportation tax revenues, so a significant portion of the initial capital funding was to be generated by the sale of revenue bonds backed by bridge tolls.

  Although the planning, design, and environmental clearance process had been underway for many years, there were shocking omissions, such as the failure to properly coordinate with the U.S. Coast Guard, which has authority over required clearances over navigable waterways, until the Coast Guard finally issued a very stern notice that resulted in the clearance being raised from 95 to 116 feet – and upstream shippers being promised mitigation payments.

  Eventually, the Washington State Senate refused to fund the Washington share of the costs and the project was cancelled after the expenditure of approximately $200 million for no result – and the need for transportation improvement unresolved. Even when there is general consensus on the need for a megaproject, when getting the project to execution requires Christmas

Treeing the project (a big present under the tree for everyone) so that everyone gets what they want, the result can be nothing getting done.

- **Alaskan Way Viaduct Replacement Tunnel** – The two-mile Alaskan Way Viaduct carried the first freeway (then US 99, later Washington State Route 99) through the Seattle central business district (CBD) from its opening in 1953 and continued to be a major component of the road system even after the opening of I-5 in stages in the 1960s. However, its placement on the waterfront was seen as distracting from the natural and built beauty and views of the area. After the similarly designed (two-level elevated) I-880 Cyprus Freeway in Oakland collapsed, with the loss of 42 lives, in the 1989 Loma Prieta earthquake, and the 2001 Nisqually earthquake damaged the Viaduct, a strong consensus developed to replace it. After a comprehensive review of options, the final decision was for a $1.96 billion bored tunnel (which came in with an at-built cost of $3.325 billion), in large part to free up the waterfront for other purposes. The tunnel is four lanes, not the six lanes of the Viaduct, and the tunnel is tolled – the Viaduct was not.

  However, the primary reason for the inclusion of this project in this list is not the 70 percent cost increase from FEIS to as-built, nor the lesser road capacity, but the 29-month delay in the project after Bertha, the giant 57½-foot boring machine, broke down and required herculean efforts, including excavating a vertical shaft down 120 feet, to repair Bertha's cutting head. On projects of this size and complexity, unexpected negative occurrences are, unfortunately, something to be expected.

- **Seattle Monorail Project** – The Seattle Monorail Project was a rarity, a major transportation project initiated by a local enthusiast, without any significant governmental support in initiation, which was then endorsed by the voters. The original 1997 plan, Initiative 41, passed by the City of Seattle voters 53 percent to 47 percent, was for a 54-mile X-shaped system, based on the one-mile 1962 Seattle World's Fair Monorail, to be built with private funding.

  It did not take long for the Elevated Transportation Corporation to determine that private funding to build the proposed system would not appear, so a second initiative to do more planning to further develop the system and place a more developed project, including funding, was placed before the voters in 2000 – and passed 56 percent to 44 percent.

  In 2002, the plan was presented to the voters, to be financed by an annual 1.4 percent vehicle excise tax on vehicles where the owners had Seattle addresses. It passed, by 877 votes, and, in doing so, created a replacement agency, the Seattle Monorail Project (SMP).

  During this period, the SMP was seen as competing with the transit plans being developed by the Central Puget Sound Regional Transit Authority (Sound Transit), including its extensive proposed light rail system. It was also far from popular with the elected officials in the City – and many of the voters. So, there was a citizen-initiated ballot measure, I-83 in 2004, to effectively end the SMP by requiring that the City prohibit the use of the public air space above city streets. It failed 64 percent to 36 percent, which meant that the SMP was still alive.

The expected vehicle fees were coming in 30 percent lower than projected – evidently, many former residents of Seattle had suddenly decided to move in with friends and relatives who resided in surrounding political jurisdictions – and projected costs were increasing. When the SMP proposed extending the vehicle tax and issuing 50-year bonds, there was great opposition from both the public and City officials. The plan was dropped and the SMP Board Chair and Chief Executive Office ("CEO") resigned.

The disputes between the City and the SMP continued and worsened until the compromise was a fifth public ballot measure, this time to either approve a shorter version or end the project. This time, the voters said no, 65 percent to 35 percent. The Monorail Project ended the vehicle excise tax, laid off staff, liquidated the properties that had been purchased for construction of the first line, and put itself out of business, transferring the remaining assets to King County Metro. The cost to the voters was $125 million – to accomplish nothing while wasting an incredible amount of the time of elected and high appointed officials.

The lesson from this is that when someone has a great idea, it is not necessarily something that can be implemented – technically, financially, or politically.

- **Sound Transit's Sound Move** – The 10-Year Regional Transit System Plan – After voters rejected the Central Puget Sound Regional Transit Authority (Sound Transit) 1995 transit plan, with a $6.7 billion projected cost, Sound Transit returned to the voters in 1996 with Sound Move, a less expansive plan with a projected $3.9 billion budget, which was approved.

  Sound Move's centerpiece was a 22-mile light rail line called Central Link, from the University District in the North through the Downtown Seattle Transit Tunnel to SeaTac airport and beyond in the South at a cost of $1.7 billion (including Federal grant funding), to be completed in 2006. 2010 light rail ridership (including that of Tacoma Link, a streetcar) was projected at 32.6 million, part of total 2010 ridership, for all transit modes, of 187 million.

  Central Link experienced multiple problems in getting construction underway, including withholding information that the budget would be far exceeded from the Sound Transit Board, the general public, and the Federal Transit Administration (FTA). The Federal full-funding grant agreement for the first segment was not funded by Congress and there were significant changes in Sound Transit leadership. The budget of $1.801 billion (1996 dollars) was exceeded, totaling $5.2 billion in year-of-expenditure dollars, approximately $3.8 billion in 1996 dollars. By 2010, 13 of the 16 stations had been completed with the last three completed in 2016 – a decade later than the voters were promised. 2010 light rail ridership was 8.4 million, 26 percent of the Sound Move projection, with total regional transit ridership at 165 million, 88 percent of the projection.

  Sound Transit has returned to the voters three times since for additional funding to complete the Sound Move projects and to further expand the transit system. The 2007 measure was defeated, but 2008's ST2 and 2016's ST3 were both successful.

Through ST2 and ST3, the original Sound Move sales tax rate increased from 0.4 percent to 1.4 percent and the 0.3 percent motor vehicle excise tax was increased to 1.1 percent. New property taxes, at $.25 per $1,000 property valuation, and a 0.8 percent rental car tax, were approved. This increased Sound Transit's budgeted local tax revenues from ~$510 million to $1.957 billion (both 2020 dollars) – for a greatly expanded scope of work.

The 1996 Sound Move also showed "Travel time savings for drivers of private vehicles" of $16-24 million per year. As we do not know the methodology for the computation of these values, we do not have the capability of computing the actual, but the Texas A&M Transportation Institute reports Seattle Metro Area "Annual Traffic Delay Hours" of 75.9 million for 1996 and 167.4 million for 2017, 220 percent of the 1996 value and the time series trend has been fairly consistently upward from 1982 through 2017.

Sound Move also discussed how a light rail line had the passenger carrying capacity of twelve freeway lanes, based on several assumptions that focus on the peak load point for light rail at the peak of rush hour. At the current day, Central Link is carrying, in the peak direction of travel, slightly less than one freeway lane at the peak load point in the peak direction at the peak hour and under 30 percent of one freeway lane off-peak.

- **First Sound Transit Light Rail Line** – After the Central Puget Sound Transit Authority (Sound Transit) received the authority from the voters to proceed with its transportation plan, the beginning of the Central Link light rail system centered on Seattle was the 7.4-mile University Link (Segment 1). Sound Transit was pushing very hard to get Segment 1 into construction as soon as possible, including using an innovative negotiated procurement methodology which would have shifted a major share of the risks to the vendor.

  The details of the procurement were kept secret – which was proper – while extended negotiations were underway. The top leadership of Sound Transit, particularly the then-Chair, kept issuing public assurances that everything was proceeding as planned.

  The announcement of the award of the Full Funding Grant Agreement (FFGA) (which would not become final until after the opportunity for Congressional review) was quickly followed by the announcement of the results of the procurement – with major increases in costs, which kept increasing, particularly as members of the Sound Transit Board, who had been kept in the dark, wanted information as to what had happened and how.

  The overrun and perhaps more important - the failure to notify the other interested parties, particularly the FTA, of these events - lead to scrutiny. A U.S. Department of Transportation (DOT) Inspector General report reported that Sound Transit was well aware of cost increases of over $1.5 billion but failed to disclose this in an attempt to get the federal grant approved.

  The end product of these events, including issues regarding the conduct of both Sound Transit and the FTA, included:

  - ▹ Funding of the FFGA was held

- The scheduling of the three phases was altered, with Airport Link becoming the first to be constructed and University Link moved back – after significant redesign

- Major changes in Sound Transit leadership

The Downtown Seattle Transit Tunnel (DSTT) was opened in 1990 with service using dual-power buses, but with a clearly-announced intention and design to allow for easy use by light rail vehicles at a later time. Before the 1990 opening, the decision was made to reinforce the public perception that light rail was coming by installing rail tracks, even though there was no timetable, at the time, when these would be used. This was not properly planned and installed, leading to a two-year shutdown of DSTT while the problems were corrected.

The lessons here are that bad events can only be hidden for so long and that there are consequences to attempted cover-ups, particularly when there appears to be a deliberate attempt to avoid undesired political and legal consequences. Also, public relations decisions cannot be allowed to override proper design and engineering.

In summary, any representation that yes, "bad things can happen on major projects, but they won't happen here because we will do things right," must be rejected.

Conclusion

Ultra-High-Speed Ground Transportation Business Case Analysis is a promotional document, not a plan. It contains numerous erroneous statements and analyses, and ignores many important factors that should be discussed.

The project that is closest to UHSGT is, beyond any doubt, the California High Speed Rail project, which is currently on life support, way over budget and behind schedule without any conceivable source of funding to complete. Construction has been limited to the Central Valley only and even that may not be completed as California Governor Newson had proposed. WSP, the author of *UHSGT*, has contracts worth $666 million – to date – for CaHSR. The very strong legal prohibition against any governmental subsidies for CaHSR operations does not appear possible to achieve, which is why the hoped for major private sector funding for construction has never appeared.

The State of Washington has its own long record of transportation megaprojects that have come in way over budget and behind schedule, including the Alaskan Way Viaduct replacement tunnel, several Sound Transit rail projects, and other projects that have absorbed over a hundred million and years of planning to produce nothing, including the Seattle Skytrain and the Interstate Bridge over the Columbia River between Portland, OR and Vancouver, WA.

The errors and misrepresentations in *UHSGT* all make the project appear more feasible or more valuable, calling the objectivity and usefulness of the document into high question.

APPENDIX 1: CALIFORNIA HIGH SPEED RAIL

Because of the many problems incurred to date, there is no current plan for California to complete Phase 1 of California High-Speed Rail

The California High Speed Rail project (CaHSR) has experienced a variety of problems, as discussed in detail below.

Because of the multitude, complexity, and magnitude of these, in his first State-of-the-State address in February of 2019, incoming California Governor Gavin Newsom announced:

> *"But let's be real. The project, as currently planned, would cost too much and take too long. There's been too little oversight and not enough transparency.*
>
> *"Right now, there simply isn't a path to get from Sacramento to San Diego, let alone from San Francisco to L.A. I wish there was."*

Governor Newsom did not cancel the project entirely (as some observers had speculated), but he did announce that construction would be limited to the Central Valley, between Merced and Bakersfield,[53] approximately 171 miles, consisting of the 119 mile segment (also shown as 117 miles in other CaHSRA documents) that had previously been awarded and was in construction and two short extensions to Bakersfield to the South and Merced in the North.[54] The cost of the original leg was given as $15.6 billion, the two extensions at $3.9 billion, and trains and other costs at $0.9 billion, for a total of $20.4 billion.[55] Also, the overall cost of Phase 1 increased in the several months since the previous report to the California Legislature in 2018 by a net $1.8 billion[56] to a new total base cost of $79.1 billion, with a low range of $63.2 billion and a high range of $98.1 billion.[57]

However, the Governor's announcement almost immediately set off discussion of political restructuring of the program. The original plan had followed the long-standing "Christmas Tree" approach to megaprojects, namely, to get the project approved, and make sure that there is a big present under the tree for everyone who has any power to approve or disapprove the project. As discussed below under "Route Creep," originally there were presents for everyone, with emphasis on the two largest regions - the Bay Area and Southern California. The powerful politicians from the last two were not pleased when the CaHSRA had to start construction in the Central Valley, but were willing to accept that as long as they had high confidence that "their" sections would be coming before too very long.

However, Governor Newsom's announcement not only specifically stated that there was no schedule for when construction would get to the Bay Area and Southern California, but also implied that there was a real possibility that it would be decades before there would be anything coming to the districts of these powerful legislators –

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53 Capital Public Radio, "Transcript And Analysis: State Of The State 2019," February 12, 2019, http://www.capradio.org/articles/2019/02/12/text-and-analysis-state-of-the-state-2019/

54 CaHSRA, Delivering High-Speed Rail to Californians – Project Update Report to the California Legislature, May 2019, Exhibit 2.5, "Merced-Fresno-Bakersfield Capital Cost Estimates," page 36, https://www.hsr.ca.gov/docs/about/legislative_affairs/SB1029_Project_Update_Report_050119.pdf

55 *Ibid*., Exhibit 2.6, "Capital Cost Estimate Building Blocks," page 38.

56 *Ibid*., "Exhibit 2.1, "Central Valley Segment Cost Estimate Review and Risk Analysis Process, page 32.

57 *Ibid*,, Table 2.1, "Updated Program Base Point Estimate and Revised Central Valley Segment Range," page 43.

and it was very possible that there would never be HSR in the two most populous areas of the state that were paying the most for it.

While the Governor expected that his announcement that going ahead with two additional projects North and South of the 119-mile original Central Valley segment would demonstrate that he was committed to completing HSR, it had the opposite effect. If powers-that-be in the Bay Area and Southern California had to wait a decade or more until they would see construction, or would never see it at all, then why use over $4 billion of available funds for extending "the train to nowhere" in the Central Valley (and electrifying the original Central Valley 119-mile section and the add-on) when there were better and immediate uses for those funds to build rail in their districts?

As Assembly Speaker Anthony Rendon (D-Lakewood – in Southern Los Angeles County) stated, "Any project that doesn't have a significant amount of service to the largest areas in the state doesn't make much sense." Senator Jim Beall (D-San José), chair of the Senate Transportation Committee commented, "They have some financial wiggle room. They could put more in the bookends and money for Burbank to Anaheim and electrify Caltrain all the way to Gilroy" (from San Francisco). While there has not been any legislative mandate to move money around yet, it is certainly a matter of intense review and discussion, including the passage of a CaHSRA resolution, introduced by Ernest Camacho, a Board member from Southern California, to compare the current state plan to the benefits of bullet train investments in other parts of the state.[58]

It would be premature to predict the outcome of this possibility, but its impacts on completing CaHSR as originally contemplated could be significant.

Nowhere in the *2019 Project Update* is there a plan on how to go forward with construction outside of the 171 miles in the Central Valley. Instead, on pp. 1-2 of the "Letter from the Board Chair," there is:

> *"Some have suggested the state should walk away from the more than a decade of collaboration and progress that Republican and Democratic administrations and a generation of legislative leaders have made to bring the project this far. Such a path would leave California, having spent $5 billion, with nothing but lawsuits, job losses and billions of IOU's with nothing to show for our debts.*
>
> *"Given those two options, the path forward is clear. The California High-Speed Rail Authority (Authority) will continue its efforts toward getting a working section completed in a responsible and transparent way."*

While Governor Newsom is sticking to his plan to add 52 miles, and electrification of the entire 171 miles in the Valley, the debate continues.[59]

Very early in the introduction of cost accounting and principles of finance courses, future business leaders are taught to "ignore sunk costs." In other words, what is done

58 Ralph Vartabedian, "In a blow to the bullet train, California might shift billions to L.A. and Bay Area projects, July 30, 2019, Los Angeles Times, https://www.latimes.com/california/story/2019-07-28/california-redirects-funds-high-speed-rail-project

59 Ralph Vartabedian, "Spending for California's bullet train divides state leaders as never before," Los Angeles Times, November 15, 2019, https://www.latimes.com/california/story/2019-11-15/california-bullet-train-project-state-leaders-divided

is done and can't be changed, so don't make decisions based on unchangeable history; make decisions on what to do in the future as to what is the best available outcome going forward.

Evidently, the "ignore sunk cost" lesson is not found in the political science curriculum. (Of course, it is easier to follow this advice when you are dealing with your own and your investors' money than it is when you are government official who would have to admit a major mistake was made – and is looking at the next election.)

The history of rail in California and early moves to HSR

Railroads have been an extremely important component of the history of California from early in its statehood, beginning when Abraham Lincoln – who was a noted railroad attorney before becoming President – had a major role initiating the plan for construction of the transcontinental railroad. The Central Pacific built East from Sacramento to meet up in Utah with the Union Pacific (UP) building West from Omaha. The Central Pacific, later the Southern Pacific, was one of the most powerful forces in California for many decades.

SP also operated the passenger rail service between San José and San Francisco, originated in 1863 until it began to be transformed into a government responsibility in 1977, now operated as Caltrain by the Peninsula Corridor Joint Powers Board (PCJPB). As we will see, aspects of the coordination of Caltrain and HSR service in this corridor is one of many challenges CaHSR faces – which provides a useful preview of what UHSGT may face in planning, design, and construction in the Cascadia service area, particularly with Sounder in the Greater Seattle area.

Senate Bill 1856 (Costa)[60] in 2002 provided for a proposition to be on the state-wide ballot in November of 2004 for a $9.95 billion bond issue. Section 1(c) of that Act stated, "The initial network from San Francisco and the Bay Area to Southern California could be in limited operation in 2008" – which proved to be very optimistic.

However, as it appeared that the economic and political conditions did bode well for passage of the ballot proposition, the date of the election was delayed in the Legislature, first to November 2006 and finally, via AB 3034[61] (Galgiani), to the November 2008 Presidential election, Barak Obama vs. John McCain, when a highly favorable voter turnout was anticipated. Proposition 1A, the High-Speed Rail Act, passed with a 52.7 percent majority.[62]

The HSR proponents believed that they would be in for a very difficult election, and would be particularly vulnerable to allegations of promises that would not be fulfilled and "bait-and-switch." So, what was to be presented to the voters, from the original 2002 Act, included several very strong safeguards, including the following:[63]

60 California Legislative Information (CLI), 2002, http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200120020SB1856&search_keywords=high+speed+rail

61 CLI, 2008, http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200720080AB3034&search_keywords=high+speed+rail

62 Ballotpedia, "California Proposition 1A, High-Speed Rail Act (2008)," https://ballotpedia.org/California_Proposition_1A,_High-Speed_Rail_Act_(2008)

63 "California General Election Tuesday, November 4, 2008, Official Voter Information Guide (Supplemental)," Proposition 1A, https://vig.cdn.sos.ca.gov/2008/general/pdf-guide/suppl-complete-guide.pdf#prop1a

- The voters were asked to authorize $9.95 billion of bonds to provide funding for the planning, design, and construction of the system; but no tax increase for HSR.

- The projected full program build-out cost, including both the San Francisco-Los Angeles main line, later extensions to Sacramento and San Diego, and improvements to connecting commuter rail services in the Bay Area and Southern California, would be approximately $45 billion.

- The $9.95 billion of bond financing would be the foundation for the financing of the system, with the majority of the funding coming from the federal government, revenue bonds backed by future fare and other HSR project revenues, private sector investments (in anticipation of future profits), and local government contributions against capital costs.

- Operations and maintenance (O&M) of the system, and each component recommended for construction, must be entirely funded by fares and other operating revenues; the use of any Federal, State, or local government funds for subsidy of O&M is specifically prohibited.

- The HSR system must achieve top operating speeds of at least 200 mph and specified non-stop HSR travel times between several city pairs, including San Francisco-Los Angeles Union Station in 2:40 (hours:minutes) or less and San Francisco-San José in 30 minutes or less.

- These Proposition 1A commitments could be changed only by returning to the voters; the Legislature, Governor, etc., would not be able to alter them (although the Legislature can take actions to interpret and advance the decision of the voters).

Other issues of note include, but are surely not limited to:

Cost Escalation

The November 2008 voter information guide provided an estimated total construction cost of $45 billion for the entire high-speed rail proposed system, including the Sacramento and San Diego legs. The 2018 Business Plan had $77.3 billion (in year of expenditure dollars) for the Phase 1 San Francisco to Los Angeles/Anaheim segment for a projected 2033 service start.[64] However, the 2019 Project Update Report to the California State Legislature – Delivering High-Speed Rail to Californian (hereinafter 2019 Project Update) – which became necessary after Governor Newson's HSR announcements[65] – showed a "Base" cost of $79.1 billion, with a low and high range of $63.2 and 98.1 billion, respectively.[66] The latest available Base estimate to complete Phase 1 is $80.3 billion, with a range of $63 to $98 billion.[67]

64 CaHSRA, "2018 Business Plan," "Capital Costs and Funding," page 33, June 1, 2018, https://www.hsr.ca.gov/docs/about/business_plans/2018_BusinessPlan.pdf

65 Sophia Bollag, "'Let's be real.' Gavin Newsom says he'll cut back on California's high-speed rail plan," Sacramento Bee, February 12, 2019, https://www.sacbee.com/news/politics-government/capitol-alert/article226151030.html

66 CaHSRA, "2019 Project Update Report, Table 2.1, "Updated Program Base Point Estimates and Revised Central Valley Segment Range," page 43, May 2019, https://hsr.ca.gov/docs/about/legislative_affairs/SB1029_Project_Update_Report_050119.pdf

67 CaHSRA, Brian Kelly, "CA High-Speed Rail Authority Program Update," slide 8, February 18, 2020, https://www.hsr.ca.gov/docs/brdmeetings/2020/brdmtg_021820_Item4_Draft_Biz_Plan_2020_Board_Presentation.pdf

The financial plan presented the month prior to the 2008 bond vote had, "Preliminary estimates of the Anaheim to San Francisco segment of the Project total between $32.7 billion and $33.6 billion, according to the Authority's construction manager, Parsons Brinkerhoff "[68] (now WSP). The current $80.3 billion base projection would be a 139 percent to 146 percent cost increase. The range of costs would be a cost escalation range of 88 percent to 200 percent.

The $80.3 billion base cost projection is far from guaranteed, as evidenced by the range – and even the top of the range could be exceeded. For a variety of reasons, including those discussed below, there are strong reasons to believe that this will not be end of the cost increases. CaHSRA has not provided any capital cost projection for the other legs. The CaHSRA 2018 Business Plan provides distances of 800 miles for the entire system and "… more than 500 miles …" for Phase 1; therefore, the portions of the system not costed will be something less than three-eights – <37.5% – of the total system cost. A simple mathematical scale-up of the $79.1 billion for Phase 1 would approach $127 billion. The cost per mile of the portions of the total system added after Phase 1 would likely be less in constant dollars that the Phase 1 costs, all else equal, but since these would be constructed after the Phase 1 system was complete (a time not even being estimated), or at least very well along into construction, inflation would act to increase the year-of-expenditure dollar costs.

Construction by Segment/Schedule Slippage

Obviously, much time has passed since "(t)he initial network from San Francisco and the Bay Area to Southern California could be in limited operation in 2008" appeared in the original 2002 authorization.

The last actual official timetable was for Phase 1 operation, San Francisco to Los Angeles, to be in operation by 2033 and operations from San Francisco to Shafter (Southern Central Valley) by 2029 (*2018 Business Plan*, page 33). However, the *2019 Project Update Report* has made that schedule inoperative[69] and no subsequent CaHSRA document has provided any completion schedule– at the present time, there is no way to know when to expect Phase 1 to be completed – if ever.

Route Creep

For the last few decades, the main line of California intra-State surface travel has been from the San Francisco Bay Area to Greater Los Angeles. The next two largest urban areas are Greater Sacramento and Greater San Diego – in other words, the I-5/CA99 corridors between Sacramento and San Diego coupled with the Bay Bridge/I-580 connection to I-5 south of Tracy in the Central Valley comprehends all four of the largest urban areas.

The current CaHSR map[70] is shown below, including the alignments for serving all these corridors. (The Phase 1 and 2 coloring in the map legend are missing in the original; Phase 1 runs from San Francisco to Los Angeles/Anaheim; everything else is Phase 2.)

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68 Infrastructure Management Group, Inc. et al (IMG), "Financial Plan for the California High-Speed Rail Authority – San Francisco to Anaheim Segment," October 27, 2008, Executive Summary, page 1, https://www.hsr.ca.gov/docs/about/business_plans/BPlan_2008_SRC_FinPlan.pdf

69 Exhibit 2.14, a Gantt Chart "Comparison of Baseline Schedules Since 2012," page 49, shows the 2018 Business Plan 2033 completion date for Phase 1, but there is not even a line for Phase 1 in the 2019 Update.

70 CaHSRA, accessed December 20, 2019, https://www.hsr.ca.gov/docs/newsroom/maps/Business_Plan_Map.pdf

Starting from a blank slate, from the Sacramento Valley Station to the Santa Fe Depot – both of which are very close to I-5 – is approximately 504 road miles. Add the distance from the Salesforce Transit Center in San Francisco to the I-5/I-580 junction in the Central Valley, about 69 miles, and about 35 miles from the I-580 in the Tri-Valley to San José along the I-680 corridor, and the road total is approximately 610 miles. This should be regarded as rough estimate of the shortest alignments to link up the five largest urbanized areas in the State. However, even if this list was adopted as the areas to be served, no more, no less, the actual route miles could be more or less, depending upon the precise alignments – for example, tunneling under the Tehachapi Mountains between the Central Valley and the Santa Clarita area on the southern side of the Mountains rather than following the winding route of I-5 could save distance – and might be the best alternative to trying to run rail up and down grades up to 6% – but the extra costs of tunneling would be significant.

However, as stated above, the CaHSRA 2018 Business Plan is at 800 miles for the entire system – why the extra length of almost 200 miles?

First, let's acknowledge that most of the detail final alignments shown on the map are nowhere near being decided. Second, there are four main "geographic" causes for the extra distance, driven by the usual governmental way of making transportation decisions – the "Christmas Tree" approach described above.

It is inevitable that this exact same type of discussion of alignment and station placement will be a major component of planning for UHSGT; to cite one obvious example, should the alignment through the Greater Seattle region go through the west side of Lake Washington to serve Seattle et al, the east side to serve Belleview et al – or both? If not both, then how will riders from the other get to the main route?

Now, as to those four geographic cases:

- The shortest distance between San Francisco and Los Angeles through the Central Valley is along the I-5 corridor on the Western side of the Valley, but there are no major or even medium-sized cities along that road. On the Eastern side, following the CA99 corridor (which is generally about 20-40 miles distant from I-5 for most of the Valley), starting with Sacramento in the North, the larger communities are Stockton, Modesto, Merced, Madera, Fresno, Kings/Tulare, and Bakersfield, all with stations planned. Running an HSR line somewhat further west could save a few miles of track overall, but would mean missing the built-out areas of these communities, which would trade lower placement issues and expense against rider access. If there were also fewer stations, there would be travel time savings (likely approximately four to five minutes per station eliminated plus a small number of minutes more depending how much the "arc" of CA99 is made into a straighter line) but, fewer riders. This addition of a relatively few miles of track to serve additional potential riders (the Fresno and Bakersfield urbanized areas alone have combined populations well over 1.2 million) appears to be a very understandable decision in this instance, even with the higher cost of construction through urban areas.

- The HSR alignment from the Central Valley to Los Angeles is not now routed along the short I-5 corridor over the Grapevine between the Central Valley to Los Angeles County. Instead, after leaving Bakersfield, the proposed alignment doglegs first up into the mountains along roughly the CA58 corridor to near Mojave in the High Desert, where it turns back South toward Los Angles along the relatively straight and level CA14 to Lancaster and Palmdale (total urbanized area population over 400,000), then down (or under) the long and windy CA14 Southwest decline from the High Desert. This is a long and expensive route for the single added station at Palmdale – but Lancaster/Palmdale is being promoted as a prime new housing area for commuters to jobs in Greater Los Angeles.

- The Phase 1 main line from San Francisco is planned to go through Los Angeles Union Station to Anaheim in Orange County. From Anaheim, following the I-5 corridor would go almost straight and mostly flat East and South to San Diego along the densely populated costal plane with millions of potential riders. However, this is not the plan for the San Diego leg.

  Instead, the Phase 2 San Diego plan is to follow the I-10 corridor almost due East from Los Angeles to San Bernardino, then South along the I-15 Corridor to Riverside and on to San Diego. This is another case of the classic tradeoff between a non-linear alignment and adding stations to draw ridership and running straight with fewer stations to save time for longer trips. With six intermediate stations planned between Los Angeles Union Station and San Diego, the decision is tending towards serving more communities – and their political sponsors, but fewer potential riders. This also means that the Los Angeles-San Diego city pair corridor – the largest near-by population pair in the State, densely populated for the majority of the corridor, with very high trips and well-used Amtrak, Amtrak California, and commuter rail (Metrolink

and COASTER) service, will receive virtually no benefit from CaHSR for trip origins and/or destinations along that coastal corridor.

- The final decision that adds route miles is how to access the Central Valley from the Bay Area. There were three basic alternatives, the shortest, in terms of miles of track required, being the I-580 corridor from San Francisco to East Bay Oakland to the Tri-Valley and then almost directly East to join the line Southeast from Sacramento. This would have likely required an additional CaHSR track south from the I-580 corridor to San José, although BART to San José, currently well into construction, could have been reasonably seen as a valid alternative for transportation purposes, but might not have been acceptable for political purposes. (Interestingly, while there is a maximum travel time requirement for CaHSR travel between San Francisco and San José, but there does not appear to be a requirement to build CaHSR between these two cities; the San Francisco-Los Angeles connection is required, but the alignment is not specified and the San Francisco-San José connection is referred to in the Act, but in the same manner as an Oakland-San José connection – which is not currently planned to be constructed.)

  The second option would be to go down the Peninsula on the Caltrain corridor to a bridge across the Bay near the existing (defunct) Dumbarton rail bridge and then through the Tri-Valley/I-580 corridor to the Central Valley. This would have also required a San José leg, for political if not for transportation purposes.

  However, the decision was to instead go down the Caltrain track in the West Bay to San José, then further South and East to Gilroy, then approximately due East along the CA152 corridor to meet the Central Valley line between Merced and Madera. The latter winds around major hills and includes getting up and down (or under) the 1,368-foot Pacheco Pass and around the San Luis Reservoir.

  (A comprehensive map of the early [2007] Bay Area to Central Valley route alternatives, including numerous variations on the three discussed above, is available at this citation.[71])

  As can be easily noted from the map, this adopted routing decision produces a pair of near parallel tracks of approximately 70 miles each. It also means that CaHSR will be near useless for time-conscious travelers between most of the Bay Area and Sacramento – metro pairs with major travel between them – because of the long round-about route that more than doubles the shorter route over the Almont Pass.

  This is partly a question of deciding which corridors to serve and partly of topographical issues, with the ability to utilize existing passenger and freight corridors also a consideration. The route adopted serves the well populated West Bay along the US 101 corridor between San Francisco and San José and the less populated CA 101 corridor down to Gilroy, then the rural and

71 Cambridge Systematics, Inc., Economic Growth Effects Analysis for the Bay Area to Central Valley Program-Level Environmental Impact Report and Tier 1 Environmental Impact Statement – Final Report," July 2007, Figure 2.2, "Altamont and Pacheco HST Alternatives," page 2-9, https://www.edrgroup.com/pdf/cs%20report_fr1_economic_growth_effects_complete_new.pdf.

undeveloped area East to the Central Valley. The alternative would serve the well populated Oakland/East Bay to the Tri-Valley I-580 corridor and, with the short leg Southeast, would directly serve San José and more of the East Bay. Depending on the alignment chosen to get from San Francisco to the Tri-Valley, it would serve either most of the West Bay corridor served by the selected alignment or Oakland/San Leandro.

The bridge or tunnel from San Francisco to Oakland was on the map, but never seriously considered back in the day, but a new proposal for a joint BART/intercity tube is now being floated – but is still, at best, in preliminary planning.[72] Overall, the I-580 Altamont Pass alternative would provide more service to more people with fewer miles of construction. Cost advantage would be highly dependent upon the details of final alignment selected. A bridge across or a tunnel under the Bay would be very expensive (but could have other uses, such as BART), but so would be totally grade-separating the Caltrain alignment to Gilroy and tunneling under the Pacheco Pass.

Both alternatives have gaps in existing rail corridors. The existing Caltrain/SP corridor from San Francisco to San José and Gilroy, while presenting many challenges to use for HSR (as discussed in detail below), does exist – but Gilroy to the Central Valley, over 30 miles as the crow flies over difficult terrain, has no existing railroad right of way to work with.

The I-580 corridor also has hill/mountain construction challenges, but this alignment has less of these than along the CA152 corridor. The Altamont Pass, at 1,009 feet, is 359 feet lower than the Pacheco Pass and, depending upon the actual alignment, could have an even greater climbing-avoidance advantage (Altamont Corridor Express, the existing commuter rail system between the Central Valley and San José, uses a long-standing freight rail line that snakes through a far lower maximum elevation, which would set up a trade-off between far less expensive construction on the surface vs. time savings). The most recent preliminary Pacheco Pass routes include a 13-mile tunnel.[73]

Because an entirely new rail bridge or tunnel from San Francisco to the East Bay was not seriously entertained at the time the Gilroy alignment was selected, the closest existing rail corridor would requiring going approximately 30 miles south and east along the Caltrain Corridor to near the site of the long-out-of-use and crumbling Dumbarton Rail Bridge – and there are additional discontinuities on the East Bay side.

One factor that may have played a role in the selection of the Pacheco Pass route: At the time of the decision (2007[74]), Rod Diridon, the former Santa Clara County (San José) Supervisor who has been called the "father of the (Santa Clara County) light rail system"[75] was still serving on the CaHSRA Board,

72 San Francisco Bay Area Rapid Transit District, "Planning for a second Transbay tube," November 14, 2018, https://www.bart.gov/news/articles/2018/news20181114-0.

73 Tim Sheehan, "Bullet train board votes on proposed Valley to San José route, amid backlash," Fresno Bee, September 17, 2019, https://www.fresnobee.com/news/local/article235180462.html.

74 Michael Cabanatuan, "Pacheco Pass chosen over Altamont for proposed high-speed rail line," SFGATE, December 20, 2007, https://www.sfgate.com/bayarea/article/Pacheco-Pass-chosen-over-Altamont-for-proposed-3232964.php.

75 "Rod Diridon movin' on," San José Mercury News/Internal Affairs," June 28, 2014, http://blogs.mercurynews.com/internal-affairs/2014/06/26/1598/.

which he formerly chaired. Mr. Diridon, a long-time tireless passenger rail and Santa Clara County promoter, had actively worked for San José to be the Northern California gateway to CaHSR, rather than sharing this status with San Francisco – and this action makes San José Diridon Station that focus, as well as the center of real estate and other development in the area. In addition, going South to Gilroy and then East means significantly more miles of track, and the Gilroy CAHSR Station, in Santa Clara County.

Failure to Attract Private Sector Partner(s)

With an expected initial capital cost of approximately $45 billion when the bond ballot measure was presented to the voters, and $9 billion to be available for HSR from the bonds, the HSR financial plan always included major funding from other sources, particularly including public-private partnerships (P3).

From a CaHSRA press release issued prior to the 2008 State-wide vote:[76]

"California High-Speed Rail Authority Executive Director Mehdi Morshed, joined Governor Schwarzenegger Tuesday in participating in a roundtable discussion at the State Capitol regarding the importance of investing in California's infrastructure and maintaining the state's economic growth through public private partnerships.

"Mr. Morshed noted the California proposed system of high-speed trains offers a unique opportunity to develop a new model for "P3" or public private partnership financing....

"Mr. Morshed noted that high-speed trains are attractive to private investors because California's proposed system will bring a $1 billion annual profit or surplus, once built."

IMG[77] has, "Based on the powers granted to it in its enabling legislation and assuming more normalized market conditions, the Authority plans to execute innovative public-private partnerships ('P3s') and is targeting $6.5 to $7.5 billion in P3 demand." $6.5-7.5 billion would be 19-23% of the original $32.7-33.6 billion San Francisco-Anaheim construction cost estimate.

However, despite extensive and continuous efforts to find P3 partners since even prior to the 2008 HSR bond election, to date, there has been no success and, given the current precarious state of the CaHSR program, little reason to believe that any at-risk financing offers or other offers shifting some or all of the risks of CaHSR will be forthcoming.

There was once what may have been a for-risk private sector offer to design/build/finance/operate/maintain (DBFOM) the San Francisco to Los Angeles HSR, but there are insufficient public documents to allow a determination of the viability of the proposal. In 2010, the *Société nationale des chemins de fer français* (SNCF, "French National Railway Company"), the operator of France's very successful TGV (*Train à Grande Vitesse*, "high-speed train") HSR service, is reported to have made a serious

76 Cited in Robert Cruickshank, "HSP and P3: A Shotgun Wedding?," California High Speed Rail Blog, March 12, 2008, https://cahsr.blogspot.com/2008/03/hsr-and-p3-shotgun-wedding.html

The CaHSRA web site has been largely purged of most historical documents.

77 IMG, Op. Cit., page 1.

offer. Evidently, this did not result in much in the way of a meeting of the minds with CaHSRA.[78]

The SNCF proposal would have followed the shorter I-5 corridor through the Central Valley from San Francisco to over (or under) the Grapevine, building largely on State-owned land with far fewer stations, for considerable savings in construction and operations costs – and not directly serving the cities along the CA99 corridor on the East side of the Valley. There was considerable debate about the acceptability of the particulars of the SNCF proposal when it became public (two years after it was made; CaHSRA never made the offer public on its own initiative), but then-CaHSRA Chair Dan Richard stated that the offer had "… no offer of funding …, "… there is the small matter that bypassing Central Valley towns raises serious legal questions along with environmental concerns," and called out SNCF for "… their (sic) role in deporting French Jews to death camps during WW II."[79] In the Times article that broke the story, an SNCF employee responded, "Simply put, the California High-Speed Rail Authority has a wish list, not a plan. This lack of an investment-grade business plan is a deadly defect, particularly in a project that by law cannot rely upon government subsidies for its operations and maintenance." At this late date, it is not possible to determine if this was a serious preliminary approach that could have developed into a useful P3 approach by a substantial organization with significant resources and expertise based on serious discussion between a willing seller and a willing buyer, an attempt to get a foot in the door by a contractor not really offering to take risk on its own head, or a refusal by a government body to consider anything but its own predetermined preferences.

Federal Funding and Potential Claw Back

The *2019 Project Update*, Table 3.1, "Summary of Total Funding Available and Total Funds Expended as of 01/31/19," shows "Total Authorized Funding" of $20.45-23.45 billion. $3.48 billion, or 15-17%, of that is Federal funds. Of the "Total Expended to Date" of $5.02 billion, $2.55 billion, or 51%, is from Federal funds.

The CaHSR master plan had always included Federal funding, but, for many years, it was more of a hope than a valid expectation based on adopted governmental action. However, after Barak Obama become President in January 2009, with strong Democratic majorities in both houses of Congress, one of the landmark components to his response to the onset of the Great Recession was the American Recovery and Reinvestment Act of 2009 (ARRA). ARRA had a total of approximately $800 billion of mostly capital grants with an emphasis on "shovel ready" projects that could be started quickly to speed the U.S. recovery.[80] One component of ARRA was the High Speed

78 Dan Weikel and Ralph Vartabedian, "High-speed rail officials rebuffed proposal from French railway," Los Angeles Times, July 9, 2012, https://transdef.org/wp-content/uploads/High-speed-rail-officials-rebuffed-proposal-from-French-railway.pdf.

79 Robert Cruickshank, "New Evidence Shows Flaws in SNCF Plan for California HSR, California High Speed Rail Blog, July 11, 2012, http://www.cahsrblog.com/2012/07/new-evidence-shows-flaws-in-sncf-plan-for-california-hsr/.

80 U.S. Congress, H.R.1 - American Recovery and Reinvestment Act of 2009, 111th Congress (2009-2010), accessed December 22, 2019, https://www.congress.gov/bill/111th-congress/house-bill/1/text.

Intercity Passenger Rail (HSIPR) Program,[81] with $8 billion for "High-Speed Rail/ Intercity Passenger Rail"[82]

Projects eligible for grants from this program do not have to meet the international commonly accepted definition of being able to operate at speeds of approximately 150 mph or over on new track or 125 mph on upgraded track; the still-active Federal definition is found in the Passenger Rail Investment and Improvement Act of 2008 §501, which defines high-speed rail as "intercity passenger rail service that is reasonably expected to reach speeds of at least 110 miles per hour." The impact of this definition meant that sponsors of far more projects in far more states were eligible to apply for these new Federal grant funds.

Also, the specific provisions of ARRA actually provided for "… Federal share of the costs … up to 100%" (*FR*, p. 29902). However, after the Democrats lost their majority in House at the November 2010 election, the massive additional funding for passenger rail that had been anticipated failed to appear, resulting in the anticipated huge and fast expansion of funding totally failing to meet the original hopes.[83]

The Obama Administration, wanting to maximize the geographic distribution of the available funds, decided to allocate the $8 billion of HSIPR and other ARRA and U.S. DOT funds to as many programs in as many states as possible, producing grants to projects in 31 states and the District of Columbia. Most states received planning grants of limited amounts, but there were larger grants to major projects, including $2.25 billion for CaHSR (the largest), $598 million for Eugene-Portland-Seattle-Vancouver, B.C., $822 for Madison-Milwaukee-Chicago, and $1.25 billion for Tampa-Orlando.[84] However, in several states (including those with Republican governors in Florida, Ohio, Texas, and Wisconsin), the projects were cancelled and the grant funds refused by the states.[85] These decisions are still being debated; one side being that such decisions were short-sighted, and the other was that taking the grant funds would obligate the respective states to finance the major share of a very expensive project providing unknown and speculative benefits; there were obvious political considerations on both sides.

The Obama Administration decided to reallocate the refused grant funds to the states that were still interested – on a more-or-less proportional basis. As other states dropped out, this worked in California's favor, increasing the original $2.25 billion allocation to $2.5 billion in one grant[86] and $926.6 million in another[87], a total increase of $1,176.6 billion, over 52%.

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81 U.S. Department of Transportation (USDOT), Federal Railway Administration (FRA), "High Speed Intercity Passenger Rail (HSIPR) Program, https://cms8.fra.dot.gov/passenger-rail/high-speed-rail/high-speed-intercity-passenger-rail-hsipr-program.

82 FRA, "High-Speed Intercity Passenger Rail ("HSIPR") Program, Notice, Federal Register (FR), Vol. 74, No. 113, Tuesday, June 23, 2009, pp. 29900-29, https://www.govinfo.gov/content/pkg/FR-2009-06-23/pdf/E9-14692.pdf.

83 Natasha Front, "A decade ago, the US was promised high-speed rail – so where is it?", QUARTZ, December 27, 2019, https://qz.com/1761495/this-is-why-the-us-still-doesnt-have-high-speed-trains/?utm_source=google-news.

84 Casey Mayville, "High-Speed Rail Corridors Get $8 Billion From Obama Administration," Government Technology, January 28, 2018, https://www.govtech.com/transportation/High-Speed-Rail-Corridors-Get-8-Billion.html.

85 Larry Sander, "Wisconsin shut out of federal train money," Journal Sentinel, May 9, 2011, http://archive.jsonline.com/news/statepolitics/121493924.html

86 CaHSRA, "Capital Costs & Funding," accessed December 22, 2019, https://www.hsr.ca.gov/about/capital_costs_funding/.

87 CaHSRA, FRA-CaHSRA "Cooperative Agreement," Amendment 1, January 18, 2017, https://www.hsr.ca.gov/docs/about/funding_finance/funding_agreements/Executed_FY10_Amendment_1.pdf.

The Brown Administration and CaHSRA, with the assistance of the strong Democratic majorities in both houses of the State Legislature, decided to do begin construction and speed it along to the maximum extent possible with the available funds, including aggressively working to gain favorable interpretations of the applicable laws and regulations – without objection from the FRA.

The CaHSR program was facing several complex issues at this time. The overriding State political and project furtherance priorities were getting something into construction as soon as possible. This produced a decision to start construction in the Central Valley, which had several advantages for this purpose:

- Compared with the rest of the Phase 1 corridor, the Central Valley alignment was flat, level, and, to a major extent, through largely rural farmland, which meant that far more miles could be constructed per billion dollars expended than in either the Bay Area or the Los Angeles/Orange County sections and the over-the-mountain approaches to either.

- The major opposition to CaHSR was centered in the San Francisco Bay Area and Southern California regions, particularly along the Caltrain Corridor between San Francisco and San José. (This is certainly not to say that there was no opposition in the Central Valley or that there were no CaHSR supporters in the more urbanized areas.)

- While there were actual and potential legal challenges all up and down the Phase 1 line, the Central Valley had the fewest and the ones that were there appeared to be the most likely to be won outright or settled through compromise.

Also, the Federal funds had deadlines for starting and ending construction (there was a major original emphasis in ARRA to get "shovel ready" projects into construction quickly to stimulate the economy – which largely proved not very realistic). However, because Proposition 1A requirements for bond funding to be released for construction mandated plans to be fully developed, including funding, and plans to be approved first. Because these approvals were being delayed, including by legal actions, the State did not have the Prop. 1A local matching bond funds to be able to draw down the Federal funds.

This problem produced three attempts at solutions. First, CaHSRA was able to negotiate with the still-Obama Administration FRA to have the deadlines extended. Second, CaHSRA lobbied FRA to allow Federal funds to be expended without requiring concurrent local match. Instead of the usual requirement that all funding sources be drawn down proportionally as construction occurred, the resulting agreement allowed Federal funds to cover a far higher percentage of the early costs.[88] Third, the Brown Administration decided to use Cap-and-Trade funds for CaHSRA construction (see following section).

To say the least, the Trump Administration has been less favorable to Federal funding of HSR in the USA, and particularly in California, than its predecessor. When Governor Newsom announced in February 2019 that construction of CaHSR

88 Ralph Vartabedian, "Key construction deadline for California bullet train pushed back four years," Los Angeles Times, May 18, 2016, https://www.latimes.com/local/california/la-me-bullet-train-warning-20160518-snap-story.html.

would only be continued for the then-in-construction section and a two short new sections in the Central Valley, one of his justifications for not stopping the project entirely was, "Abandoning high-speed rail entirely means we will have wasted billions of dollars with nothing but broken promises and lawsuits to show for it and, by the way, I am not interested in sending $3.5 billion in federal funding that was allocated to this project back to Donald Trump."[89]

However, this announcement was seized by the Trump Administration to support its contention that California would not complete the CaHSR project, which it interpreted to trigger a Federal rule that, once Federal transportation capital grant funds are accepted, the grantee must first, complete the project and, second, use it for its intended purpose for the stipulated useful lives of the assets that were purchased with the grant funds – or the grantee has to repay the unutilized portion of the grant funds to the Federal government. Assuming that Trump Administration would allege that no HSR service was ever operated, that would lead to a demand for the return of 100% of the Federal funds received.

On February 19, 2019, the FRA published, "The U.S. Department of Transportation announced today that the Federal Railroad Administration (FRA) intends to cancel $929 million in Federal grant funds yet to be paid for the California High-Speed Rail project envisioned to connect the L.A. Basin to the San Francisco Bay Area. In addition, the Department announced it is actively exploring every legal option to seek the return from California of $2.5 billion in Federal funds FRA previously granted for this now-defunct project."[90]

The same day, FRA Administrator Ronald Batory provided CaHSRA Chief Executive Officer Brian Kelly with a "Notice of Intent"[91] "that "FRA has determined that CHSRA has materially failed to comply with the terms of Agreement …" (Cooperative Agreement NO. FR-HSR-0118-12-01-01 for $928,620,000) and "… intends to terminate …" the Agreement. Among other alleged deficiencies, "… the contractor has expended 25.1% of the contract price but approximately 86.5% of contract's period of performance has elapsed, demonstrating that CHSRA is not advancing construction work at the pace necessary to maintain the Project's schedule."

CaHSRA has responded, taking strong exceptions in two separate letters (that have since been taken down from the CaHSRA web site) for the funds that "… will mostly be dedicated to the final construction of the Initial Construction Segment from Madera in the north to Shafter in the south."[92]

On May 16, 2019, FRA completed its action and terminated the Cooperative Agreement, with the statement, "… California has abandoned its original vision of a high-speed passenger rail service connecting San Francisco and Los Angeles, which was essential to its applications for FRA grant funding. FRA continues to consider all

89 Marisa Lagos, "Gov. Gavin Newsom Pivots on Water Tunnels, High-Speed Rail in First State of the State Address," KQED/The California Report, February 2, 2019, https://www.kqed.org/news/11725616/gov-gavin-newsom-gives-first-state-of-the-state-address

Andrew Nixon, "Transcript and Analysis: State Of The State 2019," Capital Public Radio, Sacramento, February 12, 2019, http://www.capradio.org/articles/2019/02/12/text-and-analysis-state-of-the-state-2019/

90 FRA, "U.S. Department of Transportation Announces Cancellation of Grant Funds to CA High Speed Rail Project," February 19, 2019, https://www.transportation.gov/briefingroom/dot0719.

91 https://www.transportation.gov/sites/dot.gov/files/docs/briefing-room/331591/fra-letter-cahsr-termination.pdf.

92 Jeff Davis, "California HSR Authority Responds to FRA Attempt to Cancel Their Grant, "Eno, March 8, 2019, https://www.enotrans.org/article/california-hsr-authority-responds-to-fra-attempt-to-cancel-their-grant/

options regarding the return of $2.5 billion in American Recovery and Reinvestment Act (ARRA) funds awarded to CHSRA."[93]

A few days later, the State announced it was bringing legal action against the Federal government for cancelation of the grant.[94]

We will not attempt to predict the outcome of this dispute; however, from what is in public view, it appears that it may take a while to achieve final resolution. One thing that we do know is that the Trump Administration has strong power to stop any further flow of funds to CaHSR while this dispute is being resolved. It is unclear where the money for repayment would come from if there were to be a final determination that is necessary. It may not be possible to finance this by the sale of Prop. 1A bonds because these were for the *construction* of CaHSR and repayment of grant funds after a determination that CaHSR *will not* be constructed, triggering a breach of contract, could conceivably be challenged. It is also conceivable that if the State does not agree to make repayment on terms dictated by the Trump Administration, the amount in question would be withheld from other federal transportation grant funds paid to California on a schedule that the federal government may determine.

Any of the actions above by the federal government could be expected to result in legal challenges by the state.

One obvious observation is that the final outcome may be less dependent on the legal arguments and the skills of the attorneys than on the outcome of the 2020 election, particularly if the Democrats win the Presidency and control of both houses of Congress – and we most definitely are not going to make any predictions in that regard.

Use of Cap-and-Trade Funds

The 2019 Project Update, Table 3.1, "Summary of Total Funding Available and Total Funds Expended as of 01/31/19," shows "Total Authorized Funding" of $20.45-23.45 billion. $8.42-11.42 billion, or 41 to 49 percent, of that is cap-and-trade funds, Of the "Total Expended to Date" of $5.02 billion, $.61 billion, or 12%, is from cap-and-trade.

Cap-and-trade is a market-based method to reduce GHG. Established in California by the California Global Warming Solutions Act of 2006 (AB32, Nunez), it "… directs the Air Resources Board (ARB) to issue a limited number of 'allowances' (essentially, emission permits), which large GHG emitters can purchase at a state-run auction or on the private market. … From an economic perspective, the primary advantage of a cap-and-trade program is that the market sets a price for GHG emission, which creates a financial incentive for businesses and households to implement the least costly emission reduction activities."[95]

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93 FRA, "Statement of Federal Railroad Administration on Termination of FY '10 Grant Agreement with California High-Speed Rail Authority," May 16, 2019, https://cms7.fra.dot.gov/newsroom/statement-federal-railroad-administration-termination-fy-'10-grant-agreement-california.

94 Ralph Vartabedian, "California high-speed rail agency sues Trump administration for canceling grant, Los Angeles Times, May 21, 2019, https://www.latimes.com/politics/la-pol-ca-california-high-speed-rail-lawsuit-trump-administration-20190521-story.html.

95 Mac Taylor, California Legislative Analyst, "The 2017-18 Budget: Cap-and-Trade," February 2017, page 3, https://lao.ca.gov/reports/2017/3553/cap-and-trade-021317.pdf.

Cap-and-trade is intended to reduce GHG emissions in two ways. First, reducing the amount of allowances each year, the price is expected to increase, thereby providing a long-term incentive for major emitters to continue to improve their processes to reduce emissions. Second, "All California Climate Investments must further the objectives of AB32 to reduce the GHG emissions that contribute to climate change, and achieve additional objectives such as reducing other forms of air pollution, including pollution within disadvantaged communities;"[96] in other words, the revenues from sales of allowances are to be used to fund programs and projects to reduce GHG emissions.

AB32 was enacted with a specific objective of reducing California GHG emissions to their 1990 levels by 2020 and providing a number of requirements and methods – including cap-and-trade – to accomplish that. Because, at the time it was enacted, the 2020 goal was the first and only target, the initial priorities for cap-and-trade investments was for projects that could have a return on investment – GHG emission reductions – relatively quickly, definitely no later than 2020.

Then, two events occurred. The first was that there were legal challenges that could have possibly overturned the State's ability to receive the cap-and-trade revenues. Specifically, if a court found that cap-and-trade was a tax, which required a two-thirds majority to become law, rather than the 50%+1 majority that was applied, the State's ability to conduct cap-and-trade could be ended. The second was that, as discussed above, California needed funds for the local share of CaHSR construction costs. Both of these issues were settled by the passage of an extension and revision act, AB1532 (Pérez, 2012), that reauthorized cap-and-trade by a two-thirds majority in both Houses, clarified that the revenues could be used for a long list of uses – and "… would prohibit the Governor's written findings on the proposed link (between State actions regarding GHG and results) from being subject to judicial review" (AB1532, Legislative Counsel's Digest) – such as use of cap-and-trade revenues for CaHSR construction.

This use of cap-and-trade revenues was controversial, particularly from the environmental community. While CaHSR has always been promoted as providing GHG benefits (see next section), even if these are achieved, the benefits cannot begin to be realized until the system is in service – and the last adopted start date for Phase 1 was 2033 and that start date has been abandoned and not replaced. Therefore, at this point, no one has any idea when Phase 1 service will begin. The 2019 Project Update has Merced-Fresno-Bakersfield service commencing in 2028, but the GHG reductions from a shorter line would, at best, be far less than for the full line and, unless the passenger loads for the short line are very high, there might not be any benefit; short line operations could actually be negative for GHG if the average passenger loads were less than for the full line.

However, *building* CaHSR is a major *generator* of GHG, as is discussed in the following section.

So, best case, CaHSR will be negative for GHG for many years to come, particularly when compared to what could have been accomplished if the cap-and-

96 State of California, Cap-and-Trade Auction Proceeds – Second Investment Plan: Fiscal Years 2016-17 through 2018-19, page ES-2, January, 2016, https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/16-17-updated-final-second-investment-planii.pdf.

trade funds utilized for CaHSR had instead been used for projects that could have immediate positive impacts.

With almost half of the committed funds for CaHSR shown as coming from cap-and-trade, this is obviously a very important component of construction funding – and, if Federal funds are stopped, and particularly if the State is required to repay the Federal government for funds it has already expended, they would be even more important – assuming, of course, that the project continues.

This sets up a strange situation in that cap-and-trade was originally intended to reduce GHG emissions, including, over time, reducing the volume of cap-and-trade allowances to be sold. However, if cap-and-trade is to be used to fund CaHSR (and several other popular programs), if the number of units sold is reduced, then the revenues that can be used to finance HSR and the other programs may also be reduced. One of the founding principles of cap-and-trade is to have the price of the allowances continue to increase over time to encourage GHG generators to invest in reducing GHGs instead of buying allowances, thus setting up a most interesting test to see if prices will go up more than the quantity sold goes down. Thus, oddly, the more that CaHSR (and the other program) must be funded from cap-and-trade revenues because there are no other available sources, the more pressure there will be to increase the number of allowances, allowing major GHG emitters to continue to pay the State to avoid having to pay the costs of reducing their GHG emissions – which appears to be a rather odd public policy position.

Greenhouse Gas Emission Reduction

GHG reduction has always been advanced as a major justification for CaHSR.

In passenger transportation, energy efficiency and GHG comparisons are very dependent upon passenger loads; the higher the average passenger load, all else equal, the less energy it takes to move a passenger one mile and the lower the GHG and other emissions per passenger mile.

However, the load factors utilized by CaHSRA in doing its operating, financial, and other modeling and projections have been questioned. The original 2008 load factor was evaluated as extraordinarily high:

> *"The Authority's projection is far higher than what is found on high-speed rail systems around the world. The Authority anticipates an average load factor of nearly 85 percent. The Federal Railroad Administration's study for California placed the average at 51 percent. The TGV system in France-which I've been on and I love, claims a load factor of 71 percent. The Authority's projected load factor is nearly 20 percent higher than the very impressive French figure."*[97]

If the CaHSRA load factor assumptions do not bear out, the reductions in GHG emissions could be significantly reduced or even eliminated.

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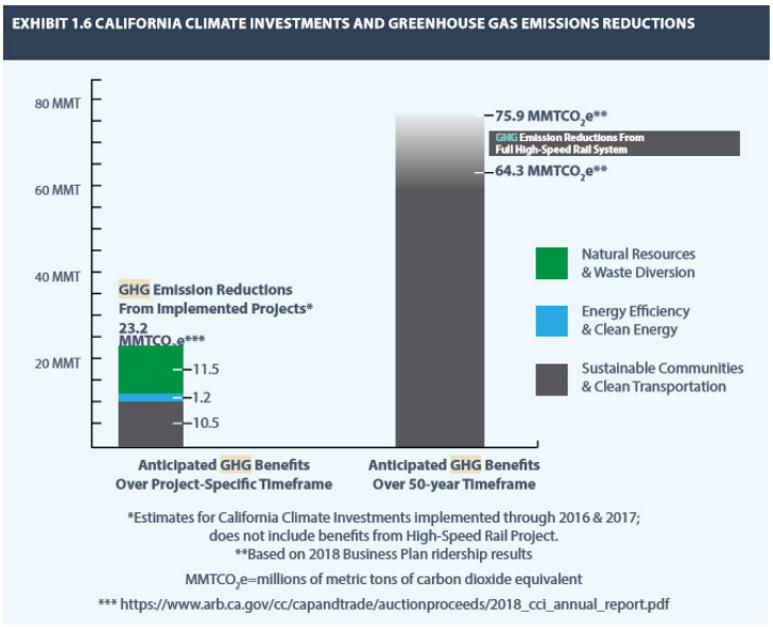
97 Joseph Vranich, "Review of the California High-Speed Rail Business Plan," Testimony to the California Senate Transportation and Housing Committee, October 23,2008, https://reason.org/testimony/review-of-the-california-high/

For more detail, see Wendell Cox and Joseph Vranich, The California High Speed Rail Proposal: A Due Diligence Report, Reason Foundation Policy Study 370, September 2008, https://reason.org/wp-content/uploads/2008/09/1b544eba6f1d5f9e8012a8c36676ea7e.pdf

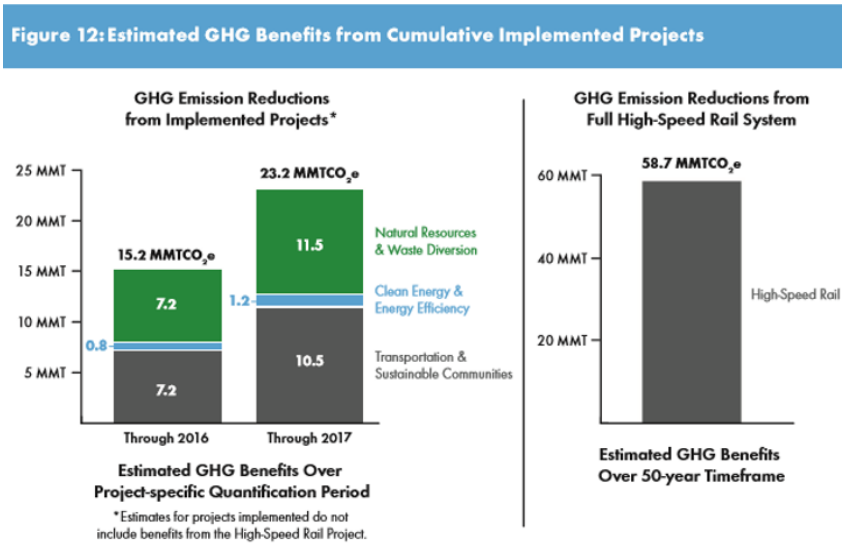
Joseph Vranich and Wendell Cox, California High Speed Rail: An Updated Due Diligence Report, Reason Foundation Policy Study 415, April 2013, https://reason.org/wp-content/uploads/2013/04/california_high_speed_rail_report.pdf.

Now let us turn to how CaHSR presents its GHG savings; from the *2018 Business Plan*, page 10:



Unless the reader reviews the above Exhibit very carefully, along with the following text, and then goes to the source document, and then the source document for its source document, it is very easy to draw incorrect conclusions – as in, it looks like CaHSR could be providing on the order of three times the GHG reductions as everything else combined.

Taking a closer look, however, shows that the savings shown for CaHSR – 64.3-75.9 million metric tons of carbon dioxide equivalent (MMTCO2e, hereinafter "Unit") reductions – is over a 50-year period. As there is not much further detail in the 2018 Business Plan, we went to the source cited in the Exhibit, the California Air Resources Board 2018 Annual Report (to the State Legislature) – *Cap-and Trade Auction Proceeds*[98] (for 2018), with a similar graphic, with additional information and discussion:



98 California Air Resources Board 2018 Annual Report (to the State Legislature) – Cap-and Trade Auction Proceeds, page 39, https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/2018_cci_annual_report.pdf

First, to properly understand what is being presented, the GHG emissions savings are for programs that were funded by the proceeds of the cap-and-trade auctions, as is made clear by title and text of the *Cap-and Trade Auction Proceeds* report.

There are two obvious differences in the graphics. In *Auction Proceeds*, the CaHSR value is 58.7 Units, while the *Business Plan* graphic has a range of 64.3-75.9 – 10-29% higher. A search of *Auction Proceeds* did not produce either of the *Business Plan* values and we were unable to find any discussion or calculation that would produce either. The HSR value changes over time; the 2019 version of *Auction Proceeds*, Figure ES-3[99], which is comparable to the 2018 Figure 12 above, shows 64 Units from CaHSR over the same period – but this was not published until March 2019, while the 2018 *Business Plan* is dated June 1, 2018.

The values on the left side of the graphic for "Through 2017" match. The *Auction Proceeds* graphic presents two values, cumulative through 2016 and 2017, which shows an increase of 8.0 Units in the most recent year, 53% of the base year total. This demonstrates that the values of the program are accruing swiftly, rather than at some distant – and uncertain – date when CaHSR Phase 1 will go into operation, and assuming that the projected GHG emission reductions will be realized, a positive outcome made somewhat uncertain by the record of the CaHSRA on making good its previous claims, such as to costs and schedule.

Heavy construction is well-known as a major generator of GHG emissions. We were interested in determining how the up-front generation of GHG for CaHSR construction was factored into the 58.7 Units benefits claimed. There was some discussion of this in *Auction Proceeds*, but this did not satisfy our needs, so we attempted to go to the source document therein cited, the CaHSRA *2016 Sustainability Report*, page viii, footnote 4. While the various CaHSR *Business Plans* do have a lot of discussion of GHG emissions during construction, these focus primarily on actions that are being taken to reduce emissions – but fail to disclose what the actual CaHSR construction emissions are.

Unfortunately, we were unable to find the *2016 Report* on the CaHSRA web site. The comparable reports for 2017, 2018, and 2019 were available and, after some comparisons, we believe that the *2017 Sustainability Report* can serve as a reasonable surrogate for its earlier sister document.

We compared the data from Exhibits 3.3, "Forecast of Average Annual Savings for Key Milestones (MMTCO2e)" and 3.4, "2016 Business Plan Forecast of Cumulative Savings (MMTCO2e)" and determined that the cumulative savings appeared to be a summation of the annual savings once CaHSR goes into operation. For example, Table 3.4 shows "High Scenario" cumulative savings of 16.8 Units through 2030, Table 3.3 shows "High Scenario" annual savings of 0.17 units for 2025 through 2028 and 1.3 for 2029 through 2040. Four years of 0.17 plus twelve years of 1.3 total 16.3. Calculations for the other cumulative totals from the annual averages were all close, but not exact, most likely due to rounding errors – in both directions.

From this, we conclude that the representations for GHG savings from CaHSR do not include the GHG emissions from CaHSR construction. We believe that this

99 California Air Resources Board 2019 Annual Report (to the State Legislature) – Cap-and Trade Auction Proceeds, page vii, https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/2019_cci_annual_report.pdf.

is a significant omission, but there is not sufficient data in the CaHSR documents we reviewed to be able to perform an acceptable evaluation for the California HSR project.

Perhaps the best known GHG emission value in California is the 427 units that is the accepted 1990 state-wide total[100]; this is the target value for all California GHG reductions to be achieved in 2020 – and then later to be reduced by 80 percent. The 1.3 Units "High Scenario" value for CaHSR reductions for Phase 1 full operations would be 0.3 percent of the 1990 State-wide total and the 2020 target. Three parts in a thousand is worth pursuing, after due consideration of other factors, but is hardly a major contributor.

Then we have the costs to achieve these benefits. Page 39 of *Auction Proceeds* states, "The $2 billion in funds implemented through 2017 are expected to reduce GHG emissions by over 23 million MTCO2e over their respective GHG emission reduction timeframes …," which works out to a cost of approximately $86 for each Unit of reduction.

From Table 3.1 of the *2019 Project Update*, as cited above, $8.42-11.42 billion of cap-and-trade funds are shown as allocated to CaHSR to produce the 58.7 Units in GHG reductions, a cost ranging from $143-195 per Unit, or 66-127% more per unit. Obviously, by the numbers, CaHSR is far from the best available use of the funds available to reduce GHG emissions.

Even $50/MMTCO2e is not a particularly low cost for reducing GHG emissions. More than a decade ago, McKinsey & Co. and the Conference Board issued a well-received joint report.[101] Under the heading, "The Central Conclusion of this Project," it stated, "The United States could reduce greenhouse gas emissions in 2030 by 3.0 to 4.5 gigatons of CO2e … at marginal costs less than $50 per ton …" (Executive Summary, page ix) and, in a graphic that has been widely reproduced (Exhibit B, "U.S. Mid-Range Abatement Curve – 2030," page xiii), shows literally several dozen technologies worthy of consideration, with only about 10% with costs over $50/unit – and about 40% of the technologies showing a net *reduction* in costs of implementation of GHG reduction methods. $50/Unit has become something of a standard for such calculations; for example, in a presentation to the ARB for consideration of a cap-and-tax GHG abatement, used a tax of $50/Unit, in part based on an assumption that the social cost of GHG emissions was $50/Unit.[102]

Finally, from reviewing the prices paid by entities that are purchasing Units at the quarterly auctions, the price range for the six auctions from August 2018 to November 2019 was $15.05 to $17.45 for the "Current Auction Settlement Price" and $14.90 to

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100 California Environmental Protection Agency Air Resources Board, Staff Report, California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit," page 27, November 16, 2007, https://ww3.arb.ca.gov/cc/inventory/pubs/reports/staff_report_1990_level.pdf.

101 McKinsey & Co./The Conference Board, Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?, December 2007, https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/Reducing%20US%20greenhouse%20gas%20emissions%20How%20much%20at%20what%20cost/Reducing%20US%20greenhouse%20gas%20emissions%20How%20much%20at%20what%20cost%20Final%20Report.ashx.

102 Joint Meeting of the California Air Resources Board and the EJAC (Environmental Justice Advisory Committee), (draft) "Recommendations from the EJAC presented at the January 27, 2017 Hearing of the Air Resources Board and draft Responses," February 14, 2017, page 2, https://ww3.arb.ca.gov/cc/ejac/meetings/02142017/crosswalk.pdf

In the example in the presentation, $50 was presented as the social cost of GHG emissions, which was used as the theoretical tax level.

$17.40 for the "Advance Auction Settlement Price,"[103] for a simple average price of $16.22.

Therefore, the $143-195/Unit in cap-and-trade funds that CaHSR is projecting it will achieve is nine to 12 times what the buyers of allowances are paying for the ability to keep generating GHG.

Therefore, by any standard, using cap-and-trade revenues to pay for CaHSR as a GHG emissions reduction tactic appears very difficult to justify.

Keep in mind that these cost per unit calculations only consider the cap-and-trade funds proposed to be used for CaHSR construction, which are approximately 11 to 14 percent of the latest total point capital cost projection of $79.1 billion. Even if funding can be found to complete Phase 1 at the latest projected cost (both far from certain), the total investment per unit of GHG reduction from CaHSR construction would be seven to nine times higher than the $143-195/Unit calculated above.

California has taken a strong position that there is an urgent need to reduce GHG emissions as soon as possible. Assume there are two options, starting immediately with most non-CaHSR projects, versus a best CaHSR case starting well over two decades in the future. CaHSR promises to become a net GHG reduction tool – and a minor one compared to total California GHG emissions. Going with CaHSR faces the very high risk that it will not ever be completed anywhere near what was originally promised and will wind up actually being a net *creator of additional GHG emissions*. The GHG benefits presented by CaHSR proponents do not appear credible compared to the decades-faster-to-implement, far less expensive, well-proven options.

Allegations of Improper Conduct Against WSP

According to a *Los Angeles Times* story:[104]

> *"When Mark Styles was hired in October 2018 to help oversee Central Valley scheduling for the California bullet train, he soon learned he had walked into a mess.*
>
> *"Over the previous half-decade the project had repeatedly fallen behind schedule, and the cost by 2018 had jumped from $65 billion to $77 billion in two years.*
>
> *"A core problem was the project's operating culture, in which managers for WSP, the bullet train's lead consultant, threatened to punish or terminate employees if they failed to toe the company line, Styles said.*
>
> *"'I was told to shut up and not say anything,' said Styles, a career construction manager who was hired as WSP's senior supervisory scheduler in the project's Fresno office. 'I was told that I didn't understand the political arena the project was in. I told them I am not going to shut up. This is my job.'*
>
> *"The atmosphere described by Styles has been corroborated by a half-dozen current and former senior officials knowledgeable about the project's Fresno office."*

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103 California Air Resources Board, "California Cap-and-Trade Program, Summary of California-Quebec Joint Auction Settlement Prices and Results, Last updated November 2019," https://ww3.arb.ca.gov/cc/capandtrade/auction/results_summary.pdf

104 Ralph Vartabedian, "California bullet train officials say they were told to suppress bad news and 'shut up,'" Los Angeles Times, March 9, 2020, https://www.msn.com/en-us/news/us/california-bullet-train-officials-say-they-were-told-to-suppress-bad-news-and-shut-up/ar-BB10XLFe.

The full story adds considerable additional details.

A follow-up article continues:[105]

"A California bullet train consultant facing allegations that its executives retaliated against employees for bringing forth negative information about the project has hired a law firm to independently investigate the matter.

"The investigation was disclosed by the California High-Speed Rail Authority at a meeting of its Board of Directors on Tuesday …

"The project is also being investigated by the criminal division of the U.S. Department of Transportation's inspector general, The Times *has learned. Former project officials told* The Times *that they were contacted by investigators out of the agency's San Francisco office."*

WSP is the prime author of *UHSGT*.

Legal Challenges

Major construction projects in the U.S. are a frequent target of claims and lawsuits in general, the bigger and more complex the project, the larger the number of claims and lawsuits and larger the dollar value.

California is generally acknowledged to be a highly litigious state. The California Environmental Quality Act (CEQA) offers several very well-known opportunities for opponents of construction projects to delay construction and to encourage project sponsors to seek settlements and compromises; it is impossible to cause a project to be cancelled directly by a CEQA action, but it is very common for projects to be delayed for long periods – and for the costs of the delays, and the settlements, to be important factors hurting the prospects of bringing in projects on time and on budget.

Even by these standards, however, the California High-Speed Rail project has proven to be an exceptional claims and lawsuits magnet. There is much to be learned from the California experience for any other potential High-Speed Rail proponents.

One of the main factors in the large number of claims and legal actions has been and continues to be the strong guarantees that were written into the enabling legislation that eventually placed Proposition 1A on the ballot in November 2008; many people – and their attorneys – believed that these were promises made to the voters that were, if necessary, legally enforceable.

Given that the opponents of CaHSR believed that election would be close, they objected to the ballot language being created by its proponents, namely, being part of the bill that specified that the measure be placed on the ballot. The leading California taxpayers association filed *Howard Jarvis Taxpayers Association v Bowen* (the then-California Secretary of State) asking for the courts to mandate that the California Attorney General should write the ballot language. The court of origin declined, but

105 Ralph Vartabedian, "California bullet train officials reveal ethics probe and OK plan for L.A. Union Station," Los Angeles Times, April 21, 2020, https://www.msn.com/en-us/news/us/california-bullet-train-officials-reveal-ethics-probe-and-ok-plan-for-la-union-station/ar-BB130JFI.

HJTA won on appeal[106] – however, by that time, the measure had passed and the question of a more unbiased ballot measure presentation being enough to change the results will remain forever hypothetical – even assuming that then-Attorney General Jerry Brown, who later as Governor was a very strong supporter of CaHSR, would have prepared ballot language more to the liking of HJTA.

Building or expanding a rail line through dense suburban communities led to the abandonment of the original plan for four-track rail corridors at the San Francisco and Los Angeles ends of Phase 1, one pair of tracks for HSR and one for commuter rail and freight movements. The town of Atherton, the City of Palo Alto, and other communities on the San Francisco Peninsula were sufficiently concerned about CaHSR impacts that they brought suit, basically, against the decision to connect San Francisco to the Central Valley via the Pacheco Pass. They attempted to get the route changed to the Altamont Pass, which would have meant far less, or perhaps even no, changes to the Caltrain alignment for CaHSR. Their first action was a challenge to the CaHSR Program FEIR in 2010, which forced CaHSRA to redo the EIR – the revised version was also challenged, this time unsuccessfully in the court of origin. That outcome was appealed and the final opinion, in favor of CaHSRA, allowing it to proceed with planning of the Pacheco Pass alignment, came in 2014.[107]

The strong guarantees built into Proposition 1A that required well-documented plans showing that project segments could be completed proved to be a fertile generator of potential legal actions. The King County Board of Supervisors and local landowners brought an action to prohibit the sale of bonds because the planning requirements had not been met. In 2013, The Superior Court Judge hearing the action ruled that CaHSRA "abused its discretion by approving a funding plan that did not comply with the requirements of the law" and "has failed to identify sources of funds that were more than merely theoretically possible."[108]

This was one of a number of actions that were brought by local governments and other interested parties in the Central Valley that were upset by the disruption of CaHSR construction; most of these have been settled, generally for relatively minor changes, if any, in route, funds for replacement of structures, higher relocation payments, and/or legal and administrative costs of the plaintiffs.[109]

CaHSRA has had multiple difficulties in acquiring the necessary plots for construction in the Central Valley. Among other problems, the number of parcels required was evidently underestimated at approximately 1,400, but is now over 1,900. As well as the number of parcels to be acquired increasing, the rebound in Valley real estate prices moved the budget from the original $764 million to over $1.5 billion – and climbing. Although CaHSRA does have the power of eminent domain, which can

106 Howard Jarvis Taxpayers Association v. Bowen, No. C060441., 192 Cal.App.4th 110 (2011), Court of Appeals of California, Third District, January 27, 2011, https://www.leagle.com/decision/incaco20110127037.xml.

107 Tim Sheehan, "Appellate court upholds environmental work for high-speed rail via Pacheco Pass," Fresno Bee, July 24, 2014, https://www.fresnobee.com/news/local/high-speed-rail/article19522596.html.

108 "California High-Speed Rail Violates Initiative, Judge Rules," Associated Press, August 16, 2013, https://www.nbcbayarea.com/news/local/california-high-speed-rail-violates-initiative-judge-rules/1920812/.

109 Tim Sheehan, "Kings County getting $10 million to settle 2014 lawsuit over high-speed rail route," Fresno Bee, August 15, 2019, https://www.fresnobee.com/news/local/article234062312.html

"California High-Speed Rail Settles Environmental Lawsuit," 13 CBS Sacramento, October 24, 2018, https://sacramento.cbslocal.com/2018/10/24/high-speed-rail-lawsuit/

Tim Sheehan, "High-speed rail agency settles Bakersfield's lawsuit against route," Fresno Bee, December 19, 2014, https://www.fresnobee.com/news/local/high-speed-rail/article19528590.html

be used to acquire parcels for construction quickly and the price to be negotiated or litigated later, most agencies prefer to at least attempt negotiated purchases. The delays in procurement of right-of-way land has led to many delays in construction, with Tutor Perini, a major construction contractor, announcing it may file delay claims for $500 million or more and many other contractors also filing expensive claims. These delays and overruns came as at least three high-ranking contractor personnel left the agency.[110]

CaHSRA had structured large Disadvantaged Business Enterprise, Disabled Veteran Business Enterprise, and Micro-Business programs, with a combined target of 30% of contracts/subcontract value awarded. But, the delays have been particularly troublesome for these smaller businesses, particularly when they bought or leased equipment and hired in anticipation of getting work started – which turned out delayed. Also, many smaller businesses have complained about slow payment for work they did perform.[111] Part of the problem may have been due to the ARRA statutory requirements for the Federal grants with deadlines to start and complete construction, which may have led CaHSRA to begin construction before it had the personnel and control structures and systems in place to undertake and manage such a major project.

One matter that has not reached the courts as of the date of preparation of this paper, but is already causing conflict, is arising out of the Federal action to cancel a major Federal grant discussed above. On December 15, 2019, approximately six months after the formal Federal action to cancel a Federal construction grant (and the State filing a legal action to prohibit the cancelation), the CaHSRA Board acted to begin the procurement process to lay rail and provide operating systems for 119 miles of track in the Central Valley – at an estimated cost of $1.6 billion. The FRA sent CaHSRA a letter expressing its disapproval for releasing this bid.[112] We'll have to wait and see how this conflict may develop.

San Francisco-Los Angeles Union Station: two hours, 40 minutes.

California Streets and Road Code (SRC) §2704.09(b)(1), which came from Proposition 1A, states: "The high-speed train system to be constructed paramount to this chapter shall be designed to achieve the following characteristics: Maximum non-stop service travel times for each corridor that shall not exceed the following: San Francisco-Los Angeles: two hours, 40 minutes. Meeting this requirement appears to be quite challenging."

Starting with the 2018 Business Plan, page 81, "Given the scale of the Phase 1 System – stretching more than 500 miles from San Francisco/Merced to Los Angeles/ Anaheim …" (let's call it 501 miles), then backing out approximately 26 miles from Los Angeles to Anaheim, and approximately 12 miles from Merced South to where

110 Tim Sheehan, "HSR projected real estate costs almost double to $1.5 billion for Valley Segment," Fresno Bee, September 14, 2019, https://www.fresnobee.com/news/local/article218398575.html.

Ralph Vartabedian, "California's bullet train's mishandling of land deals adds to mounting costs and delays," Los Angeles Times, September 16, 2019, https://www.latimes.com/california/story/2019-09-15/california-bullet-train-land-acquisition.

111 Stephen Stock, Michael Horn and Kevin Nious, "Promises Not Kept? Some Small Businesses Say High-Speed Rail Has Cost Rather Than Benefited Them," NBC Bay Area, November 21, 2019, https://www.nbcbayarea.com/investigations/some-small-businesses-say-high-speed-rail-has-cost-them/2153188/.

112 Tim Sheehan, "Feds forbid bullet train bids for track, systems. California moves ahead anyway. Now what?," ,https://www.fresnobee.com/news/local/article238317708.html.

the HSR line from San Francisco over the Pacheco Pass meets the Valley Main Line[113] – and we have 463 miles to be covered by trains from San Francisco to Los Angeles in 2:40. Deducting out the 52 miles from San Francisco Salesforce Center to San José Diridon, and the 30 minutes allowed for that travel segment by SRC §2704.09(b)(3),, and we have 411 miles to be covered in 2:11.

Let us now assume that the proposed blended operations between CaHSR and Metrolink commuter rail in Southern California, where the planning and alignment are not as far advanced as in the Bay Area,[114] will have the same distance and the same speed impacts as that with Caltrain in the Bay Area (see following section), and back out another 52 miles and 29 minutes, leaving 359 miles to be covered in 1:42 – which, for non-stop operations, would require an average speed of travel of 211 mph, which is very close to the top design speed of 220 mph.

Doing another calculation, to cover 359 miles at 220 mph, that would require 1:38 – so, there are only ~4 minutes that could be lost to meet the travel time requirement.

There is a very significant difference between top operating speed – specified for 220 mph – and being able to maintain that speed for the entire distance of a trip between station pairs over 300 miles apart. Starting with proper designs to be able to operate at that speed, being able to do 220 mph requires a well-maintained trainset operating on well-maintained track – that is very close to straight and level. Any curves past minimal or up or down grades more than minimal can reduce maximum operating speeds. Switches have to designed and maintained properly for operation at maximum speed. Going through stations without stopping – seven between San José and Los Angeles – or urban areas, at 220 mph, creates wind and noise that may not be acceptable.

In the real world, trains do not generally operate at the absolute high design speed between station pairs for all of these reasons, and because operating and maintenance costs increase far more than linearly as speed increases.

It would not be proper to say that it is impossible to meet the 2:40 maximum time limit for San Francisco-Los Angeles service – but, it would require an extraordinarily high level of design, particularly through the high percentage of difficult rural and dense urban alignments, and very high levels of operations and maintenance.

Early Train Operator Operating Subsidy

The intersection of the huge gap between the funds necessary to complete CaHSR and the funds available, and the political reality of keeping construction on-going, forces CaHSR proponents to make the difficult decision between:

- Concentration of all available funding on construction (and its planning and design precursors) to get the entire Phase 1 completed as soon as possible.

113 CaHSRA, "Merced to Fresno Project Section Central Valley Wye,: https://www.hsr.ca.gov/docs/newsroom/maps/Central_Valley_Wye.pdf.

114 CAHSRA, "Palmdale to Burbank Project Section" map, https://www.hsr.ca.gov/docs/newsroom/maps/Palmdale_to_Burbank.pdf.

- Begin HSR operations on each segment as they are completed, thereby "proving" the value of CaHSR as an aid to generate more funding to complete the full system, or at least Phase 1.

It is questionable if CaHSR will be able to cover operating costs out of operating revenues if and when the entire Phase 1 is completed. However, as long as CaHSRA and the CaHSR proponents continue to formally state it will happen, in the absence of any action by CaHSRA that budgets for a subsidy or otherwise contradicts this assertion, it will be difficult (but not necessarily impossible) for CaHSR opponents to succeed in a legal challenge that the system cannot be operated without violating the Proposition 1A prohibition against government operating subsidies.

If, after the entire system was completed, the first operating budget was to be submitted with a requirement for large public sector subsidies, the proponents would be in a position to argue, "We just completed spending tens of billions of dollars on building CaHSR; now we have to just leave it there to rot because it is not legally permissible to operate it!?!?"

However, if there is a decision to start operating CaHSR each segment as it is completed – "proof" of value – then the no-government subsidy prohibition goes into effect for each segment – and, almost certainly, the first shorter segments in the Central Valley will have far more difficulty reaching break-even from operating revenues alone.

Many CaHSR observers concluded that CaHSRA had opted for the former, no-HSR-until-full-completion, alternative. The first 119-mile segment, Madera to Poplar, to enter construction did not include either propulsion power supply or HSR trainsets, among other absolute requirements for HSR service operation. However, this would have restricted the alignment to be used by conventional trainsets on the State's San Joaquin Amtrak California, faster than current service, but, by definition, not HSR service. The Proposition 1A no-government subsidy of HSR operations would not apply because no HSR service would be operated.

However, when California Governor Newsom, in his inaugural State of the State Address in February 2019, announced that the initial 119-mile Central Valley segment would be lengthened to 171 miles and electrified, this brought the no-government subsidy issue to the fore.

The specific requirement from Proposition 1A is:

"The planned passenger service by the authority in the corridor or usable segment thereof will not require a local, state, or federal operating subsidy."[115]

A plain reading of the above, specifically the "… or usable segment thereof …" phrase, appears to support the contention that the proposed initial 171-mile operating section would be subject to the no-government operating subsidy requirement.

Shortly thereafter, CaHSRA promulgated its operating plan, *California High Speed Rail Early Train Operator – Central Valley and Peninsula Corridors Operators Financial*

115 California Streets and Highway Code Section 2704.08©(2)(J), http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=SHC&division=3.&title=&part=&chapter=20.&article=2.

Plan Study,[116] later followed by *California High-Speed Rail Early Train Operator Side-By-Side Study Quantitative Report*,[117] hereinafter "ETO 2019" and "ETO 2020." Unfortunately, the financial and operating statistics are presented in fragmentary, incomplete, and non-standard formats. The early report has somewhat more financial detail than the latter.

ETO 2019 has some surprising errors in the data reported, including:

ETO 2019 Reported vs. Actual Data				
	Reported		Actual	
Data	Values	Note	Values	Note
Altamont Corridor Express 2017				
Daily Ridership	5,918	1	4,985	2
Annual Ridership	1,503,000	1	1,299,717	2
Annual Revenue	$9,975,000	1	$8,899,220	2
San Joaquins 2017				
Annual Ridership	1,689,000	1	1,120,000	3
Notes				
1 ETO 2019 page 226				
2 NTD ACE Profile 2017, https://cms7.fta.dot.gov/sites/fta.dot.gov/files/transit_agency_profile_doc/2017/90182.pdf				
3 Amtrak Monthly Performance Report, September FY2017 (Preliminary and Unaudited), December 27, 2017, "Route Level Results," page (Amtrak has September 30 year-end), https://www.amtrak.com/content/dam/projects/dotcom/english/public/documents/corporate/monthlyperformancereports/2017/Amtrak-Monthly-Performance-Report-September-2017-Preliminary-Unaudited.pdf				

Also, ETO 2019, pp. 225-226, shows 206,453 train miles for the "Without HSR" scenario for an "O&M Cost Estimate (2018 USD)" of $41.3 million, or a cost of $200.05/train mile, vs. 292,645 train miles for the "With HSR" scenario at O&M Cost of $47.9 million, at a cost of $163.68 per train mile. Adding 86,192 train miles at an added cost of $6.6 million produces a marginal cost per train mile of $76.57, 38% of the "Without HSR" scenario cost per train mile. Being able to achieve this appears questionable, particularly since the proposed change will be from nine bus and three bus roundtrips to 15 and four, respectively, which means a larger increase in the number of trips than train miles, and a higher portion of rail vs. bus trips. Adding more trips is more expensive than adding train miles to existing trips and trains are more expensive to operate than buses.

These costs are clearly shown as being expressed in "2018 USD", 2018 dollars, but the total cost of operations of ACE in 2018 was $21,584,107 (NTD ACE "Profile" 2018) for 169,678 train revenue miles (TRM),[118] for an average cost per TRM of $127.21.

We will not attempt to validate the projected HSR train data in ETO 2019 and ETO 2020, but having this many errors and questionable calculations in what is readily available historical data does not build confidence in the values shown for a transportation mode that has not even been created yet in the same schedules on the same pages.

116 CaHSRA, May 1st, 2019, https://www.hsr.ca.gov/docs/about/legislative_affairs/Central_Valley_and_Peninsula_Corridors_Operations_Financial_Plan_Study.pdf.

117 CaHSRA, February 8, 2020, https://www.hsr.ca.gov/docs/about/business_plans/2020_Business_Plan_Side_by_Side_Study_Quantitative_Report.pdf.

118 NTD, "2018 Service" Excel™ spreadsheet, https://www.transit.dot.gov/ntd/data-product/2018-annual-database-service.

However, regardless of the accuracy of the projected costs and revenues, every presentation in both ETO 2019 and ETO 2020 shows large subsidies for operation of both the entire proposed system of CaHSR, ACE, and San Joaquins service. While CaHSRA has declined to separate out the subsidies between these three rail modes (and the integrated bus service), because the cost of the CaHSR service exceeds the total increase in fare revenue (ETO 2020, Figure ES-10, "Change in Annual Operations and Maintenance Cost, Revenue and Potential Subsidy Requirements"), there must be a subsidy by even the most aggressive possible cost accounting.

Which raises the question, how can CaHSRA propose operating this CaHSR service with a subsidy when it appears to conflict with the no-government subsidy requirement of Proposition 1A?

The answer can be found in CaHSRA interpretation of the meaning of the highlighted portion of the requirement, as shown below:

> *"The planned passenger service by the authority in the corridor or usable segment thereof will not require a local, state, or federal operating subsidy."*

The CaHSR proponents, and CAHSRA, have decided that the operations subsidy prohibition only applies to HSR service actually *operated* by CaHSRA itself; if the service is operated by another entity – the Early Train Operator – than the requirement does not apply and the service can be subsidized by the State.

In the "Rebuttal to Argument Against Proposition 1A," in the *Official Voter Information Guide*, responding to the concern that CaHSR will require taxpayer operating subsidies, we have:

> *"It's simple and fair—once completed, THE USERS OF THE SYSTEM PAY FOR THE SYSTEM." (EMPHASIS in the original)*

A plain reading of the two above statements, at a minimum, appears to raise some question as to the propriety of CaHSRA's interpretation, but we will not attempt to render a legal opinion on this matter. However, unless and until CaHSRA and other CaHSR proponents are clearly, specifically, and finally instructed otherwise by a higher authority – the California Legislature, Administrative, and/or Judicial branches – a projection that CaHSRA will proceed under its current assumption will almost certainly prove to be totally valid.

California Legislative Analyst Report

A recent report by the California Legislative Analyst provides independent commentary on many of the issues raised above:[119]

- "In this report, we identify a number of key issues for legislative oversight. First, we point out that the near- and long-term schedules identified in the draft 2020 business plan appear ambitious. Second, we identify some near- and long-term funding challenges confronting the project. Third, we raise concerns that HSRA's plan to use a third-party public entity to operate interim service from Merced to Bakersfield appears to be inconsistent with the spirit

119 Gabriel Petek, Legislative Analyst, Legislative Analyst Office, Review of the Draft 2020 High-Speed Rail Business Plan, March 2020, https://lao.ca.gov/reports/2020/4202/HSR-draft2020-041320.pdf.

of Proposition 1A. Forth, we identify some of the key assumptions made by the ETO that affect its assessment of alternatives. Fifth, we identify some key actions that HSRA plans to take in the coming months that will significantly limit the state's flexibility to change its approach to the project in the future." (Executive Summary, page 1)

- "With these issues in mind, the Legislature will want to consider whether it is comfortable with HSRA's proposed approach, would like an alternative approach, or would like to preserve its flexibility to change the project in the future. It will be important for the Legislature to provide direction soon given that HSRA is poised to make key decisions—such as entering into major contracts—that will reduce flexibility to change the project if legislative priorities change, costs increase, or planned funding does not materialize." (Executive Summary, page 1)

- "As shown in Figure 4, the draft 2020 business plan estimates that the total cost to complete Phase 1 is $80.3 billion, which is about $3 billion higher than the 2018 cost estimate. This cost estimate is about $1.3 billion higher than the 2019 cost estimate." (page 11)

- "According to HSRA, the cost increase since 2018 is a result of two main factors (1) the $1.8 billion cost increase to the ICS (Initial Construction Segment, 119 miles from Madera to Shafter in the Central Valley) reflected in the PUR (biennial Project Update Report), largely due to an increase in the size of the contingency, and (2) $1.3 billion in additional construction costs due to the delay in the scheduled completion of the Valley-to-Valley line." (page 11)

- "The 2020 business plan continues to suggest that the state's goal is to complete Phase 1. However, draft 2020 business plan does not identify specific funding sources to construct the rest of Phase 1 beyond the Merced-to-Bakersfield segment." (page 12)

- "Under the proposed track and systems contract, the contractor will be expected to construct track in five mile, nonconsecutive segments. HSRA indicates this approach is needed to meet the federal requirement to complete a segment usable for intercity passenger rail by 2022. This is because—due to project delays—the track-and-systems contractor will need to begin its work before HSRA has completed all of the right-of-way acquisitions and construction of civil works for the ICS. While this approach is expected to expedite the completion of track and systems, it will add significant complexity to the work performed by the track-and-systems contractor and is likely to raise the costs of the contract." (page 15)

- "HSRA currently estimates that the ICS track will be completed by the end of 2022 in order to meet the 2022 deadline for federal grant agreements. This leaves little margin for error if property acquisitions or civil works are delayed. In order to meet the federal grant deadline for construction work, HSRA will have to significantly increase its spending rate, including for construction and environmental work. Specifically, according to a January 2020 HSRA report, it will have to spend about $185 million per month to meet the federal grant deadline. The authority's spending has averaged less than half of that amount—about $76 million per month—over the past year and only an average

of $112 million per month over the past three months. Additionally, there is only a small margin for error in the time line for completion of environmental documents for Phase 1 prior to the 2022 federal grant deadline." (page 15)

- "HSRA's current schedule assumes that the project has access to full funding. However, HSRA has not identified funding for completion of segments beyond Merced to Bakersfield. Given the lack of identified funding, the ability of HSRA to complete the portions of the project beyond the Merced-to-Bakersfield segment on the schedule currently envisioned is highly uncertain." (page 15)

- "To date, there have been significant cost increases related to the construction work on the ICS. For example, the current value of the major ICS civil works construction contracts (including contingencies) are roughly 70 percent higher on average than originally planned. Given the project's past history of cost increases and the inherent cost risks associated with large and complex construction projects, there is risk that the project may continue to experience cost increases. In particular, the Merced and Bakersfield extensions are still at the early stages of design. Accordingly, these portions of the project are likely to be subject to a greater uncertainty than the portions that are closer to completion." (page 16)

- "HSRA's proposal to use a third-party public entity to operate the Merced-to-Bakersfield interim service in order to facilitate compliance with Proposition 1A does not appear to be consistent with the spirit of the measure (Proposition 1A). The intent of the measure's requirement that passenger train service provided by HSRA, or pursuant to its authority, not require an operating subsidy appears to be to ensure that passengers of the system—rather than the general public—pay for the full cost of its ongoing operations and maintenance. However, under HSRA's proposed approach, the state (and general taxpayers) is anticipated to pay for whatever portion of the system's operating costs that are not recovered from passenger fares—estimated at roughly $54 million annually. Even though HSRA is not anticipated to receive this subsidy directly under its proposed approach—as it would be provided to the third-party public operator—this does not change the practical effect that the state would likely bear a portion of the system's operating costs, at least during interim service." (page 18)

The above is only a selection of a far longer list of concerns in the LAO report.

APPENDIX 2: THE HISTORY OF MEGAPROJECTS IN THE CASCADIA CORRIDOR

The State of Washington and its political subdivisions have their own long history of megaprojects with major issues, or which have gone wrong, including:

Washington Public Power Supply System (WPPSS)

WPPSS' creation traces back to the 1950's – its purpose was to provide additional electric power supply capacity to ensure that users in the Washington State would have sufficient supply. In 1957, the Washington State Legislature established WPPSS as a municipal corporation, a governmental entity with a governing board comprised of representatives from the 17 member utilities, with Seattle City Light the largest.

Because of high anticipated growth in electrical demand and limitations on adding hydro power, nuclear power appeared to be an attractive option at the time. After the initial decision to go nuclear was made, and the formal agreement between the utilities was executed in 1971, the actions of the Organization of Arab Oil Exporting Nations in 1973 to reduce oil production, increase prices, and embargo shipments to the U.S., the decision to go nuclear appeared well founded. Eventually, five nuclear plants were planned.

Unfortunately, construction management was substandard and costs eventually rose to three to four times the original estimates. These costs were in addition to many other problems, including poor contractor procurement and management and quality control. Making these problems worse, it appears that WPPSS management consciously withheld information about such issues from Board members. Eventually, the problems became known, including the total cost increasing to $24 billion. Only one of the plants (#2 at Hanford, now the Columbia Generation Station) was completed. Because the other four plants were never completed, there was no electricity sold to generate funds for bond debt service, so WPPSS defaulted on $2.25 billion in revenue bonds. The bondholders sued and there was a partial settlement in 1988 for $753 million, but the litigation continued until the final settlement in 1995.

This is generally acknowledged as the largest U.S. municipal bond default of all time.[120]

No Megaproject should ever be commenced without first, capable and experienced staff to manage the project and the contractors, strong project control systems and procedures, and necessary quality control processes. For "rookie" agencies undertaking their first major project, there is a temptation to begin the project quickly, without these – which is almost always a very serious error.

I-5 Columbia River Bridge

The I-5 "Interstate Bridge" over the Columbia River between Portland, Oregon and Vancouver, Washington has been a bottleneck for passenger and freight transportation for decades; in 2010, while the study of the new bridge was well underway, a report by TRIP, the national transportation research group, rated the Interstate Bridge as Oregon's worst traffic choke point.[121]

The existing bridge, actually two almost identical through-truss spans, date from 1917 and 1958 and are vertical-lift bridges to allow for passage of larger water traffic. Both spans have three traffic lanes, a total of six in both directions, without breakdown lanes. The only other bridge in the Portland-Vancouver Area is the I-205 bridge approximately seven miles East (all distances are straight line; road travel distances are far longer). The next two closest bridges are the Lewis & Clark (Longview) Bridge approximately 35 miles downstream (North and West) of the Interstate Bridge and the

120 David Wilma, "Washington Public Power Supply System (WPPSS)," July 10, 2003, HistoryLink, https://www.historylink.org/File/5482

Elain Myers and David Lee Myers, "Lessons from WPPSS: A $2.25 billion fiasco illustrates the drawbacks to "business as usual" approaches for many social decisions," Governance, Context Institute, Autumn 1984, https://www.context.org/iclib/ic07/myers/

Michael Johnston, "The Biggest Municipal Bond Disasters of All Time," Municipal Bonds.com, January 4, 2013, https://www.municipalbonds.com/news/the-biggest-municipal-bond-disasters-of-all-time/

121 Erik Robinson, "I-5 bridge labeled Oregon's worst choke point," The Columbian, May 13, 2010, https://www.columbian.com/news/2010/may/13/i-5-bridge-labeled-oregons-worst-chokepoint/.

Bridge of the Gods more than 30 miles upstream (East) of the I-205 Bridge. The actual road distance on the Oregon side between Lewis & Clark and Bridge of the Gods is approximately 90 miles.

The planning and design of the replacement bridge had to reconcile the different desires of the large number of organizations that had to reach consensus for the project to proceed to construction; which, arguably, is what ultimately caused the project to fail.

To a large extent, the Oregon side, and particularly the City of Portland and the Tri-County Metropolitan Transportation Authority of Oregon (Tri-Met, the transit operator for the Greater Portland area South of the River) wanted to severely limit any expansion of road capacity and to promote transit and active transportation (chiefly walking and cycling). Both Oregon and the City have strong anti-road and pro-transit/active transportation policies.[122]

While Vancouver and Clark County on the Washington side have been experienced good population, economic, and job growth for some time, there are still far more jobs on the Oregon side of the river which, to some extent, has made the Washington side a "bedroom community" for Greater Portland, with only two ways of crossing the river, one several miles from downtown.

The different tax situations between the two states also impacts housing location decisions. Oregon has an income tax and Washington does not (a Washington resident working in Oregon is subject to Oregon non-resident income tax on Oregon income, but not Washington income, and a two-income family with one Washington-only income would generally have a lower overall tax bill than if they lived in Oregon); conversely, Oregon has no sales tax, but Washington has high sales taxes (which has been known to lead to Washington residents who purchase major items South of the River and fail to pay the Washington use tax).

The Oregon side has far more restrictions on single-family detached home construction, including an urban growth boundary, so the work-in-Oregon-live-in-Washington situation has caused problems for each side to blame on the other.

Portland, Tri-Met, and Oregon made light rail over the new bridge a condition of approval, which increased the cost significantly. The FEIS showed the cost of the transit component as $856.3-944.3 million of the total cost of $3,157.3-3,507.8 million[123] (~27%), but these costs appeared to be more the product of the maximum likely Federal Transit Administration capital grant amount than the actual cost impact. For example, including light rail in the bridge design, along with other design choices, produced a dual identical bridge design, both with two decks with the underdeck for the light rail tracks and pedestrian/cycle walkway. Without light rail, the second deck would have been unnecessary (the pedestrian/cyclist pathways, with far lower static and dynamic loads, could have easily been handled as an outrigger(s) or other minimal cost design on an auto/truck bridge). Without the lower deck,

122 Thomas A. Rubin and Fatma Mansour, Transit Utilization and Traffic Congestion: Is There a Connection?, Reason Policy Study 427, December, 2013, "Portland Urbanized Area Case Study," pp. 53-63, https://reason.org/wp-content/uploads/files/transit_utilization_traffic_congestion.pdf.

123 U.S. DOT et al, Columbia River Crossing FEIR, September 2011, Chapter 4, "Financial Analysis," Exhibit 4.2-1, "Capital Cost Estimates by Alternative …," page 4-4, https://www.clark.wa.gov/sites/default/files/dept/files/council-meetings/integrity-resolution/3w4ex1.pdf.

the bridge could have been designed far lower (and lighter in weight) to provide the required clearance for River shipping, which also would have meant shorter bridge approaches on both sides. It may have been possible to build one, wider bridge (or a single two-decker) to serve both directions of travel rather than two bridges, but this could have caused complications with the approaches and the transition plan for when the new bridge(s) would replace the old.

The high costs of the replacement bridge designed for light rail meant that the available funding from Federal, State, and other governmental road user fees and grants would not be sufficient to pay the construction costs. This led to a decision to toll the bridge, with an initial toll schedule proposed at $1-2 for passenger cars, in 2006 dollars, and bonding against future toll revenues to help finance bridge construction.[124] As would be expected, the prospect of having to pay tolls was not popular with most Washington residents, who would be paying most of the tolls, but was favored by the government transportation officials on the Oregon side, who saw tolls as a way – along with congested traffic – to encourage Washington residents to utilize transit – or move to Oregon, or at least pay the piper for not moving to Oregon. Of course, if the toll was imposed on only the I-5 Bridge, there would be a transfer of traffic to the I-205 Bridge, assuming that it would not also be tolled, which would have a number of undesirable impacts.

Although the various studies conducted had gone on for years, at a cost of at $175 million[125] ($200 million by the time the project ended), there were still a surprising number of omissions. One of the most glaring was the failure to properly coordinate with the U.S. Coast Guard on the amount of clearance needed for ships under the bridges: "Extensive discussion at several levels of our organizations have substantially exhausted the dispute resolution measures … between the Coast Guard and Federal Highway Administration. … (t)he Coast Guard cannot determine if the preferred 95-foot bridge clearance will meet reasonable navigation requirements based on the information provided for review. … the Coast Guard will not be able to accept a bridge permit application based on the information provided in the FEIS, or adopt it as written."[126] The clearance was eventually increased to 116 feet, and mitigation agreements were made with upstream manufacturers who would be impacted.[127]

Bus Rapid Transit over the Bridge on managed lanes, which, arguably, could have carried far more riders than light rail at significantly lower cost, was never properly considered as an alternative to light rail.

Under continuing opposition from a wide variety of interests, ranging from environmentalists adamantly against any roadway expansion to Hayden Island residents who would be impacted for five years of construction to non-believers in light-rail-across-the-river to anti-tollers to anti-taxers, the project was brought to a halt

124 Ibid, Exhibit 4.3-3, "Toll Rate Schedule Scenarios – Toll Rates in Each Direction," pp. 4-9/11.

125 Oregon Live, "Columbia River Crossing spends $175 million, most on consultants, with nothing to show," July 4, 2013 https://www.oregonlive.com/business/2013/07/columbia_river_crossing_spends.html#incart_m-rpt-2.

126 Memorandum, from Sally Brice-O'Hara, Vice Commandant, U.S. Coast Guard, to John D. Porcari, Deputy Secretary of Transportation, "DRAFT ROD (record of decision) FOR THE I-5 COLUMBIA RIVER CROSSING PROJECT," December 7, 2011, http://couv.com/wp-content/uploads/2012/03/Letter-from-Coast-Guard.pdf.

127 Eric Florip, "Coast Guard approves CRC bridge permit," The Columbian, September 26, 2013, https://www.columbian.com/news/2013/sep/27/coast-guard-approves-crc-bridge-permit/.

when the newly conservative Washington State Senate refused to approve the $450 million Washington State share in 2014.[128]

Attempts to revive the original project failed,[129] but there is still a need for the project, so periodic revivals continue.[130]

When special interests value their own requirements over those for the general good, the result can be that no one receives any benefit.

Alaskan Way Viaduct Replacement Tunnel

The two-mile Alaskan Way Viaduct carried the first freeway (then US99, later Washington State Route 99) through the Seattle CBD at its opening in 1953 and continued to be a major component of the road system even after the opening of I-5 in stages in the 1960's.[131] However, its placement on the waterfront was seen as distracting from the natural and human-built beauty, and views, of the area, in the same way as the Embarcadero Freeway was seen as out-of-place in San Francisco – which was one of the major reasons the Embarcadero Freeway was taken down.

When the similarly designed (two-level elevated) I-880 Cyprus Freeway in Oakland collapsed, with the loss of 42 lives, in the 1989 Loma Prieta earthquake,[132] and the 2001 Nisqually earthquake significantly damaged the Viaduct itself, a strong consensus developed to replace the Viaduct, both for public safety and to open up the waterfront for other purposes.[133] The projected cost was $1,960 million (vs. $3,518 million for "Cut-&-Cover Tunnel" and $1,971 million for "Elevated Structure").[134] After a comprehensive review of options – and a great deal of technical, financial, urban development options, and political discussions, the final decision was for a bored tunnel.[135]

The budget for the bored tunnel, as built, is now $3,325.7 million (including $148 million in budget increases).[136] – and the tunnel is four lanes, not the six lanes of the Viaduct. The tunnel is tolled – the Viaduct was not – providing $200 million of the funding for construction in the final budget.

However, the primary reason for the inclusion of this project on this list is not the 70% cost increase from FEIS to as-built – although that is certainly worthy of note

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128 Jeff Mapes, "What killed the Columbia River Crossing? A razor-thin Senate election last November," The Oregonian, July 2, 2013, https://www.oregonlive.com/mapes/2013/07/what_killed_the_columbia_river.html

Stevie Mathieu, "Officials adjust focus to a future bridge replacement," The Columbian, July 1, 2013, https://www.columbian.com/news/2013/jul/01/officials-adjust-focus-to-a-future-bridge-replacem/.

129 Oregon Department of Transportation, "ODOT announces plans to close down Columbia River Crossing Project, March 7, 2014, https://content.govdelivery.com/accounts/ORDOT/bulletins/a9a9f1.

130 Jeffery Mize, "New I-5 Bridge project: Here we go, again … again," The Columbian, October 13, 2019, https://www.columbian.com/news/2019/oct/13/new-i-5-bridge-project-here-we-go-again-again/.

131 WSDOT, Alaskan Way Viaduct Replacement Project/About/History, accessed December 17, 2019, https://www.wsdot.wa.gov/Projects/Viaduct/About/History.

132 FHWA, Public Roads/Replacing Oakland's Cyprus Freeway, accessed December 17, 2019, https://www.fhwa.dot.gov/publications/publicroads/98marapr/cypress.cfm.

133 City of Seattle, Office of the Waterfront and Civic Projects/Program Overview, accessed December 17, 2019, https://waterfrontseattle.org/about/program-overview.

134 FHWA, WSDOT, and City of Seattle; Alaskan Way Viaduct Replacement Project Final EIS; July 2011; Summary' Exhibit S-10; "Build Alternative Costs;" page 8, http://data.wsdot.wa.gov/publications/viaduct/00_AWVFEIS_Summary.pdf.

135 Andrew Garber, "Tunnel in place of viaduct: A deal, but how to pay?," The Seattle Times, January 13, 2009, https://web.archive.org/web/20090115000109/http://seattletimes.nwsource.com/html/localnews/2008621043_viaduct13m.html.

136 WSDOT, Op. Cit., Budget, accessed December 17, 2019, https://www.wsdot.wa.gov/Projects/Viaduct/Budget.

– but the 29-month delay in the project schedule[137] after Bertha, the giant 57½-foot boring machine, broke down and required herculean efforts, including excavating a vertical shaft down 120-feet, to repair Bertha's cutting head. Although the ensuing litigation – suit and counter-suit – was eventually completed mainly in favor of the State (assuming that the court of origin outcome becomes the final outcome),[138] no award of monetary damages can return the almost two-and-one-half years of delay to project completion.

On projects of this size and complexity, unexpected negative occurrences are, unfortunately, something always to be expected. Even if there is financial contingency provided for in the budget, and the schedule includes slack time, a total halt to the tunneling project for 867 days is just never going to be factored into to project planning.

Sound Transit Sound Move – The 10-Year Regional Transit System Plan

After the failure of the 1995 ballot measure to approve taxes for its long-range transportation plan, in preparation for the November 1996 vote that established the taxes to fund the Central Puget Sound Regional Transportation Authority's (Sound Transit) transit expansion plans, the governing board adopted Sound Move – The Ten-Year Regional Transit System Plan (hereinafter Sound Move) on May 31, 1996.[139] This was a less ambitious plan, costed out at $3.9 billion compared to $6.7 billion in the failed 1995 measure.[140] Sound Move formalized what the voters, taxpayers, and transportation systems users could expect if the proposed new taxes – "… a 4/10 of one percent increase in sales tax and a 3/10 of one percent increase in the license tab tax to be collected within the RTA District" (Sound Move, page 33) were to be approved. Sound Move comprehends the capital and operating improvements to be provided; revenues and expenditures; and guiding principles, including:

> *"Conservative funding assumptions-the primary funding sources will be modest voter-approved local tax increases, federal grants and long-term bonding.*
>
> *"The RTA assumes no state funds, thus placing no additional demand on limited state resources that are needed for other regional transportation investments."*

In this section, we will compare the projected financial and operating projections made in SM to what actually occurred at the end of the planning period, under the following methodology:

- Although the "10-Year Regional Transit System Plan" was adopted by the Sound Transit board and the voters in 1996, the operating results in Sound Move are for 2010, fourteen years later.

137 Mike Lindblom, "Bertha's breakthough just 'halftime' for tunnel project, Seattle Times, April 4, 2017, https://www.seattletimes.com/seattle-news/transportation/sense-of-history-builds-as-tunnel-machine-bertha-inches-toward-daylight/.

138 Mike Lindblom, "Contractor ordered to pay Washington state $57M over tunnel-boring machine Bertha's big stall, Seattle Times, December 13, 2019, https://www.seattletimes.com/seattle-news/transportation/contractor-ordered-to-pay-state-over-tunnel-boring-machine-berthas-big-stall/.

139 Sound Transit, accessed December 19, 2019, https://www.soundtransit.org/get-to-know-us/documents-reports/sound-move-ten-year-regional-plan (The citation and link to Sound Move will take the reader to series of "PDF" documents that appears to be a scan of its printed version and the Appendices with supporting documents.)

140 Josh Cohen, *Sound Transit (King, Pierce, and Snohomish counties)*, HistoryLink.org Essay 8002, page 3, November 28, 2017, https://www.historylink.org/File/8002.

- We will assume that all cost and revenue values in Sound Move are expressed in 1996 constant dollars. There is no explicit statement to this effect in Sound Move, but this is the assumption that works best for making the case for the contents of Sound Move being valid. Although there is no statement of the year of constant dollars, common practice, and common sense, would support 1996 dollars. The constant dollar assumption is consistent with two statements in Sound Move:
    - On page 33, it states, "The RTA assumes federal funding for new rail starts of $55 million per year and other federal funding sources of $18 million per year," an annual total of $73 million.
    - On page 34, Table 2, "Revenues," shows Federal revenue of $727 million. $73 million/year for 10 years is $730 million, which, within rounding, is consistent with $727 million.
- We will first review the ridership projections. One of the supporting documents for Sound Move was "Benefits, system use and transportation impacts of Sound Move," which includes, as a note to Table 2, "Ten-year total transit trips," "These estimates include only those transit riders using regularly scheduled, regular fare bus and rail lines within the RTA District boundary (dial-a-ride, subscription bus, school bus, etc. are excluded)." Therefore, the following modes and transit operators will be comprehended in the comparison:
    - Modes:
        - All bus modes, including Trolley Bus, except those specifically excluded above
        - Commuter rail
        - Light Rail, which includes Streetcar (in 1996, when Sound Move was published, streetcar was classified as a type of light rail by the FTA)
    - Transit operators:
        - Central Puget Sound Regional Transportation Authority (Sound Transit)
        - City of Everett (Everett Transit)
        - King County Department of Metro Transit (King County Metro)
        - Pierce County Transportation Benefit Area Authority (Pierce Transit)
        - City of Seattle (bus service only, not monorail)
        - Snohomish County Transportation Benefit Area Authority (Community Transit)

Comparison of *Sound Move* Projections and 2010 Actual			
Item	**Projection**	**2010 Actual**	**Comment**
Taxes	0.4% Sales 0.3% Motor Vehicle[141]	1.4% Sales 1.1% Motor Vehicle $.25/1,000 Property 0.8% Rental Car[142]	Tax ballot measures approved in 1996, 2008, and 2016
2020 Tax Revenues	$510 million[143]	$1.957 billion[144] Above is FY20 $'s, ~$1.102 billion in FY96 $'s	
Light Rail Stations	45th Street to South 200th Street (16 Stations)[145]	Westlake to SeaTac (13 stations)[146]	Last three stations opened in 2016
Light Rail Costs	$1.801 billion[147]	3.8 billion[148]	Constant 1996 $'s
Annual Boardings: [149] Light Rail Commuter Rail Total	 32.6 million 3.2 million 187 million	 8.4 million 2.5 million 165 million	

141, 142, 143, 144, 145, 146, 147, 148, 149

Taxes have increased significantly – the two original tax rates both more than tripled and two new ones were started. Total receipts are up 116 percent, inflation adjusted. In fairness, while much of the increased taxes went to cover cost overruns and delays (see next section for Central Link issues), Sound Transit did successfully convince its electorate on two occasions out of three attempts, to give it more tax revenues to pay for more projects.

Light rail was late in getting started (the first segment opened in 2009) – and completed (2016, ten years later than the original construction schedule) – and wound up 111 percent over the original budget – again, inflation-adjusted. The delays in light rail construction likely contributed significantly to light rail ridership coming in at 26 percent, commuter rail ridership at 78 percent, and total ridership at 88 percent of the 2010 projections.

While transit ridership was well under the 2010 target in Sound Move, light rail/streetcar ridership reached 27.1 million (83 percent of the 2010 target) and commuter

141 Sound Move, page 33, accessed December 19, 2019.

142 Sound Transit, "Paying for regional transit," accessed December 19, 2019, https://www.soundtransit.org/get-to-know-us/paying-regional-transit.

143 Computed from data from following citation. Sales Tax 2020 of $1,446 million x (.4%/1.4%) = $413 million, plus 2020 Motor Vehicle Excise Tax of $355 million x (.3%/1.1%) = $97 million; total $510 million..

144 Sound Transit, "Long-Range Financial Plan Projections 2019 Update and Proposed 2020 Budget, presentation to Board of Directions, October 24, 2019, page 10, https://www.soundtransit.org/get-to-know-us/paying-regional-transit

Rental Car tax not broken out, may be included in Sales Tax revenue; 2018 revenues were <$4 million, so any adjustments passed as not material.

145 *Sound Move*, "Benefits, system user and transportation impacts of Sound Move" (hereinafter Benefits), page 4.

146 Sound Transit, Press Release, "Sound Transit opens Link light rail service to SeaTac," December 19, 2009 , https://www.soundtransit.org/get-to-know-us/news-events/news-releases/sound-transit-opens-link-light-rail-service-to-seatac

147 Sound Move, page 34.

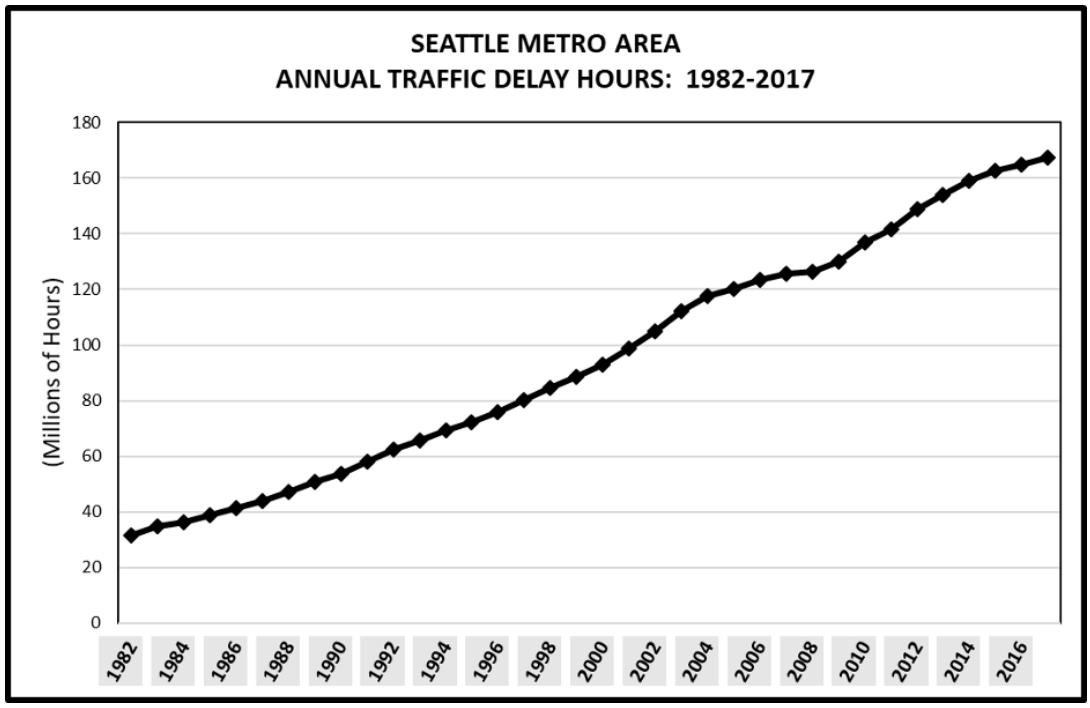
148 Total cost for comparable 16-station Central Link, completed in 2016, was $5.2 billion, per C.B. Hall, "Why Sound Transit's projects are so costly," Seattle Business, July 2013, http://www.seattlebusinessmag.com/article/why-sound-transits-projects-are-so-costly

This is the current dollar cost. Assuming a construction mid-point of 2007, an inflation factor of 1.37 was calculated from the U.S. Bureau of Labor Statistics, CPI for All Urban Consumers, Seattle-Tacoma-Bellevue, WA accessed December 19, 2019,, https://data.bls.gov/pdq/SurveyOutputServlet.

149 For all modes, Projections from "Benefits," page 2: Actual from National Transit Database, 2010 Table 19, Transit Operating Statistics: Service Supplied and Consumed, accessed December 19, 2019, https://www.transit.dot.gov/ntd/data-product/2010-table-19-transit-operating-statistics-service-supplied-and-consumed.

rail 4.6 million (144 percent of the 2010 target) in 2018, and total ridership was 192.1 million (103 percent of the 2010 target).[150] While the two increases are not huge, the Greater Seattle Area is almost unique in the larger U.S. urban areas in actually showing increases in ridership over the past several years.

"Benefits," page 7, shows a range of estimate of $16-24 million in "Travel time savings for drivers of private vehicles." We will not attempt to calculate the value of the travel time savings actually achieved (or not), but we offer the following time line, prepared from data from the Texas A&M Transportation Institute, the longest-operating and best-known source of traffic congestion and travel time change data:[151]



While it is not possible to directly evaluate the value of time saved through the Sound Move projects using the original procedures and algorithms, the above data – the 1996 value was 75.9 million delay hours, 2017 was 167.4 million, an increase of 120 percent – calls into question how much, if any, actual time savings have been realized, particularly since there does not appear to be much in the way of change in the slope of time series data after the road travel impacts of the "Great Recession" that began in 2008 are considered.

Another section, "Comparing the capacity of rail systems and highways," compares the carrying capacity of light rail against highways. For highways, it provides a computation of a highway lane operating at Level of Service (LOS) "E" (transportation systems can be graded on quantitative data from "A" to "F," and while the meaning of these has changed over the years, LOS "E" is the second lowest; to simplify, for a freeway, it means that operations are close to breaking down to stop-and-go, or LOS "F"), it uses 2,000 vehicles/hour with an average vehicle occupancy of 1.25, producing 2,500 persons per lane per hour.

150 National Transit Database "Profiles" for 2018, accessed December 20, 2019, https://www.transit.dot.gov/ntd.

151 Texas A&M Transportation Institute, Urban Areas in the Study, Seattle Metro Area, accessed December 19, 2019, https://mobility.tamu.edu/umr/data-and-trends/urban-areas-in-the-study/.

For light rail, the calculation starts with six-car trains, each car with 125 passengers, for 750 per train, with a train every three minutes, 20 trains an hour, for a total of 15,000 passenger per rail line per hour. So, a pair of tracks could carry 30,000 passengers an hour and, therefore, would be equal to 12 freeway lanes.

Questions could be raised on every value above; for the freeway values, they are probably slightly overstated, with perhaps 1,600-1,800 passenger car equivalents per hour and a peak hour occupancy of 1.10-1.15 being more likely to be near the top of the range to avoid LOS "F" for the methodology in use when this calculation was made. However, that would destroy the ability of the Sound Move light rail proponents to say that one light rail line (meaning a pair of tracks) would have the exact equal carrying capacity as a 12-lane I-5 through central Seattle.

Let's take another look at the light rail numbers. Six-car trains are very long for light rail – for several reasons. One problem is that the first vehicles that Sound Transit purchased, from Kinkisharyo, are a nominal 95-feet long.[152] A six-car train would be 570-feet long, so, assuming space for crosswalks and a bit of fudge factor at each end of each block along the alignment, for blocks less than approximately 600 feet long, a street running train stopped at a station or a red light on an alignment shared with rubber tire vehicles would be blocking the last cross street before the station or stop. In many cities, it is difficult to operate trains even half this length; for example, to operate three-car trains (each car 90-feet) for Los Angeles-Long Beach Blue Line on Washington Boulevard South of the Los Angeles CBD, the traffic signal progressions had to be adjusted so that trains would not get a red light on many of the cross streets because the last cross street passed through would have been blocked by the trains. Of course, all street-running section stations must be at least a nominal 570 feet.

To actually operate six-car trains, Sound Transit would have to plan and execute an entire light rail alignment with either very long blocks and/or very tightly managed traffic signaling systems to ensure that trains will not be caught "sticking out" and blocking cross-streets (which normally means converting many formerly through streets into "T" intersections or raising or lowering either the streets or the rail right-of-way – and, at the level of service described, for at-grade intersections, cities and counties that are willing to accept significant reductions in the amount of the rubber-tired traffic across the light rail line. This is, in fact, what we are seeing in the early lines, but if these principles will continue for the entire system is yet to be seen.

There are no U.S. transit systems that currently operate six-car light rail consists, or five. Indeed, the Kinkisharyo Technical Data sheet for the Sound Transit car states, "Maximum Cars to Train Line: 4 in revenue & 8 for emergency move."[153] Sacramento Regional Transit (RT) does regularly operate four-car trains, but that is a result of a decision that was made decades ago, and is still regretted today, that there would be a key section of its alignment on its first line that would be single-tracked to save construction costs. Because a train going in one direction cannot enter the single-track section until the train coming from the other direction clears it, RT is limited to fifteen-minute headways, four trains/hour/direction, to produce 16 cars past a point per hour per direction. Three-train light rail consists are current in common use,

152 Kinkisharyo, "Seattle, WA – Sound Transit, Technical Data (hereinafter "Kinkisharyo Technical Data")," accessed December 21, 2019, http://www.kinkisharyo.com/main/wp-content/uploads/2015/08/ST.pdf.

153 *Ibid*.

including by Sound Transit. For 2018, Sound Transit reported an average train consist (vehicle miles/train miles) of 2.74,[154] generally with three-car consists at peak.

Sound Transit's current Central Link schedule has six-minute headways at peak.[155] With three-car consists, that's thirty cars/hour past a point.

So, the current level of light rail service is, at most, 25 percent of the number of vehicles per hour past a point that was discussed in *Sound Move*. Sound Transit is planning for very large expansion of such service and, obviously, has a lot of room to grow to reach what the voters were told in 1996.

The 125 passengers/car on trains with 74 seats is what is known in the transit industry as a 169% seated load, 51 standees and 74 seated. This is close to the maximum number of standees that will allow riders to enter and exit the train quickly without troublesome interactions with other passengers and extended station dwell times. This type of load is undesirable to passengers for any length of time, particularly for light rail service, and for longer trips and trips with frequent stops, starts, turns, or vertical changes. As a practical matter, while 125 is certainly not the absolute highest number of passengers that will ever occur – occasional spot loads over 250 on larger light rail vehicles are not at all unusual in U.S. light rail – 125 passengers per car is generally something that happens only as a train is approaching the leading edge of the CBD during morning peak periods, or leaving same in the afternoon.

Sound Transit's average light rail passenger load for 2018, as reported to the National Transit Database, was 29.5. This is the all-day, every day, annual average, and the peak hour service ratio, particularly approaching the peak load point, is much higher – but, the flip side of that is that the load factors at non-peak times and in the non-peak direction during the peak, are much lower.

There is one more factor that is not discussed by Sound Transit in the above discussion of system capacity: speed. The calculations above generate passengers past a point at the peak load point, which is an important consideration in transit system design and operation. But, going further, if this average passenger load is multiplied by speed, the product is average passenger-miles per unit of track, generally measured on a per directional route mile basis, also known as "transportation work" – which is an equally important metric in transportation planning.

In "Sound Move – The 10-Year Regional Transit System Plan," page 3, under "Electric light-rail characteristics," we have, "average speed – 25-35 m.p.h." From 2018 NTD data, the overall weighted average speed of operations of U.S. light rail systems is 21.5 mph, the fastest is Saint Louis Metro at 23.5 mph, and Sound Transit light rail (not including the Tacoma Link Streetcar) came in at 20.5 mph.

There are several light rail systems in the U.S. that approach 25 mph, but the only individual light rail line that exceeds 30 mph, the Los Angeles Green Line, which is totally grade-separated, does not serve downtown Los Angeles or any other urban center, and has the longest average distance between stations of any U.S. urban rail system other than the San Francisco Bay Area Rapid Transit District (BART). These

154 National Transit Database, 2018, Service Table, accessed December 23, 2019, https://www.transit.dot.gov/ntd/data-product/2018-service.

155 Sound Transit, Link Light Rail Schedule, accessed December 23, 2019, https://www.soundtransit.org/sites/default/files/documents/schedule-link-light-rail.pdf.

are characteristics not found in any other existing U.S. light rail line, nor any planned for the Sound Transit service area.

In fact, if we look at heavy rail, such as the New York City Subway system, the Chicago "L," or the Los Angeles Metro Red/Purple Lines, where the service is totally grade separated, the national average speed for 2018 was 19.8 mph. Of the 15 U.S. Heavy Rail operators, only two, led by BART at 35.3 mph, exceed 30 mph, and only two others exceeded 25 mph.

Overall, the high end of the 25-35 mph range is clearly impossible with the type of service planned in the ST3 ballot measure presented to the voters in 2018 and even 25 mph is quite questionable.

In contrast, a freeway operating at LOS "E" – as specified in Sound Move – would have a speed of 52 mph (assumes Free-Flow Speed – which is not the same as the posted speed limit of 65 mph).[156]

If we do the math for a freeway lane on a peak hour basis, a more realistic basis, 1,700 vehicles/hour/lane with a 1.125 passenger load at 52 mph is 99,000 passenger-miles/lane. For mid-day, if we assume LOS "C," vehicles/lane/hour are 66% of LOS "E," or ~1,100 and the speed increases to 64.5 mph, with the all-day load factor of 1.63,[157] the passenger-mile value increases to 116,000.

For light rail at peak, three-car trains every six minutes (10 trains/hour) with an average of 50 passengers/vehicle from end-to-end at 21 mph is 31,500 passenger-miles. If you want to focus on the peak load point, and use 125 average passenger load, the passenger miles would be 78,750 (passengers past a point for bi-directional light rail service would be 7,500).

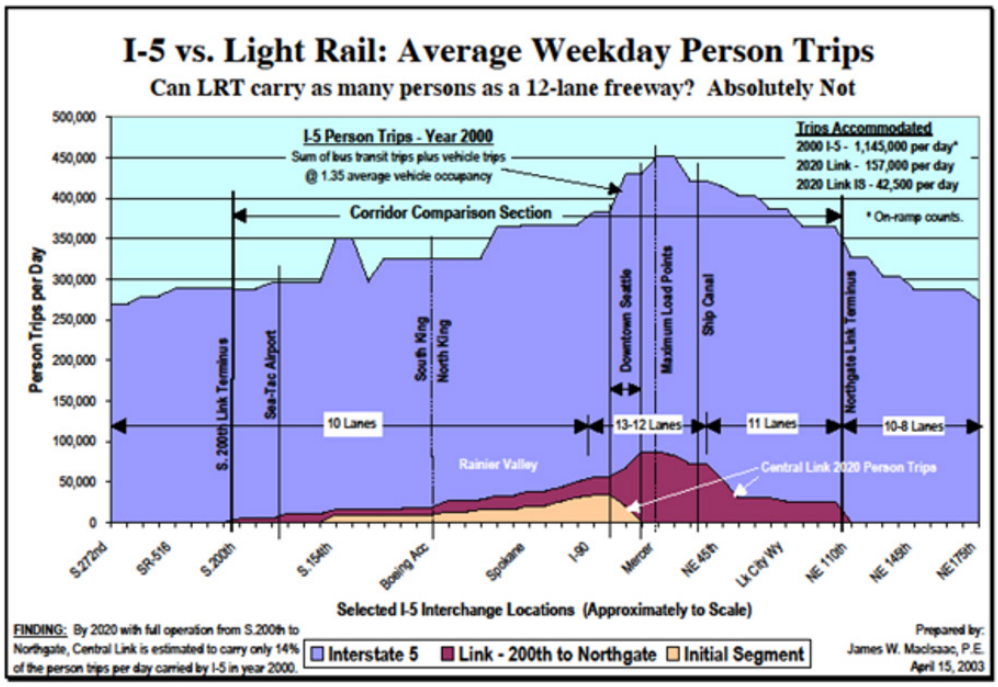
So, during peak, light rail would provide almost identical (95 percent) transportation work at the peak load points, but significantly less on an end-to-end basis. On an all-day basis, light rail does not compare as well (27 percent).

When Sound Transit first released the one-light-rail-line-is-equal-to-12-freeway-lanes, the author was approached by various Puget Sound transit professionals and interested parties about this calculation. At the time, I went through the Smart Move discussion above and, working with the late Jim MacIssac, P.E., we came up with a methodology to test the Sound Move thesis. Jim obtained the detailed on- and off-ramp data for the entire I-5 corridor through the greater Seattle area, calculated the passenger loads on the road at every segment along the way, and then took the then-most current ridership data from Sound Transit for Central Link ridership by station, with the ons and offs, for the initial and full initial systems, and he put together this graphic:[158]

156 Transportation Research Board Highway Capacity Manual, Third Edition, 1994, Updated, Table 3-1, "LOS Criteria for Basic Freeway Sections," page 3-11. (This has since been superseded, but it was the applicable professional standard at the time that Sound Move was adopted.).

157 Federal Highway Administration/National Household Travel Survey, "Travel Profile: United States," accessed December 24, 2019, https://nhts.ornl.gov/assets/2017_USTravelProfile.pdf; data used is from 2000 survey; for 2017, it increased to 1.67.

158 R.C. Harkness, "How Sound Transit Abused the Planning Process to Promote Light Rail and also CETA Comments on DSEIS for Sound Transit's 'Regional Transit Long-Range Plan,'" on behalf of the Coalition for Effective Transportation Alternatives, January 2005, p, 74 https://bettertransport.info/pitf/harknessreport.pdf.



As Jim's graphic shows, the projected full first light rail line, 45th Street to South 200th Street (as built, the Red Line goes from University of Washington Station [3720 Montlake Boulevard, NE] to Angle Lake [19955 28th Avenue South]) would carry, at the peak load point, at the projected ridership, approximately 14 percent of what I-5 actually carried in 2000. A similar analysis for peak hour showed Central Link carrying ~22 percent of the capacity of I-5.

Also note that the peak for light rail is far more pronounced than for I-5 and that the I-5 capacity extends at a high level far beyond the city center. Obviously, I-5 has reached and exceeded its planned capacity, but any proposal that claims that light rail can relieve congestion through the Seattle metro area is badly mistaken.

Finally, I-5 is a major freight corridor, both locally in the Greater Seattle area and as the major truck corridor between the Mexican Border in the South to the Canadian border in the North; even further when the Mexican and Canadian roadway systems are properly included. The usage of light rail for goods movement is, at most, minimal.

There is a very well-known mantra in certain circles, namely, "you can't build you way out of congestion." While this is something of an oversimplification, it is not totally wrong in today's world. At the current point of development of our surface transportation system, the road systems in most larger urban areas, particularly those that are growing swiftly, have not had their road capacities expanded to keep pace with demand growth for many years, generally decades. This leads to the "induced demand" hypothesis, where any increase in capacity is quickly utilized and traffic congestion does not generally change very much.

As Tony Downs pointed out decades ago with his "triple convergence hypothesis," it is not so much that people are suddenly taking trips that they wouldn't have taken without the new road capacity, it is that a large group of individuals are each making a choice that works best for them, shifting back to driving during the peak from another time, shifting back to the main road from other routes, and shifting back to driving

from transit.[159] (Over time, added capacity will generally produce new trips, as well, particularly as population and urban development expand.)

However, if expanding road capacity won't do much for traffic congestion relief in most cases (each circumstance is unique, of course; I'm generalizing), then why should it be expected that adding transportation capacity through transit would relieve congestion?

Particularly since light rail has less carrying capacity than a freeway lane?

In fact, there is not any such example in the U.S., no urbanized area where change in transit utilization can be statistically or anecdotally linked to changes in traffic congestion.[160] The short explanation for this is that transit is just too small a component of overall travel to make a difference, even if usage is significantly expanded – and cases where there has been a significant expansion of transit usage are difficult to find.

While making long-range plans to solve transportation plans can be most interesting, there is an important counterweight – reality. One needs to review similar long-range transportation plans in other urban areas and compare their objectives with the obtained outcomes.

Unfortunately, this is not often not a very pleasurable experience.

Sound Transit Central Link Light Rail Line Segment 1

After Sound Transit received the authority from the Central Puget Sound electorate to proceed with Sound Move in 1996, it promptly began planning for the construction of the Central Link (now Red Line) light rail system centered on Seattle, beginning with the 7.4-mile University Link (Segment 1), to be followed by the 12.6-mile Airport Link (Segment 2), and the 3.5-mile Northgate Link (Segment 3).[161] Sound Transit was pushing very hard to get Segment 1 into construction as soon as possible, including using an innovative negotiated procurement methodology which would have shifted a major share of the risks to the vendor while speeding up getting to and through construction. Three potential vendors were short-listed to prepare detailed plans to be evaluated and negotiated to finalize the best offers and the selection of the preferred vendor. While the procurement was underway in 2000, Sound Transit was working closely with the Federal Transit Administration to finalize the Full-Funding Grant Agreement (FFGA) for the Federal share of the project funding, apparently with the objective of being able to execute the construction contract as soon as the FFGA was awarded and get the project into construction as soon as possible.

The details of the procurement were kept secret while the negotiations were underway, which was not improper while negotiations were underway. But, the need for secrecy ended when a deal was structured and should have been presented to the Board for its approval and to the FTA in compliance with the responsibilities of a grantee. One of the three potential vendors had dropped out (which was publicly

159 Anthony Downs, "The Law of Peak Hour Freeway Congestion," Traffic Quarterly, Volume 16 (1962), https://babel.hathitrust.org/cgi/pt?id=uc1.$b3477&view=1up&seq=457

160 Rubin/Mansour (Op. Cit.).

161 Memorandum, from Kenneth M. Mead, Inspector General, U.S. Department of Transportation, to The Secretary (of Transportation), "ACTION: Interim Report on the Seattle Central Link Light Rail Project [N-2001-051], April 4, 2001, page 1. (Hereinafter "Mead").

announced), which, along with some leaked information of unverifiable reliability, raised questions as to how the negotiations were proceeding, particularly the price. During this period, the top leadership of Sound Transit, particularly the then-Chair, kept issuing public assurances that everything was proceeding as planned.

The announcement of the award of the FFGA (which would not become final until after the opportunity for Congressional review, although, at that time, only one FFGA announcement had ever not produced an executed FFGA, and that was due to the potential grantee cancelling its application after a change in local ordinance) was quickly followed by the announcement of the results of the procurement – with major increases in costs, which kept increasing, particularly as members of the Sound Transit Board, who had not received any information on the procurement until the public announcement (which was proper) wanted information as to what had happened, and how.

The overrun and, perhaps more important, the failure to notify the other interested parties, particularly the FTA, of the events, lead to close scrutiny. As summarized in a memorandum from the U.S. Department of Transportation Inspector General (DOT IG) to the Secretary of Transportation:[162]

> *"The Central Puget Sound Regional Transit Authority … plans to construct the Project in two segments and estimates it will cost $4.164 billion including financing costs. The original estimate for the Project was $2.5 billion, just 7 months ago. … The Federal Transit Administration (FTA) awarded a $500 million full funding grant agreement … for the first segment January 19, 2001. Segment 1 is currently the most expensive transit project in the United States with a full funding grant agreement. Sound Transit estimates that Segment 1 will cost $2.6 billion (about $1 billion more than the original baseline estimate of $1.674 billion). … Sound Transit knew in July 2000 that the tunnel bids on Segment 1 were substantially over the amount budgeted because it had received cost proposals for the tunnel contract that were substantially higher than their engineer's estimate. However, Sound Transit hoped to develop cost savings that would lower the bid. … In November 2000, FTA knew that Sound Transit was considering options that constituted Project scope changes and that Sound Transit was waiting for the grant agreement to be awarded before making any changes to the Project. Sound Transit knew that scope changes, such as tunnel alignment changes, could require a revision to the grant agreement, during with time it could lose the opportunity for Federal funding under the Transportation Equity Act for the 21st Century."*

Sound Transit initially attempted to keep the Segment 1 University Link project going forward[163] after the Segment 1 cost overruns were acknowledged,[164] but, after the DOT IG report, and the expression of concerns by key Members of Congress, the new Secretary of Transportation, Norman Mineta, announced that the Bush Administration's 2002 Budget would have no funding for Central Link.[165] The

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162 Mead (Op. Cit.), pp. 1, 3.

163 Sound Transit, Resolution No.R2001-01, "A RESOLUTION … to authorize execution of a full funding grant agreement …," January 11, 2001, https://www.soundtransit.org/st_sharepoint/download/sites/PRDA/FinalRecords/2001/Reso%20R2001-01.pdf.

164 Seattle Times Staff, "Light-rail cost soars $1 billion," Seattle Times, December 13, 2000, https://archive.seattletimes.com/archive/?date=20001213&slug=TTGI2KF2J.

165 Seattle Times Staff, "Ups and down in the light-rail funding battle," Seattle Times, September 11, 2003, https://www.seattletimes.com/seattle-news/transportation/ups-and-downs-in-the-light-rail-funding-battle/.

construction focus shifted to make what was originally the Segment 2 Airport Link the first Segment to be approved for construction[166] and, after significant additional reviews, a new FFGA was executed on October 24, 2003.[167]

The cost overrun on University Link, and likely even more the failure to properly inform the Board, the public, and FTA of the problems, led to a rapid turnover of personnel. Sound Transit was indeed very fortunate that Joni Earl, formerly the Deputy Snohomish County Executive, had been recruited to become Chief Operating Officer just as these issues became known in October 2000. She became Interim Executive Director in January 2001 and was given the position permanently in June 2001.[168] Coming in as a new face, without the diminished creditability of those who were at the helm of Sound Transit leading up to the Segment 1 problems, she quickly imposed superior management techniques and worked tirelessly to restore Sound Transit's credibility. Her impact was not unfairly stated in a news article headlined, "How Joni Earl saved light rail."[169]

Unfortunately, while Ms. Earl's improvements had major positive impacts, this was hardly the end of Sound Transit's problems, as evidenced by the project cost overruns cited herein.

This process demonstrates very well the extremely high importance of having the proper competencies, systems, processes, controls, and organizational ethics in place well before any major projects even enter planning. The right people, particularly the CEO, are where this must begin - people who are willing to tell their own board members and other powerful stakeholders what will and will not work, and get them to accept that. In the end, there is no substitute for people with mud on their boots and sun- and weather-crinkled faces who have been there before and have done that.

One of the interesting factors that became known during Central Link/Red Line design and construction involved the DSTT. It was opened in 1990 with service provided by dual-power buses, but with a clearly-announced intention and design to allow for easy use by light rail vehicles at a later time.[170] Before the 1990 opening, a decision was made to reinforce the public perception that light rail was coming by installing rail tracks, even though there was no timetable when these would be used. One compelling argument was that, by putting in the rails initially, a lengthy, expensive later shutdown to install the tracks could be avoided. At a budgeted cost of $5 million, this was approved as a justifiable expense.

Unfortunately, it turned out that a decision was made to save money on electrical installation of the rails. The problem is stray electric current corrosion, where improper grounding, literally to the ground rather than back to the propulsion power stations, leads to corrosion of underground utilities, foundations, etc. – a technical

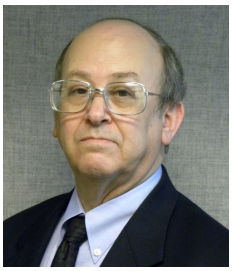
166 Sound Transit Staff Report, Resolution NO. R2001-16, "Select Initial Segment of the Central Link Light Rail Project to be Constructed and Operated, November 29, 2001, https://www.soundtransit.org/st_sharepoint/download/sites/PRDA/FinalRecords/2001/Reso%20R2001-16.pdf.

167 Secretary of Transportation, Annual Report on New Starts – Proposed Allocations of Funds for Fiscal Year 2005, January 28, 2004, "Central Link Initial Segment," pp. A-103-5.

168 Sound Transit, News Release, "Joni Earl named Sound Transit Executive Director," June 12, 2001, https://www.soundtransit.org/get-to-know-us/news-events/news-releases/joni-earl-named-sound-transit-executive-director

169 Joe Copeland, "How Joni Earl saved light rail," Crosscut, October 18, 2015, https://crosscut.com/2015/10/how-joni-earl-saved-light-rail.

170 Walt Crowley, "Bus service begins in downtown Seattle transit tunnel on September 15, 1990," HistoryLink Essay 2702, September 15, 2000, https://web.archive.org/web/20161019081347/http://www.historylink.org/File/2702.



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problem that had been well-known in civil and transportation engineering and similar disciplines since at least the 1920's.[171] The improper installation required that the existing non-usable rails be torn out and replaced with properly installed rails, which cost far more, and took longer, than if the initial improper rail installation had not been done. The amount "saved" by the poor initial decision was approximately $1.5 million.[172]

It also turned out that the physical dimensions of the tunnel had to be changed to comply with the requirements of the Americans with Disabilities Act of 1990,[173] which was the more detailed follow-on to the former §504 regulations implementing the requirements of the Rehabilitation Act of 1973.[174] In order to provide for wheelchair access to light rail vehicles, the tunnel roadway was lowered eight inches. As a result of these and other changes to DSTT, it was closed for two years and the cost of the changes was over $45 million.[175]

It could be argued that the designer of DSTT, working in the 1980's, should have foreseen the need to comply with wheelchair access for both bus and rail. While the ADA was not passed until 1990, the §504 statute dated from 1973, the initial transit regulations a few years later – and being upgraded over time – and Elderly and Handicapped/Senior and Disabled advocates had been very active in demonstrating for what became the ADA, including major demonstrations at virtually every American Public Transportation (nee Transit) Association conference for many years prior to the ultimate passage of ADA. While not insisting on proper electrical insulation of the rails appears to be an error that could and should have been avoided, it is more difficult to make a solid case that the ADA requirements should have been foreseen – and, if the tunnel roadway had to be lowered anyway, then the lack of proper rail insulation would have mattered far less (we assume that alternatives to lowering the tunnel floor for ADA compliance, such as providing wheelchair ramps or raising the platform height, were considered and found unworkable or less desirable).

The lessons here are that bad events can only be hidden for so long before the problems are discovered and that there are consequences to attempted cover-ups, particularly when there appears to be a deliberate attempt to avoid undesired legal consequences.

Also, public relations decisions cannot be allowed to override proper design and engineering and, if the design is to prepare for future usage change or expansion, make sure that the design is as complete and provides for as much flexibility as possible. It is never possible to fully anticipate everything, but the more effort is put into this process, the more likely that the results will be positive.

171 Corrosion Doctors, "Stray Currents in Transit Systems," accessed December 28, 2019, http://www.corrosion-doctors.org/StrayCurrent/Transit-Systems.htm.

172 Eric Pryne, "Bus tunnel error years ago is costly in shutdown today" ("Bus tunnel error"), Seattle Times, October 13, 2005, https://web.archive.org/web/20170202051148/http://old.seattletimes.com/html/localnews/2002557741_tunnel13m.html.

173 FTA, "Americans with Disabilities Act," accessed December 29, 2019, https://www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/americans-disabilities-act.

174 FTA, Circular C 4710.1, "Americans with Disabilities Act (ADA) Guidance," November 4, 2015 https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/Final_FTA_ADA_Circular_C_4710.1.pdf.

175 "Bus tunnel error," (Op. Cit.).