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California Department of Transportation (Caltrans)

To: RailPlan@dot.ca.gov

Subject: Comment letter on draft 2023 California State Rail Plan

May 9, 2023

To Caltrans State Rail Plan Team:

The Rail Passenger Association of California (RailPAC) is pleased to submit this public comment letter on the draft 2023 California State Rail Plan. We very much appreciate this opportunity to provide input to the import rail transportation planning that Caltrans is doing.

RailPAC is a 501c3 group of railroad professionals and advocates that has campaigned for improved personal mobility in California and the west since 1978. RailPAC is an all-volunteer statewide organization that advocates for the improvement of regional and intercity passenger rail service, and for an expanded comprehensive public transportation network serving cities and towns throughout the entire state of California.

Improved regional and intercity passenger rail needs to be a cornerstone of California's transportation investments between now and the year 2050. RailPAC sees improved regional and intercity passenger rail as critical, along with complementary improvements in the freight rail system.

Aside from the obvious environmental benefits of reducing air pollution and providing additional transportation capacity, efficient passenger rail travel is vital to California's economic well-being. The livelihood and security of all Californians cannot be dependent upon increasingly congested and deteriorating highways, rail networks and airports.

Below are RailPAC's detailed comments on the California State Rail Plan, March 2023 draft.

Sincerely,

Brian Yanity

Vice President-South and Board Member,
Rail Passenger Association of California and Nevada (RailPAC)
Fullerton, California

2023 CALIFORNIA STATE RAIL PLAN March 2023 draft (main document)

p.12-13: RailPAC agrees with the overall Rail Plan Vision

" Modern, zero-emissions equipment and better infrastructure maintenance means faster trains"

It should be noted that electric trains powered by overhead wire, not hydrogen propulsion, are faster and more efficient than the current diesel fleet.

p. 15: "California is Leading the Way"

> "No other public investment is as capable of efficiently connecting large numbers of people across communities and between regions as modern, zero-emission rail networks."

We agree.

p. 18: Decarbonizing the Transportation Network

Why is hydrogen the only thing mentioned for "zero emissions technologies". Worldwide and in California, hydrogen will only play a minor role in the rail industry, due to the inherent limitations of hydrogen technology.

p. 19: "Progress Since the 2018 California State Rail Plan"

More projects could be shown here (maybe in a table as well?):

- New SBCTA Arrow train between San Bernardino and Redlands
- Burbank junction improvements
- Grade separation projects, various.
- San Diego and Orange County LOSSAN double track/siding projects
- Freight rail capacity projects (at Ports, etc.)

Rail Plan Vision

p. 21:

> *"Leading the Zero-Emission Transition*
> California has long been recognized as a leader in setting environmental goals with specific targets, specific deadlines, and specific paths to implementation. In 2020, Governor Newsom challenged the status quo by setting a bold agenda to transition new vehicles, including heavy equipment like transit vehicles and locomotives, to be zero emission. Caltrans immediately stepped up to the challenge and delivered a strategy for meeting the zero-emission goal ahead of the Governor's deadline and ahead of CARB's implementation timeline. This strategy will support regional and intercity rail operators across the state to transition their existing fleets to zero emissions over the coming decade. More detail on this process is available in Section 2.2.2.

Zero-emissions rail is promised throughout the whole document, but the only tried and true zero-emissions rail is all electric, not hydrogen. It is very concerning that in this document there is barely any mention, and certainly no support given, for proven overhead wire rail electrification. Caltrans' and CARB's irrational fetish for hydrogen as the only solution for mainline rail needs to be challenged. As stated on p. 13 "the status quo is not an option". In recent years there has been a status quo of Caltrans and CARB being over-enthusiastic and irrationally promoting hydrogen as a magical silver bullet for rail, while continually dismissing proven overhead wire rail electrification, or ignoring that it even exists. This needs to change.

p. 23:

1.2.1 Role of Rail and Intercity Bus in the State Transportation System

> "Rail will continue to play a critical role in meeting California's challenges of accommodating a growing and changing population, expanding the economy, reducing GHG emissions, and protecting the environment. Immediate investment in increased rail capacity is a
> necessary strategy that California must pursue to meet its GHG reduction goals and accommodate the ever increasing transportation demand.
>
> …This will offset capacity demand on roads and at airports—expansions that require significant investment and carry serious environmental externalities and equity impacts. The state cannot meet its climate goals or reduce congestion by further increasing road and airport capacity. Effective use of the rail network is central to pandemic recovery, while increasing quality of life for all Californians, particularly in disadvantaged communities.
>
> With more efficient operating performance, the network can support additional service. With more frequent service, better connectivity, and greater ease of access, ridership will grow, reducing costs per passenger. More, faster trains, running more often with timed connections, will be competitive with car and in-state air travel."

RailPAC very much agrees with this, and are appreciative that Caltrans acknowledges the central role of rail in GHG-reduction.

1.2.2 Engaging Equity

p. 23-24:

The environmental justice and safety implications of hydrogen storage and fueling facilities needs to be considered before they are funded and built in communities.

Leakage of hydrogen and explosion/fire risk are a real possibility for nearby residents of hydrogen facilities.

p. 24:

1.2.3 Implementation Strategy and Capital Funding

More detail needs to be given on overall budget figures for 5-year near-term and 10-year mid-term capital programs, perhaps a table?

p. 25:

1.2.4 Impact of COVID-19

These figures show how the emphasis on passenger rail schedules should be on round-the-clock regional rail schedules, replacing the 9 to 5 commuter schedule emphasis.

1.3 California's Rail System

p. 27:

The map incorrectly shows the Perris Valley Line, the Alameda Corridor and the LOSSAN line in San Diego County as being privately owned. They need to be shown in green for public agency ownership.

p. 28:

There is brief mention of "Several of Amtrak's long-distance routes also serve California markets. An overview of intercity rail and long-distance routes is provided in Appendix 4.2."

This is not the correct appendix to reference:
Appendix 4.2 shows the Farebox Recovery Ratio for each state-supported rail service over the previous ten years from fiscal year 2009-10 to 2018-19. There is nothing in Appendix 4.2 about Amtrak's long distance routes.

Appendix 4.3 shows On Time Performance (OTP) for state supported and interstate rail services in California during fiscal year 2019. But the OTP table is hardly an "overview".

Table 1.1. "Multi-State Amtrak long-distance passenger routes serving California" in Appendix 2.1 does have brief descriptions of these routes. But this is the only mention of them in the whole draft State Rail Plan, and there is no description of their value to California, or how they could be improved in the future.

There needs to be a lot more discussion in this document about Amtrak long-distance trains.

1.3.3 Regional Rail

It is commendable the term regional rail is being used instead of commuter rail.

The regional rail services should be listed here in a table, like was done in the 2018 State Rail Plan, and not relegated to the appendix.

1.3.4 Urban Rail Transit

The urban rail transit systems should be listed here in a table, like was done in the 2018 State Rail Plan, and not relegated to the appendix.

Pgs. 28-33: 1.4 Trends and Opportunities

p. 32:

"A modern, zero-emission rail network will reduce the transportation sector's substantial GHG emissions"

This is not true about Caltrans' preferred "zero emissions" option of hydrogen. The production and use of hydrogen results in substantial GHG emissions.

p. 33: 1.4.6 Governor Newsom's Leadership On Air Quality & GHG Emissions

Why are "battery and/or hydrogen" the only technologies mentioned for rail decarbonization. Why is conventional electrification with overhead wire not mentioned?

p. 34:

1.4.7 Freight Demand and Growth Trends

Specific corridors should be discussed- showing how improved freight rail service on a corridor mitigates the need to expand a parallel highway (Alameda Corridor vs. 710, for example). In

addition to mitigating the need for highway expansion, supporting the freight rail network is a key strategy to eliminate emissions of freight transport. In particular, mode shift to rail is one of the most important ways to reduce the GHG emissions of freight movement over land.

Some data and numbers should be shown to provide evidence that "Freight rail has a significant role to play in mitigating air quality impacts", particularly in regards to zero-emissions trains. Freight rail electrification should also be discussed.

1.4.8 Resiliency in the Transportation Network

> "Each Caltrans district has developed an adaptation priorities report to prepare the transportation system for climate change and to identify assets most at risk. However, since the rail network is largely privately owned, rail infrastructure is not analyzed in the report. The state's general adaptation planning framework and prioritization methodology outlined in the report is indicative of climate change adaptation efforts more broadly, many of which are relevant to the state's rail network."

Much of the state's most heavily used passenger and even freight (Alameda Corridor, ports) rail lines are publicly owned. Caltrans should be working with public agency owners on climate adaptation priorities on specific rail corridors.

Chapter 2: NETWORK VISION

p. 37-38:

> "We will achieve our equity commitments through an engagement process where everyone is treated with dignity and justice. We will reform programs, policies, and procedures based on this engagement to avoid harm to frontline and vulnerable communities. We will prioritize projects that improve access for and provide meaningful benefits to underserved communities.
> ..
> We will change how we plan, design, build, and maintain our transportation investments to create a more resilient system that more equitably distributes the benefits and burdens to the current and future generations of Californians."

Hydrogen storage facilities, pipelines, and fueling stations would have a disproportionate impact on low income-disadvantage communities alongside rail facilities. Leakages and explosion hazards from hydrogen rail support infrastructure will be quite serious. Trackside infrastructure needed (traction power substations, paralleling and switching stations) for conventional overhead electric rail presents far less safety risks to local communities than hydrogen.

p. 39: For Passengers

"More frequency and shorter connection times mean less time waiting for trains. Modern, zero-emissions equipment and better infrastructure maintenance means faster trains."

This is true for electric trains, NOT battery or hydrogen trains.

For Partner Agencies:

> *"Technical Support*
> The Vision provides a documentable, reproducible set of technical assumptions for future service goals, operating plans, equipment parameters, and infrastructure interventions. Caltrans will provide technical resources, digital models, and technical expertise in interpreting, analyzing, and further iterating detailed technical work."

Caltrans has provided no technical evidence, analysis or adequate explanation for why the state has decided to purchase hydrogen multiple-unit trainsets, with an option to buy many more, while electric alternatives were dismissed.

p. 40-43: 2.2 The Need for Strategic Planning

> "Decisions required to manage, enhance, and expand the public transport network are complex. Decision-making involves large groups of stakeholders, consequential social equity considerations, and is time- and resource- intensive. Public agencies must navigate a range of technical questions supporting service planning, environmental impacts analyses, civil engineering, project development, funding strategy, and, ultimately, project delivery and revenue service operations.
>
> California has ambitious equity, environmental, and economic goals. Current project delivery timelines and capital costs, particularly when compared to international peers, are out of line with achieving the

> State's ambitions. Service network improvements take too long to implement and cost too much to deliver. While there are many challenges to reducing project costs and speeding implementation timelines, the planning phase is an opportunity to reduce complexity and drive better outcomes in public transportation service and infrastructure investment."
>
> "Effective strategic planning requires agency staff, executives, and boards to be empowered through transparent, reproducible analyses scaled to the level of detail and specificity appropriate to the decision in question. Given the interconnected nature of the State's transport network and the overlapping responsibilities of funding and operating agencies, clear documentation and coordination of process, parameters, and recommendations is critical to working across multiple stakeholder groups, jurisdictions, and planning horizon years.
>
> Conversely, a lack of transparency or reproducibility creates opaque processes that are difficult to understand, scale, or ultimately deliver. Overinvestment in detail or unnecessary specificity delays timelines, creates confusion, and introduces false precision. Effective strategic planning empowers planners to clearly understand the question at hand, collect the data and analysis needed to answer that question, and ultimately articulate recommendations, coordinate with partners, and deliver on implementation."

Since many, if not most rail services are operated on interregional multi-jurisdictional routes, Caltrans should take the lead in developing strategies, engineering and supply chain support to streamline project planning and delivery timelines thus reducing project capital costs. The goal of this effort would be to match or approach the project performance metrics of international peers. California falls short of matching the project timeline or costs of international peers. Yet despite this, Caltrans appears to be using the experience and costs of Caltrain's torturous electrification timeline and cost metrics as the benchmark for overhead electrification in California, without exploring or analyzing international experience with overhead electrification projects.

2.2.1 Strategic Planning and Public Engagement

> "Engagement is most effective when it demonstrates respect for stakeholders. Effective engagement must respect stakeholders' values, their intelligence, and their time; providing meaningful opportunities to understand critical issues and provide actionable feedback.
>
> That respect demands a robust technical process that provides a platform on which stakeholders can understand tradeoffs, develop informed opinions about options, and ask relevant critical questions. The methodology described for Service-led Strategic Planning is focused on the technical aspects of transportation operations required for delivering future service. Service-led Strategic Planning provides a platform for respectful, meaningful engagement."

Caltrans has long been dismissive of rail electrification advocates in California, always ignoring rail electrification and the voluminous technical, economic and scientific data on it, voices critical of hydrogen, and automatically giving hydrogen promoters the benefit of the doubt. If there was a "robust technical process", why did hydrogen trains get purchased with no public discussion?

2.2.2 Service Led Strategic Planning: Methodology & Process

p. 43-44 2.3 Host Railroad Coordination

> "In California, most passenger rail service is operated on infrastructure owned by freight railroads (or 'host railroads'). Freight railroad owners' incentive and duty to their shareholders is to preserve and grow their freight business. They do this by improving efficiency and preserving/building network capacity to accommodate growing freight traffic. Passenger rail service must not negatively impact the core freight business or infringe on future freight operations.
>
> In technical service and operations planning, Caltrans considers the potential impacts of the planned passenger rail service improvements on railroad capacity, and access to yards and customers. Infrastructure investments necessary for increased passenger train volumes will also add capacity and flexibility to freight operations. Caltrans' articulation of future service goals and implementation strategy, paired with increased use of technical planning tools, provides a technical foundation and venue for strategic collaboration in implementation planning.
>
> The State's goal is to enable continued, market responsive growth in goods movement by freight rail, while providing for increased passenger capacity. This will be achieved through early and continuous dialogue with the freight railroad partners, and progressive identification of shared opportunities. In some cases, ensuring capacity for passenger and freight rail operations will be realized through development of a shared track infrastructure used by both freight and passenger trains. In other cases, ensuring capacity for freight will involve the development of largely dedicated track for passenger and freight trains in a shared right of-way, while retaining the ability to share track under certain conditions; or the development of separate freight and passenger infrastructure.
>
> Since 2018, the State has supported to several 'freight pathing studies', in collaboration with or led by host railroads, to optimize infrastructure and provide more freight and passenger slots with targeted improvements.
>
> Where freight and passenger services share a corridor, opportunities exist to expand or reorganize agreements for additional capacity for passenger service. While the solutions will be context-specific, the State's strategic leadership in coordinating service planning and supporting detailed technical analyses will continue to facilitate increased dialogue with freight partners.

Caltrans needs to ensure that the freight pathing studies offer sufficient resiliency for passenger operations, in case of accidents, repairs, track damage/closures, etc. The State must also be aware of the impacts to passenger trains from profit-driven freight railroad operating practices and business models (described below in freight rail section), and work with passenger rail operators and freight railroads to insure sufficient investment in track capacity.

p. 44: 2.4 State Policy Initiatives

> "Caltrans recognizes the climate emergency and transportation's role in fighting that emergency; requiring massive mode shift away from highways and regional air travel to a modern, zero-emission rail network to serve statewide travel markets as well as investing in climate resilient infrastructure and equipment."

A truly zero-emissions rail network requires overhead wire electrification of the core mainline rail corridors in California.

p. 44-45:

> "California will not meet its environmental goals relying solely on a shift in transportation technologies (e.g., electric cars). Further, changing motive power does nothing to address equity or economic development and may even exacerbate problems if zero-emissions cars lead to more single-occupancy vehicle driving, more demand for highway capacity, and more resulting sprawl and dispersed land uses."

We very much appreciate Caltrans recognizing that electric road vehicles alone are insufficient to meeting California's environmental goals.

p. 45-46. 2.4.1 CTP 2050 Coordination

Does the figure shown of 76% reduction in GHG emissions take into account any changes in modes of transportation (such as from road to rail)?

p. 46-47. 2.4.2 CAPTI Coordination

Electric rail, and mode shift from road to rail, need to be listed here.

Rail Investment vs. Freeway Expansions:

Many strategic rail assets are nearing the ends of their useful lives. Some are functionally obsolete and many rail segments are threatened by sea level rise. For the transportation planning from now until the year 2050, consideration of long-term maintenance costs of these life-expired assets is critical. Public and private investments to modernize these life-expired rail assets will yield maintenance cost savings for the state over the next several decades while improving service. The shift of traffic from highways to rail also helps the lower the maintenance cost of roads as a result of reduced wear and tear.

California is spending, or intends to spend, billions of dollars on freeway expansions. The induced demand resulting from road capacity expansion means continued traffic congestion, increased pollution, a reinforcement of dispersed land use (sprawl) and additional Californians displaced by freeway construction. California would get a better return on investment and increased reduction in GHG emissions if a portion of this funding was spent on rail capital improvement projects instead. This funding redirection would be a critical part of leveling the playing field for active transportation, rail, transit, and shared modes.

State transportation planning needs to clearly discourage freeway expansions. The State Rail Plan proposes a variety of viable alternatives to freeway expansions. Highway funding needs to focus on repaving and maintaining existing highways and streets, and not expansion of the highway network. California has a tremendous backlog of street and road maintenance and repair projects, and will continue to for the foreseeable future.

As described by the draft State Rail Plan (p. 39):

> *Sensitive Infrastructure*
>
> Highways require large amounts of land and right of way. In urbanized areas, this divides communities and is detrimental to safety, environmental justice, and equity. Shifting travel from the highway network to a zero-emission rail network decreases need for roadway expansion and community displacement, improves air quality (reducing particulate and NO2), and reduces noise and light pollution.

Environmental Balance, CEQA reform:

Too often in California, lineside stakeholders have blocked worthy rail projects in existing rail rights-of-way that have enormous public benefits.

One factor that the State Rail Plan should explore is the tension between California's macro level climate goals and the local focus of the California Environmental Quality Act (CEQA). With its specific project focus CEQA has no mechanism to weigh macro level tradeoffs between initiatives that generate large savings in GHG but have noticeable local impacts. Within the CEQA analysis GHG savings are a calculated abstract value as compared to real impacts on neighborhoods impacted by the project. But those GHG savings are not abstract values they represent other Californians whose houses and businesses will be destroyed by climate change enhanced wildfires, floods and sea level rise unless GHG is reduced.

Quality of life is another area that under CEQA, is weighted toward project-impacted neighborhoods. There is no countervailing quality-of-life impact weighting for those Californians held captive by gridlock often missing key family and community events. To meet the challenge of climate change, this tension between local and macro priorities needs to be addressed.

Moving forward, equal weight in the decision process also needs to be given to quality-of-life issues for harried commuters stuck in gridlock Key actions listed in the rail plan – enhanced rail safety, quiet crossings, highway/rail grade separations, additional right-of-way fencing and electrification - all provide mitigation for lineside stakeholders. Perhaps some legislative clarification/relief may be warranted.

While the draft 2023 California State Rail Plan outlines a broad interconnected network with high service levels that will rebalance the state's transportation system, it leaves many critical questions unanswered. No mention is made of the institutional failures over the last decade that failed to deliver vital capacity improvements on California's corridors, undermining the Rail Plan. This leaves stakeholders unaware of the rigorous efforts needed to achieve the plan's visionary goals. There is no action item to work toward a consensus among stakeholders to support the projects outlined in the vision. Of critical importance is the goal of the State Rail Plan to play major role in meeting California's climate change goals. But to achieve that goal a radical change in the process of achieving capacity improvements needs to be considered.

The near veto power exercised by lineside stakeholders, despite the fact that that the majority of rail line improvements will be constructed within existing rail rights-of-way that have been in

service for over a century. In all cases the proposed projects have significant public benefits. Also, opposition to operating any additional rail frequencies should not be an acceptable position. Despite the risk to the Plan's goal, this is not discussed nor are strategies and mitigation efforts designed to balance lineside stakeholders' issues vs. the benefits of the proposed investment.

One particular negative impact of this veto power is the loss in the state's credibility with the freight railroads. With the state unable to deliver capacity additions a disincentive is created for the freight railroads to work with the state.

Chapter 3: PASSENGER NETWORK STRATEGY

p. 49: 3.1 Evolving State Service and Connectivity Goals

p. 50 – 52: 3.2 Passenger Network Design Principles

Coordinated planning, guidance and standards at the state level is essential.

p. 53: 3.3 Geographic Service Areas and Organizational Framework

p. 54-55:

3.4 Planning Year Horizons

3.4.1 Near-Term (~ +/- 5 year) Investments

A table or other information format showing numbers for the overall cost estimate/budget, number of projects, in this timeframe should be provided here.

3.4.2 Mid-Term (~2032 ~10 Years) Investments

A table or other information format showing numbers for the overall cost estimate/budget, number of projects, in this timeframe should be provided here.

3.4.3 Long-Term (~2050) Investments

A table or other information format showing numbers for the overall cost estimate/budget, number of projects, in this timeframe should be provided here.

> "Intercity rail improvements include electrification of express services in both Northern and Southern California, complementing HSR in network hubs with pulsed service schedules.."

Rail electrification should not wait until 2050, it can be done much sooner.

> "The zero emission and integrated rail corridor between the San Francisco Peninsula and Sacramento identified in the Vision would not be possible without a second bay crossing."

The second San Francisco Bay crossing should be electrified with overhead wire, as hydrogen is too dangerous to use in tunnels.

p. 56-65: 3.5 2027 Near-Term Plan Goals

Budget estimates and funding status need to be provided for key projects needed to realize these goals.

p. 59: 3.5.7 Coast Route Corridor

The existing Amtrak *Coast Starlight* , which uses the Coast Route Corridor, needs to be listed and discussed.

Coast Route Corridor plans should include an LA-San Francisco train using the Coast Route.

Ventura County LOSSAN improvements which need construction funding include Rice Avenue Grade Separation, CA 188 Grade Separation, and Moorpark-Simi Valley Double Track.

Capital projects along LOSSAN and UP Coast Route will improve Amtrak Coast Starlight on-time performance.

p. 60:

3.5.10 Cross Valley Rail Corridor

Why bus and not rail?

p. 60-61:

3.5.11 CA High Speed Rail Phase 1 Corridor

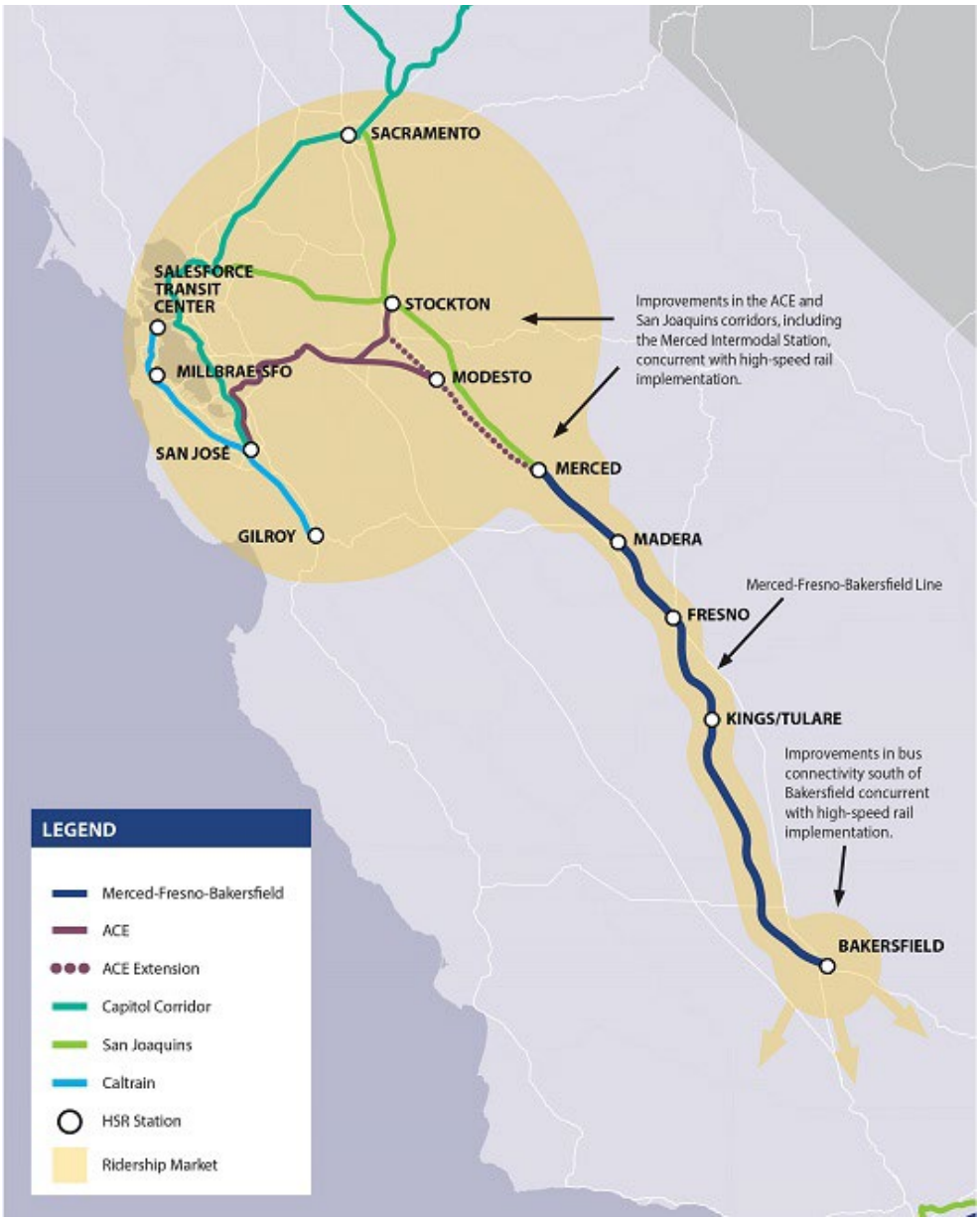
Rancho Cucamonga-Los Angeles is listed as “High Speed” but should it be listed as “Regional Rail” instead? Or are there near-term plans to seriously upgrade the LA-Rancho Cucamonga station of Metrolink’s San Bernardino Line?

Central Valley:

High Speed Rail is the priority for this corridor.

RailPAC also supports the Altamont Corridor Vision including the Altamont Pass Tunnel, Valley Link, and the Stockton Diamond Grade Separation.

RailPAC agrees with the support for High Speed Rail in the SRP. The California High Speed Rail project is crucial to the economic development in the Central Valley. Revitalizing the cities and towns of the Central Valley, stimulating their economies by tapping their enormous reservoirs of untapped labor, housing, infrastructure and other resources and connecting them to jobs in the coastal cities will be a game changer. In addition, airport capacity will benefit from shifting short-haul air travel within California to High-Speed Rail.



With over six million residents, the Central Valley is the fastest growing area of California. Ridership forecasts show that the Central Valley segment generates the greatest possible ridership and the largest reductions in highway travel and greenhouse gas emissions compared to other options. The California Demand Forecast Model has an established track record and is very credible.

In viewing this issue, the role of the Central Valley HSR segment within the statewide rail network needs to be considered. The Merced-Bakersfield segment is not intended as a stand-alone railroad. From the first day of its operation, the initial HSR service will not be carrying just passengers in the Merced - Bakersfield local market. The Central Valley HSR segment will leverage a *San Joaquins* and Altamont Corridor Express (ACE) frequency expansion creating substantial synergies and a statewide network that results in the substantial ridership growth.

An overhead contact system (OCS) high-speed demonstration rail line, Merced to Bakersfield, facilitates testing and integration of trains, electrification, signal and control systems into a reliable operation. This speeds future expansion of service as future segments are constructed. It also results in substantial rail ridership growth, proof of concept and is the most financially viable option resulting in increased ACE and San Joaquin service with a reduced subsidy. It also results in the greatest reduction in GHG emissions.

Beyond completing the current segments, the key strategy should be on laying the foundation with pre-construction investments on the network addition that will move the quickest to an operating segment that will generate surplus free cash to expand the system further. That network addition is Chowchilla - Gilroy. It is the shortest of the greenfield construction alternatives and has only one challenging mountain crossing. Concurrently, negotiations can continue with the Union Pacific for purchase of their rail line between Gilroy and San Jose.

For these reasons RailPAC supports the California High-Speed Rail Project Early Interim Service between Bakersfield and Merced as the most viable path to a high-speed network and the only viable alternative to increased highway and airport investment.

p. 61: 3.5.12 Las Vegas Corridor

High Desert Corridor will connect with Metrolink at Palmdale, and not just Phase 1 HSR service.

Las Vegas to Southern California is too important and too lucrative to have development put off to 2050. The timeline for Palmdale-Las Vegas via the High Desert Corridor needs to be moved up.

This section should include mention of restoration of the Amtrak *Desert Wind*: LAUS-Fullerton-Riverside-San Bernardino-Barstow-Las Vegas-Salt Lake City (Denver?). Additionally, the State and Amtrak partners should work with Brightline West to study the possibility of running a restored *Desert Wind* over the Brightline West tracks from Devore through Las Vegas as it otherwise would not be time-competitive.

p. 62:

3.5.13 Antelope Valley Corridor

Extensions north to Rosamond and Mojave should be studied.

3.5.14 Central Coast to Los Angeles Corridor

Service frequency to San Luis Obispo should be every two hours, and Goleta-Moorpark/Chatsworth every hour.

3.5.15 Los Angeles to San Diego Corridor

Los Angeles-Fullerton should be half-hourly

> Planning goals related to Table 3.5.15, "Plan for long-term realignment and or tunneling of the LOSSAN corridor at Del Mar"

Need to add mention of a San Clemente bypass.

3.5.16 Inland Empire Corridor

Needs to mention improved Metrolink frequency on all lines serving the IE and the possiblity of regional rail services from Barstow to Rancho Cucamonga over the Brightline West infrastructure, including the addition of stations in Barstow, Victorville, and Devore.

3.5.17 Coachella/Arizona Corridor

Los Angeles- Indio Coachella Valley Rail, needs to be listed as Regional Rail.

Study of extension of Coachella Valley Rail to Calexico needs to be mentioned.

The existing Amtrak *Sunset Limited* needs to be mentioned, along with proposed frequency of daily (up from current 3x/week), and eventually twice a day.

Needs to mention the opportunity provided by "California Connector" what would allow trains to serve San Bernardino station while still being able to continue out to Coachella Valley and beyond. Opportunity for at least 90-110 MPH service in portions of Coachella Valley where existing route is already fully grade-separated.

3.5.18 Inland Empire to San Diego Corridor

Early work on this segment of CAHSR needs to be started once all the environmental documents for Phase 1 are certified, which is expected to occur within the next 18 months.

p. 63:

> "Complete maintenance and layover facility investments for integrated services".

Need to specify where the specific layover facility projects would be.

> "Plan for long-term realignment and or tunneling of the LOSSAN corridor at Del Mar"..

Need to add San Clemente. Caltrans needs to support engineering and environmental studies of a San Clement bypass tunnel.

3.6 2032 Mid-Term Plan Regional Goals

p. 64-68:

Why is there no mention of electrification under Mid-Term Goals, like there was in the 2018 State Rail Plan?

Northern California

p. 65:

3.6.1 North Coast Corridor

The Cloverdale-Arcata bus should run every two hours, instead of every four.

3.6.2 North Bay Rail Corridor

Rail extension of SMART to Cloverdale and Suisun/Fairfield could be possible before 2032.

3.6.3 Sacramento Valley Corridor

RailPAC supports a North State passenger rail initiative, which would be a good compliment to Amtrak *Coast Starlight* service. A route serving Yuba City, Oroville, Chico, Red Bluff, Redding and Dunsmuir should be investigated. While work is currently ongoing to extend ACE and *San Joaquins* to Chico, *Capitol Corridor* should also be added to that extension to enable direct trips to the northern portion of the Bay Area and better utilize some of the "orphaned" Capitol Corridor trips that would not be continuing to Roseville or Auburn.

3.6.4 East Sierra Corridor (*Seasonal)

Why can't the proposed bus between Reno and Roseville be year-round, instead of seasonal? The Nevada State Rail Plan envisions that service between the Las Vegas and Reno areas of that state by use of the "C" Corridor via the Central Valley of California. The State of Nevada should be engaged for coordination and support of this service.

3.6.5 Sacramento to San Francisco Bay Area Corridor

Capitol Corridor extension to Chico, Redding should be added

p. 68:

3.6.11 Cross Valley Rail Corridor

Rail should be studied for Cross Valley Corridor, providing a valuable connection to HSR.

p. 68-70 : Mid Term Goals: Southern California

In Los Angeles County, priority LOSSAN improvements that need to be fully funded for construction include the Raymer (Van Nuys)-Bernson (Chatsworth) Double Track, as well as the Los Nietos/ Norwalk Blvd., Doran Street and Broadway/Brazil (Glendale and Los Angeles) grade separations.

The State Rail Plan needs more discussion of Metrolink's Southern California Optimized Rail Expansion (SCORE). This 10-year, $10 billion capital program will not only greatly increase the capacity, reliability and frequency of passenger service in the region, but will help do the same for freight movement by increasing the overall capacity of rail corridors. A component of the SCORE program which is directly relevant to the LA-Anaheim corridor is the Fullerton Junction project and related track capacity upgrades (3rd and 4th tracks) on the BNSF San Bernardino Subdivision between LA, Fullerton, Riverside and San Bernardino.

Southern California priority rail projects:

Outlined below are recommendations of RailPAC for near-term Southern California project grant requests. The list reflects the importance of the project, weighted towards projects that are far enough advanced through the planning process that design and construction funding can be bring the project, and its benefits, into service near-term. The only exception to these guidelines is guidance recommending funding to begin the planning efforts for some critical long-lead time mega-projects that address failing infrastructure due to sea level rise and wave action.

1. **Fullerton Junction Interlocking Project, Fullerton –** Construction Funding
2. **Raymer (Van Nuys) - Bernson (Chatsworth) Double Track, Los Angeles –** Construction Funding
3. **Del Mar Bypass Tunnel, Del Mar –** Right of Way Failure, Funding for Environmental Impact Report (EIR/EIS), preliminary Design
4. **LinkUS, Phase II –** Funding for 100% Design and Pre-construction
5. **San Clemente Bypass Tunnel, San Clemente –** Right of Way Failure, Funding to complete Scoping for the Project, Environmental Impact Report (EIR/EIS)
6. **Doran Street and Broadway/Brazil Grade Separation, Phase II, Glendale and Los Angeles –** Design and Construction Funding
7. **San Dieguito Bridge and Double Track, Del Mar –** Life-expired trestle, Environmental Impact Report (EIR/EIS), Design and Construction Funding
8. **17th Street/Lincoln Ave. Grade Separation, Santa Ana –** Construction Funding.

9. **North Oceanside Bridge Replacement, Double Track, Oceanside** – Replace Life-Expired Bridge, Construction Funding
10. **San Onofre/North Green Creek Beach Bridges Replacement, Double Track Project, San Diego County** - Three life-expired timber trestles, double track - Construction Funding
11. **Ball Road Grade Separation, Anaheim** – Environmental Study, Design and Construction Funding
12. **Fullerton – Riverside – San Bernardino Complete Third Main Track, Riverside County –** Construction Funding
13. **Jackson Street Grade Separation, Riverside** – Funding for Environmental Studies, Design, Pre-construction and Utility Identification and Utility Relocation, Construction
14. **Lone Hill to White Ave Double Track Project, San Dimas/La Verne** – Construction Funding
15. **Lilac Ave to Rancho Double Track Project, Rialto** – Construction Funding.

RailPAC's recommendations are also weighted toward the LOSSAN corridor because of its potential. With its current level of ridership (Metrolink and Amtrak *Pacific Surfliner*), 2nd highest in the US, it can be improved to become a higher speed (110 mph) corridor offering service every 15 or 20 minutes. Transforming the LOSSAN corridor will drive large ridership and revenue growth. This expanded capacity and higher speeds, equal to building an eight-lane freeway, will mitigate the need for parallel highway expansions. The existing LOSSAN route is at risk due to climate change which must be addressed to avoid closure and resulting gridlock on I-5.

Four of the key projects listed on the map are rail-road grade separations. Stakeholders and agencies should try to leverage funding contributions from the Local Streets and Roads Program (LSRP), funded by SB1, which provides funds for rail grade separation projects. Grade separations provide multiple benefits – improved rail operations, safety by eliminating collisions, reducing traffic congestion by eliminating wait times typical of at-grade separations, and reducing greenhouse gas (GHG) emissions.

Finally, there has been substantial investment by CHSRA for projects in Southern California. CHSRA contributed a $423 million Link Union Station project, building upon $18.7 million of prior planning funding for design and environmental work. CHSRA contributed $76.7 million for the Rosecrans/Marquardt grade separation. CHSRA also contributed $1.3 billion in Southern California connectivity projects for additional rail projects including the Regional Connector.

Analysis of data by RailPAC from local agencies found that overall, over $38 billion is already authorized for rail projects in Southern California. Given this level of investment, there is a question of whether the $38.4 billion existing funded rail projects in Southern California risks approaching a 'saturation' level of capacity of the construction industry and public agencies.


RailPAC
Rail Passenger Association of California and Nevada
Southern California Priority Projects
LANCASTER
VENTURA
MOORPARK
SIMI VALLEY
CHATSWORTH
CAMARILLO
VAN NUYS
HOLLYWOOD BURBANK AIRPORT
LOS ANGELES
GLENDALE
LOS ANGELES UNION STATION
SAN BERNARDINO
RIVERSIDE
FULLERTON
ANAHEIM
SANTA ANA
PERRIS
IRVINE
ORANGE
RIVERSIDE
SAN JUAN CAPISTRANO
SAN CLEMENTE PIER
OCEANSIDE
SOLANA BEACH
SAN DIEGO
SAN DIEGO - OLD TOWN
SAN DIEGO
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
(projects numbered by order of priority)
1. Fullerton Junction
2. Raymer (Van Nuys)-Bernson(Chatsworth) Double Track
3. Del Mar Bypass Tunnel
4. Link Union Station, Phase II (100% design, pre-const.)
5. San Clemente Bypass Tunnel
6. Doran St. and Broadway/Brazil Grade Separation (Glendale and LA)
7. San Dieguito Bridge and Double Track (Del Mar)
8. 17th Street/Lincoln Ave. Grade Separation (Santa Ana)
9. North Oceanside Bridge and Double Track
10. San Onofre/North Green Creek Bridge and Double Track
11. Ball Road Grade Separation (Anaheim)
12. Fullerton-Riverside-San Bernardino Third Main Track
13. Jackson Street Grade Separation (Riverside)
14. Lone Hill to White Ave. Double Track (San Dimas and La Verne)
15. Lilac to Rancho Double Track (Rialto and San Bernardino)

p. 68:

3.6.12 Las Vegas Corridor

Apple Valley to Rancho Cucamonga should have a half-hourly frequency- the same frequency as Apple Valley to Las Vegas. This could be run as a regional/commuter operation by Metrolink contracted to Brightline West with their rolling stock but making intermediate stops beyond the ones proposed by Brightline West at Hesperia and Rancho Cucamonga.

p. 69:

3.6.13 Antelope Valley Corridor

Extensions north to Rosamond and Mojave should be studied.

3.6.14 Central Coast to Los Angeles Corridor

LA to San Francisco using the Coast corridor , serving the Central Coast, needs to be studied.

3.6.15 Los Angeles to San Diego Corridor

The state-supported Amtrak *Pacific Surfliner* along the LOSSAN corridor needs to be greatly increased in frequency, and electrified.

RailPAC supports the Del Mar and Miramar tunnels, the south Orange County bypass tunnel through San Clemente, and various double-track and grade separation projects along LOSSAN corridor, particularly in San Diego and Orange counties. These projects should also be designed and built to increase maximum speeds on the line up to at least 110 MPH, particularly for the existing long straight stretches e.g. between Santa Ana and Laguna Niguel.

3.6.17 Coachella/Arizona Corridor

San Gorgonio Pass-Coachella Valley Rail initiative:

RailPAC fully supports the main feature of the preferred Build Alternative Option 1 of the Coachella Valley Rail: the construction of a new third mainline track along 76 miles of the Union Pacific (UP) Railroad’s existing Yuma Subdivision between Colton and Coachella. Given the capital costs of the third mainline track proposed from Colton to the Coachella Valley, RailPAC wants to emphasize the variety of benefits to passenger and freight rail that are possible with this investment in additional track capacity. Any proposed service in the Coachella Valley Rail (CVR) corridor, and the capital improvements associated with it, must be recognized as a building block for future expansion. The initiatives described below would add significant public value to any capital grant request for a Colton-Coachella third mainline track:

Greater frequency and speed of CVR passenger trains-

Improvements to the level of CVR service evaluated by this Tier 1/Program EIS/EIR recommended by RailPAC, would require and be enabled by the third mainline track: far greater frequency (minimum of 6 round-trips per day, preferably 12 or more—could be split between Metrolink and Amtrak California-served service) and higher speed (a goal of at least 60 mph *average* speed which would be similar to *San Joaquins*, up from the roughly 45 mph currently proposed). Fast and frequent service, competitive with driving, is essential to attract a rail ridership significant enough to provide major public benefits of reduced traffic congestion and pollution on the I-10 and SR-60 corridors.

Daily Amtrak *Sunset Limited*-

Increase of the frequency of Amtrak's *Sunset Limited* from tri-weekly to daily service has long been a goal of RailPAC. Of the multiple congestion bottlenecks along the *Sunset Limited* route between LAUS and New Orleans, which need to be relieved to allow daily service of this long-distance Amtrak train, the San Gorgonio Pass/Coachella Valley segment in Southern California is among the most important. There has long been wide-ranging support in the Coachella Valley for a daily *Sunset Limited*. Indio has been pushing for the *Sunset Limited* to return service to their community as well; and a new station built for the CVR service could also serve long-distance Amtrak trains. Not long after the *Sunset Limited* frequency is increased to daily service, it should be increased to twice a day (as should all other Amtrak long-distance trains).

A daily, then 2x daily, *Sunset Limited* could complement the regional CVR service. One of the markets served by Amtrak long-distance trains are shorter distance corridors. The *Sunset Limited* can add an extra schedule at off-peak times to add options and customer value to the CVR. The current schedule of the *Sunset Limited* which serves the Palm Springs station late in the evening/early in the morning almost certainly offers such an opportunity.

Benefits to UP freight rail-

According to the CVR EIR documents, steady growth of UP freight traffic on the Yuma Subdivision is projected to increase to 88 daily one-way freight trips on the Colton-Coachella segment by 2044 more than double the 2018 average of 42 one-way freight trains per day. While UP has invested in many track capacity improvements on the Sunset Route over the years, one of its chokepoints remains the San Gorgonio Pass/Coachella Valley. With the new third main track, UP could run more conventional long-distance freight trains on the Sunset Route, and future short and medium-haul freight trains from LA/Inland Empire to the Coachella Valley and Arizona could be justified on public benefit of getting trucks off of I-10.

New California-Arizona regional passenger service-

Amtrak's May 2021 Connects US 'Corridor Vision' proposed one daily roundtrip of a LA-Arizona regional service, between LAUS, the Coachella Valley, Yuma, Phoenix and Tucson. For the long term, a daily or even twice-daily *Sunset Limited* on its own is not sufficient to be the prime mover of rail passengers between LA, Coachella Valley, Phoenix and Tucson. RailPAC

recommends that dedicated Southern California-Arizona corridor passenger trains should start with a minimum service of two daily trains each way, leaving morning and mid-day from both LA and Phoenix/Tucson (further complementing the *Sunset Limited* and future LAUS-Coachella Valley and Tucson-Phoenix trains). The 2018 California State Rail Plan (p. 37) recommended an 'interstate blue ribbon commission' in collaboration with Arizona for improved California-Arizona future rail service. High speed rail on new, dedicated track along the I-10 corridor between LA, the Coachella Valley, Phoenix, and Tucson should also be studied. Since the environmental and planning stages for a whole new line would take some time, they should be done concurrently with the first steps to improving passenger rail between Southern California and Arizona: upgrade the existing Sunset Limited to daily service, and bringing it back to Phoenix Union Station by restoring the Wellton Branch (the out-of-service, UP-owned line West of Phoenix in Arizona).
Calexico extension-

RailPAC supports an Imperial Valley extension to the Coachella Valley Rail passenger service under development. Some trains of the Los Angeles-Coachella Valley service should extend to Brawley, El Centro and Calexico in the Imperial Valley (as described in RCTC's 1991 *Los Angeles - Coachella Valley - Imperial County Intercity Rail Feasibility Study*). The combined population of the bi-national region of the Imperial County/Mexicali Municipality is over 1.2 million people, providing a valuable international connection opportunity and ridership driver for new passenger rail service.

3.6.18 Inland Empire to San Diego Corridor

p. 70:

A new freight rail connection from the Inland Empire to the U.S./Mexico border (Otay Mesa area) is needed. This could include new passenger trains, and should also be considered as part of the CHSRA's Phase 2 plans to build a line to San Diego. HSR track between Los Angeles, the Inland Empire, and San Diego could host lightweight express freight trains at night, which today is common in Germany.

3.7 Long-Term Regional Goals

p. 71 – 74: Northern California

p. 72:

3.7.4 East Sierra Corridor

RailPAC supports new, year-round regional passenger rail service (perhaps an extension of the *Capitol Corridor*) connecting the Bay Area, Sacramento and Reno. This would also serve the Las Vegas to Reno travel market as outlined in Nevada's State Rail Plan.

3.7.5 Sacramento to San Francisco Bay Area Corridor

Increase speeds, new crossing for Carquinez Strait.

p. 73:

3.7.7 Coast Route Corridor

RailPAC supports the acquisition by the State of California of Union Pacific's Coast Line Los Posas (Moorpark) – Lick (San Jose). Caltrans should request funding for development of governance, rail line evaluation and appraisal, contract development and initial payment to the current owner of the track, UP.

p. 74:

3.7.9 Northern San Joaquin Valley Corridor

Fill in table entry Oakland to Merced, show Regional Rail and HSR. One can take BART Oakland to San Jose and transfer to CHSR to Merced.

3.7.10 CA High Speed Rail Phase 1 Corridor

3.7.11 Cross Valley Rail Corridor

Develop Cross Valley Rail Corridor into a second north-south passenger spine in the Central Valley that helps connect to the express HSR service but would provide rail service to communities relatively far from the HSR line. On the east end, extend south via Porterville then transition to UP corridor to serve Earlimart, Delano, McFarland, Saco, Bakersfield HSR, Lamont, and Arvin. On the west end, extend to Coalinga. Also, provide connection north of Lemoore to Riverdale, San Joaquin, Firebaugh, South Dos Palos, Los Banos, Newman, Patterson, Westley, and Tracy to provide connection to/interlining with Valley Link and possibly eBART. All new infrastructure should be laid for a minimum standard operating speed of 125 mph where practical.

While some might question why there's a need to "duplicate" the high-speed rail route, the state has multiple north-south road connections, both full freeways as well as State Routes which are just two-lane roads. Thus, it does not seem unreasonable to have a second passenger route in the state as well and for a significant portion of the route, it would be more than 20 miles away from the HSR mainline and even farther from the nearest HSR station. Thus, there would be substantial value provided to those communities which host or were formerly located on a rail line but which is not currently seeing passenger service by once again enabling them to get on the train and go to another community along the line or travel to a HSR station and transfer for trips to other regions of the state. Finally, as noted several times in the state rail plan better integration of housing and transit is crucial to helping the State meet a litany of goals. Many of the towns and cities in the Central Valley were originally built around a railroad connection and still retain a traditional form focused around the old station. So in conjunction with the slate of housing laws passed by the Legislature in recent years, rail service provides an opportunity for revitalization while also introducing new station areas where more compact, less car-centric

developments could be located. This would also help abate the ongoing turnover of farmland into suburban tract home developments.

p. 75 - 77: Southern California

p. 75:

3.7.12 Las Vegas Corridor

A restored Amtrak *Desert Wind* service (LA-Las Vegas-Salt Lake City) on this corridor would complement Brightline.

3.7.13 Antelope Valley Corridor

A Metrolink extension to Mojave, if Mojave Airport aerospace employment grows significantly. Such a line would also have a stop at Rosemond, where it would connect with bus service to Edwards Air Force Base. This was studied by the Kern County COG, which recommended this extension and station in Rosemond. See https://scag.ca.gov/sites/main/files/file-attachments/0903fconnectsocal_passenger-rail.pdf?1606001722

p. 76:

3.7.14 Central Coast to Los Angeles Corridor

This should include San Francisco Bay-Los Angeles through trains using the Coast Corridor.

3.7.15 Los Angeles to San Diego Corridor

For San Diego to San Ysidro, why have integrated bus every 4 hours when you have regional transit every half hour. That makes no sense. Also, San Ysidro is misspelled.

3.7.16 Coachella/Arizona Corridor

There should be more description in this plan of high speed rail corridor between Southern California and Phoenix, including analysis of a routing along the Interstate 10 corridor.
p. 77:

3.7.17 Inland Empire Corridor

San Bernardino-Los Angeles should be every 15 minutes.

Riverside/San Bernardino to Fullerton should be every hour on intercity/regional express.

3.8 Integrated Bus Connections

Specific examples of integrated bus connections need to be provided.

General passenger rail comments:

One short-term priority is improved safety and security at rail stations. While station security is generally the purview of local public agencies, Caltrans can coordinate and perhaps help find funding for these efforts.

Given that this is a long term plan, RailPAC advocates for expedited planning of rail projects for the medium and long term as well.

RailPAC recommends enhanced actions to promote the passenger rail services it already has. To continue that growth California should continue to prioritize development of its statewide California Integrated Travel Program. While HSR will generate substantial benefits its expansion should not be at the expense of conventional rail projects which also generate substantial benefits and are key connecting routes for HSR.

Investments in regional and intercity passenger rail will create resilience and redundancy in the California's transportation system and economy by rapidly expanding ridership on an electrified rail network powered by renewable energy sources. Passenger rail stations are also the perfect catalyst for compact infill development.

As described in the 2018 California State Rail Plan and the current draft document, the state should expedite the planning and construction for 'emerging corridors' such as Coachella Valley/San Gorgonio Pass, Central Coast, Tulare Cross Valley Corridor, Caltrain extension to Salinas, Monterrey, Santa Cruz.

The California High Speed Rail project is crucial to the economic development of California, and especially in the Central Valley. Revitalizing the cities and towns of the Central Valley, stimulating their economies by tapping their enormous reservoirs of untapped labor, housing, infrastructure and other resources and connecting them to jobs in the coastal cities, will be a game changer. In addition, airport capacity would benefit from shifting short-haul air travel within the State to High-Speed Rail. Finally, the Tulare Cross Valley Corridor could connect to HSR at the Kings/Tulare High Speed Rail Station.
Long Distance and Interstate Passenger Rail:

Amtrak's "National Network" long distance services- the *Sunset Limited* (Los Angeles – New Orleans), *Southwest Chief* (Los Angeles – Chicago), *California Zephyr* (Oakland – Chicago) and *Coast Starlight* (Los Angeles – Seattle)- are a key part of California's transportation network, but are barely even acknowledged by the draft State Rail Plan.

Amtrak trains allow Californians the option of traveling to a large matrix of cities big and small throughout the US. These trains also bring out-of-state visitors to California for vacations, to attend college and to visit family and friends. The Amtrak long-distance trains are also essential for interregional transportation within California. Overall direct and indirect spending associated with these rail passenger services generates over a billion dollars in yearly spending in California.

These long-distance rail routes not only serve California's underserved rural areas, they also

represent key frequencies in existing and emerging corridors. For example, The *Coast Starlight* is a key frequency for the Coast Line serving Los Angeles – Santa Barbara – San Luis Obispo LOSSAN Corridor, San Luis Obispo – Salinas – San Jose – Oakland – Sacramento corridor and the San Jose Oakland – Sacramento Capitol Corridor.

Amtrak's long-distance services aid in meeting the goals of the State Rail Plan. Offering a more energy efficient alternative to driving or flying these routes fulfill the goal of reduced GHG emissions. Serving rural cities, both in and outside California, with limited or no air or motor coach service, providing an option for those who cannot fly or drive for medical or physical reasons these routes expand accessibility for Californians. Utilizing existing transportation assets, (i.e., freight rail infrastructure), these routes reduce environmental impacts. By facilitating options for Californians who are dependent on (or choose) non-auto modes these routes advance quality of life, more long-distance passenger rail service options add to system resiliency and safety. Frequencies should be at least doubled from the present once per day departures. Finally, as was noted above, Amtrak's long-distance routes generate strong economic activity. These routes also aid rural cities in maintaining and enhancing their often historic downtown businesses.

Appendix 4.3 (pg. 331-2) shows the abysmal on-time performance of the Amtrak long-distance trains. Caltrans should take a direct interest in, and support Amtrak in negotiating with the Class Is to improve reliability of passenger trains within and going to/from California. The State of California should also champion both the dependability and the expansion of Amtrak service nationwide, not just in California. California can form coalitions with neighboring states to improve rail service, and encourage the Federal government to invest more in Amtrak long-distance trains.

In 2014, the Federal Railroad Administration (FRA) in collaboration with UP, BNSF, state and local transportation agencies, released the *Southwest Multi-State Rail Planning Study*: https://railroads.dot.gov/elibrary/sw-study-summary-report

The 2018 California State Rail Plan supported better interstate passenger trains to Arizona, Nevada and Oregon (p. 124):

> **4.3.2 Interstate Rail Connections**
>
> Beyond California's statewide goals, the State has an interest in maintaining long-distance national Amtrak service, with interstate connections to Oregon, Nevada, and Arizona; thereby providing service and access to communities that are not on the high-frequency State passenger rail network. The State also has an interest in developing specific passenger rail corridors in coordination with Nevada and Arizona to provide for future interstate HSR service to Las Vegas, Nevada, and Phoenix, Arizona. These future HSR connections represent significant opportunities for accommodating interstate travel to these important destinations via passenger rail, which will address congestion on interstate highways and at California's airports.

RailPAC offers the following recommendation for new or improved routes over 750 miles that would have great benefit to California and Nevada (listed in order of priority):

1. Increase the *Sunset Limited* to daily frequency and restore service through Phoenix. We urge FRA to help with funding design and environmental studies for refurbishing and reopening the Union Pacific Railroad's Wellton Branch, and other key capacity projects along the Sunset Route.

2. Restore the *Desert Wind*:
Los Angeles-Fullerton-Riverside-San Bernardino-Victorville-Barstow-Las Vegas-Salt Lake City-Denver-Chicago. Negotiate with Brightline West to use their infrastructure from Devore to Las Vegas.

3. Introduce second trains each day on Amtrak's long-distance routes, including the four that serve California: the *Coast Starlight*, *California Zephyr*, *Southwest Chief*, and *Sunset Limited/Texas Eagle*.

4. New El Paso-Dallas section added to *Sunset Limited*-
Split a Dallas section in El Paso then diverging from the *Sunset* route at Sierra Blanca (east of El Paso), or a new LA-Dallas through train created utilizing:
El Paso/Sierra Blanca-Odessa-Midland-Big Spring-Sweetwater-Abilene-Fort Worth-Dallas
(This train could continue to Chicago as the *Texas Eagle* or east to Meridian, MS as a section of the *Crescent*).

5. Restore the *San Francisco Chief*/Bay Area section of the *Southwest Chief*:
Oakland/Richmond-Stockton-Modesto-Merced-Fresno-Bakersfield-Mojave-Barstow, then joining at Barstow the *Southwest Chief* to Chicago, or new through service via Vaughn-Clovis-Amarillo-Wichita-Newton-Topeka (the route of the *San Francisco Chief* before its discontinuance in 1971).

6. Oakland – Dallas-
This would follow the same route as the *San Francisco Chief* described above, between the Bay Area and New Mexico, then would continue as:
Belen/Albuquerque-Clovis-Lubbock-Sweetwater-Abilene-Fort Worth-Dallas

7. New version of *Golden State*-
Another addition on the *Sunset* route would be a new Chicago-Los Angeles train (paralleling the historical Southern Pacific *Golden State* route, although taking BNSF east of Vaughn, NM), that would also give the Coachella Valley, Phoenix, Tucson and El Paso a new through service to Chicago:
Los Angeles-Yuma-Phoenix-Tucson-El Paso-Alamogordo-Vaughn-Clovis-Amarillo-Wichita-Newton-Topeka-Kansas City-Fort Madison-Mendota-Chicago.

The above map shows RailPAC's Amtrak long-distance priorities superimposed on a vision map of a future Western North America rail network including new and improved long-distance passenger trains. This background map was compiled by RailPAC member Brandon Champlin, after consultation with passenger rail advocacy groups and railroad experts across the West. The background future vision map is included to show the potential for broad 'network effect' connections across North America of new inter-regional and corridor train services.

At the February 2023 Southwest regional working group meeting (according to summary posted recently on the Long Distance Service Study website), there was support voiced for restoring the *Desert Wind*, *San Francisco Chief* as well Phoenix service, and for increasing long-distance train frequency to twice a day. It is also hopeful to see that the *Desert Wind*, the *Sunset Limited* through Phoenix, *San Francisco Chief* are some of the discontinued routes being examined by the study team.

All of the routes described require a great increase in size of Amtrak's long-distance rolling stock fleet. The high priority for Amtrak's current long-distance trains in the near term is repair and rehabilitation of stored equipment as fast as possible. Only with repair and refurbishment of existing equipment, can all long-distance trains be restored to pre-Covid consists and amenities. With new equipment, the amount of long-distance service to California could easily more than

double in size (and ridership) with new routes described above. Caltrans can work in coordination with Amtrak to procure large new fleets nationally, which brings down the equipment purchase cost for state-level agencies such as Caltrans.

New and improved long-distance Amtrak service will bring many benefits to California. One benefit that cannot be overstated is the greatly reduced greenhouse gas emissions by shifting some long-distance travel to rail instead of driving or flying. Investments in Amtrak long-distance service will thus help California achieve its climate goals.

Caltrans, in coalition with DOTs in neighboring states, needs to support long distance trains more it currently does- for example, offer operational funding for second daily trains.

California should support a Federal trust fund, or long-term stable funding source, rail and transit operations, including for Amtrak National Network.

The main challenge facing Amtrak is not lack of demand, but lack of equipment and crews to support that demand.

Chapter 4: FREIGHT NETWORK STRATEGY

p. 78 - 82: 4.1 California's Freight Network

4.1.1 Freight Network Goals

p. 79:

It is commendable that Caltrans recognized the central, vital role that freight rail has for the entire state, and how it is essential for the state's policy goals.

> "California's ports, logistics industry, manufacturers, and agricultural industry's ability to compete depends on rail connections to/from the rest of North America. Caltrans will continue to collaborate with freight railroads and support public/private freight projects to maintain this competitiveness."
> …
>
> "*Environmental:*
>
> Railroads are traditionally four times more fuel efficient than trucks, with one ton of freight on a train moving an average of 470 miles on one gallon of diesel fuel, a 75% decrease in greenhouse gas emissions. However, that historic advantage is being challenged by rapid evolution of cleaner diesel engines and ZE technology in long-haul trucking. As California's current truck regulations are implemented through 2023, trucks will produce less PM2.5 and NOx emissions by 2023. Beyond 2023, future CARB Regulations will further reduce truck emissions, eventually bringing them to zero. The freight railroads need to transition to zero emission locomotives following the other freight source categories."

The rail/steel wheel vs. road/rubber tire inherent energy efficiency ratio will not be altered by "rapid evolution of cleaner diesel engines and ZE technology in long-haul trucking". An electric train will use at least 75% less energy per ton-mile moved than an electric truck. Being "cleaner" in regards to PM2.5 and NOx emissions does not necessarily mean that there will be any reductions in GHG emissions. Empirical evidence needs to be provided to back up the assertion that trucks in California are already (in 2023) cleaner, in terms of NOx and PM emissions per ton-mile, than trains.

"Zero-emissions trucks" all have a GHG emissions footprint for their manufacture and mining of materials. The lifecycle GHG emissions of "zero-emissions" trucks will thus will not be zero.

Particulates from tire and road wear are a significant source of particle pollution from trucks- and a problem completely avoided by trains. CARB and Caltrans need to consider tire and road wear pollution in their environmental evaluation of trucks.

To quote from the 2018 California State Rail Plan, section 3.1.7 (p. 116), Policy 3: Reduce GHG Emissions and Other Air Pollutants:

> "A 2009 FRA study reported that a double-stack container-trailer-freight rail car moves freight three to five times more fuel-efficiently than a truck.[162] Each freight train carries much more total weight than a single combination truck, so each train movement reduces truck traffic on highways and reduces GHG emissions."

Electric trains are the most energy efficient way to move freight on land, moving a ton with as little as one-tenth the energy used by diesel truck.

p. 80:

The map should show Union Pacific's new intermodal facility in Fontana.

p. 81:

> *Equity:*
>
> Freight rail is inherently infrastructure focused; too often that infrastructure is co-located with disadvantaged communities and priority populations burdened with air quality, noise pollution, grade-crossing safety, and physical barriers. While directly providing good paying jobs and supporting manufacturing and agricultural industries those benefits must be balanced against challenges rail operations and rail infrastructure can create in communities.
>
> Freight rail is also an outlet for highway traffic and highway expansion. Without effective rail connections to ports in places like Los Angeles, Long Beach, Oakland, and Richmond, state highway networks would require significant expansion to handle increased truck traffic. The State can reduce the need for highway expansion by supporting and improving rail infrastructure to attract freight traffic and growth away from highways, enhancing trade corridors by lowering transportation costs for businesses.
>
> Caltrans is committed to taking the broader, network focused approach to considering and supporting future growth of the freight network and the transition to ZE operations.
>
> *Support for Passenger Services*
>
> Lastly, the freight network supports economic, environmental, and equity goals via its support and facilitation of passenger services. Regional and intercity rail has and will continue to largely utilize freight railroad owned and dispatched right of way. To deliver the passenger service goals identified in the long-term Vision, Caltrans and host railroads will need to work increasingly collaboratively to identify, plan, and deliver improvements with shared benefits."

Electrification, with overhead wire, needs to be discussed as way to mitigate the impacts of freight rail impacts to trackside communities.

More specific examples need to be given for how effective rail connections to the ports of Los Angeles, Long Beach, Oakland, and Richmond prevent the need for state highway expansion.

p. 83:

If "Caltrans is committed to taking the broader, network focused approach to considering and supporting future growth of the freight network and the transition to ZE operations", then why doesn't Caltrans call for overhead wire electrification of freight mainlines?.

Co-utilization of overhead wire infrastructure by passenger and freight trains would be an excellent way for the freight network to support passenger services.

Amtrak long distance trains need to be part of Caltrans' outreach with host railroads about corridors shared with passenger trains.

p. 84 – 86: 4.2 Freight Rail Governance

4.2.3 California Public Utilities Commission (CPUC)

Section 130 priority list of grade separation projects should be shown in the state rail plan appendix. Possibly a map or table be shown here in the main document of the priority grade separations, with cost estimates.

The 2018 California State Rail Plan (section 5.2.4, p. 166, Table 5.3) showed a list of "project examples of grade-crossing improvements with co-benefits".

p. 87- 89 : 4.3 Freight Demand and Growth Trends

4.4 Freight Rail Vision

p. 90:

What "Inland Port Facility" is being referred to? This paragraph is the only place in the document which mentions an "Inland Port" and needs more context. A discussion here of related short-haul freight rail, for example between an ocean port and an inland port. The 2018 State Rail Plan discussed short-haul freight rail improvements as a key strategy (section 5.2.6, p. 168).

Transitioning the freight network to zero-emission operations requires electrification of mainline railroad tracks.

What specific freight rail infrastructure projects does this plan recommend? Why are there no lists/descriptions of specific rail infrastructure projects, and what their costs/benefits would be?

The 2018 California State Rail Plan provided far more detail (references to sections of 2018 plan), with tables listing project examples:

- 5.2.2 (Table 5.1, p. 164)- Trade Corridor Improvements
- 5.2.3 (Table 5.2, p. 165)- Economic Development and Short Lines
- 5.2.5 (Table 5.4, p.167)- Additional Terminal and Yard Capacity
- 6.3.3. (pp. 201-288)- Freight Rail Effects and Benefits

The 2023 State Rail Plan should provide more guidance on mode shift of freight movement from truck to rail, with specific Port-to-Inland Terminal short-haul rail "lanes" and projects described.

Strengthen the bullet on port to rail as follows: "Support trade corridor improvements, avoiding highway expansion, shifting freight loads from trucks to rail and by increasing the portion of on-dock rail at California ports."

p. 91 - 94: 4.4.1 ZE Transition

The CARB graph showing how NOx and PM emissions being much lower from trucks in 2040 compared to trains completely ignores the possibility of zero emissions electric freight rail. It also does not show the difference in GHG emissions between trucks and rail.

p. 92: conventional overhead catenary electrification is briefly mentioned, but the emphasis of this section is almost entirely on hydrogen and battery locomotives. This is baffling given that both of those would have significant challenges to implement them for use with heavy fright rail, compared to established overhead wire rail electrification technology.

p. 93:

In Europe and Asia, many electric locomotives are cheaper to purchase than the equivalent diesel locomotives.

p. 94 – 95: 4.4.2 Partnering with CARB

CARB keeps ignoring electric rail in favor of hydrogen; Caltrans and CARB need to embrace overhead wire rail electrification.

p. 95 - 96: 4.4.3 Network Capacity Analyses

> "Understanding the capacity of a railroad or a rail network is a complex question that demands more technical analysis than simply dividing the available track space by the number of potential trains, as might be represented in highway planning.
>
> A railroad does not have a simple set limit of how many trains per hour it can accommodate. Any question of current or future capacity depends on many administrative and technical variables."

This section does a good job of explaining the complexity of what 'trains per hour' capacity available on a particular railroad corridor. Freight rail capacity planning, including pathing studies (next item below), needs to also take into account emergency and unusual circumstances. Resiliency is key.

Specific, high-priority freight rail capacity constraints (or bottlenecks) on the state rail system should be described, and shown on maps (or at least in tables like was done in the 2018 State Rail Plan, see comments on section 4.4 above).

p. 96 - 97: 4.4.4 Freight Pathing Studies

Caltrans needs to ensure that the freight pathing studies offer sufficient resiliency for passenger operations, in case of accidents, extreme weather, repairs, track damage/closures, etc. (i.e. "just in case" instead of "just in time").

More road and highway funding should be used for grade-separation projects, as to keep rail funding focused on improving capacity of the rail network.

p. 98: 4.5 Progress Toward Implementation

General freight rail comments (also relating to 'progress towards implementation'):

The majority of intercity and regional/commuter passenger rail service in the U.S. is on tracks shared with freight trains. Therefore, sufficient capacity, safety and reliability of the nation's freight rail system is vital to the interest of rail passengers. These two different uses of railroad infrastructure need not be in conflict. Both passenger and freight trains sharing the same tracks will benefit from coordinated planning, efficient operations, and capital improvements.

Coordination with "host railroads", usually one of the Class I railroads, is vital for safe and efficient passenger rail operations. Additional freight capacity facilitates more passenger rail frequencies, fewer delays and faster service. RailPAC supports strategic freight rail investments by the state. However, on-time performance is a persistent and on-going issue. Lack of sufficient maintenance and capital infrastructure work by the host railroads also hurts the safety and reliability of passenger service. Under Federal law, the Class I railroads have common carrier obligations to serve the public interest. This includes sufficient accommodation of passenger trains.

Adverse effects of Class I railroad cost-cutting-

As the 2023 State Rail Plan, Interregional Transportation Strategic Plan, Climate Action Plan for Transportation Infrastructure (CAPTI), California Transportation Plan 2050 (CTP 2050), California State Rail Plan (CSRP), and California Freight Mobility Plan (CFMP) planning efforts move forward, freight rail traffic presents a key challenge to achieving the goals of these plans. RailPAC recognizes that the State of California does not own railroad tracks (aside from the HSR corridor under construction), and has limited influence and jurisdiction over private interstate railroad companies. Unlike the public sector, which measures success with volume metrics, privately-funded railroad companies measure their success with yield metrics and maximizing revenue with the minimum of capital investment. The result is that profitable but low-yielding traffic is discouraged in order to create capacity for higher yielding traffic, or "demarketing" of a large base of existing (or former) customers. Service has been cut off entirely for some. Last-mile local service is diverted through high pricing to mainline transload centers. This means more truck traffic on the highways, low volume growth and a decline in rail market share.

With yield maximization railroads have prioritized their highest yielding traffic flows pricing away lower yielding traffic, even though it is profitable, to reach a low operating ratio (costs divided by revenue). This lower yielding traffic is pushed to the highway. Price is used to manage traffic flows to match capacity, thereby avoiding capital expenditures for additional capacity or to allow the removal of capacity and its maintenance expense.

For example, in California both UP and BNSF or their prior owners operated intermodal yards in Fresno and Bakersfield. Containers and trailers for those cities are now moved by truck from terminals in Stockton/Modesto or Los Angeles. This rate-of-return metric has been successful in yielding strong cash flows even during the latest recession. But this creates a conflict with state, regional and local planning goals, and increases pollution, road wear and congestion.

The recent backlog and congestion of containers that need to be moved to and from California ports has also been made much worse by Class I decisions to reduce terminal capacity, rolling stock and workforce in the past several years. The railroads are common carriers, chartered to operate for the public convenience and necessity. However, in practice they can avoid shipments they don't want, by setting conditions such as price, service, or reliability, that drive those shipments onto highways.

The latest iteration of this Class I railroad strategy has resulted in public impacts far beyond additional truck traffic. For example, UP, which owns and operates almost 3,300 miles of track in California, has been adopting what they call Precision Scheduled Railroading (PSR) in order to cut costs. UP is operating longer and heavier trains, some three miles or more in length, which are slower to accelerate. The industry standard pre-PSR was 11,000 feet for long distance freight trains, which is over two miles. Under PSR the trains have grown to over 18,000 feet, almost three and a half miles long. This results in longer wait times for vehicles and pedestrians at grade crossings and more delays to passenger trains. This inconveniences the public (hundreds of people at a time), creates more pollution from idling vehicles, delays passenger trains (making them less competitive), negatively impacts fire, police and ambulance response times, and interrupts the flow of local commerce. Class I railroads have made these cost-cutting changes without the corresponding investments in yards, highway overpasses and longer sidings to mitigate the negative impact on the public. While California has programs to address improving the yield of traffic with targeted state investments, and has invested substantial public funds to support freight railroads (e.g., Colton Crossing), a broader analysis of the impact of the different goals of the Class I railroads (maximize yield) is warranted.

Also of concern to the State of California is the laying off of tens of thousands of railroad employees over the past several years, a period which has seen the profits of major railroads skyrocket. Radical reductions in workforce have resulted in remaining employees working longer hours (increasing fatigue), and being forced to performed duties they are not qualified for – all resulting higher rate of accidents. For passenger trains, a reduced Class I railroad workforce means more delays and a higher risk of accidents.

Five years ago, in RailPAC's commentary on the 2018 State Rail Plan concern was raised about freight railroads' focus on yield, or maximum profit: (1st quarter 2018 issue of *Steel*

Wheels magazine, pg. 8): https://railpac.org/wp-content/uploads/2020/11/Steel-Wheels-2018.Q1.pdf

Market share growth (vs. truck) under the Class I's current business model (so-called Precision Scheduled Railroading) is considered to be a negative since it would require aggressive pricing or service improvements. In addition, using price increases and service reductions shipments that remain are forced to large regional load centers/ intermodal terminals with the final distribution by highway (as described above). The railroad retains the majority of the movement and revenue. However, these regional centers are generally located in exurban areas with highway distribution on congested urban freeways.

The result of both of these strategies is more truck movements, shrinking rail mode share and less rail capacity investment. This is the opposite of the goals as outlined in the rail plan. Yet readers of the rail plan know nothing of this conundrum or strategies for state investments to improve the profitably of lower yielding traffic and to bring short-line entrepreneurial energy to the freight railroads. Only by increasing profitability of lower yielding traffic through state initiatives (as is done in some states for agricultural traffic) can the public benefits of increasing the rail mode's share of freight traffic be achieved.

A key example of the manifestation of both of these challenges (almost a case study) is Union Pacific's Coast Route Corridor (discussed in sections 3.5.7, 3.6.7 and 3.7.7). The travel volume between the Central Coast and Northern and Southern California is significant – on par with or even exceeding the travel volume between the Bay Area and LA Basin. The parallel highway, US 101, has segments that even today are severely congested. Yet the Coast Line lies underutilized.

Anchored at both ends by publicly owned line segments, the Coast Line is clearly a secondary "overflow" route for the Union Pacific. The combination of UP's maximum yield focus and its use of centralized load centers located on its core lines, means that local origin/destination traffic has shrunk to a very low level. Lineside stakeholder opposition to passenger-related capacity expansion has meant that UP will not agree to any additional passenger trains. So the Coast Line sits almost fallow carrying a fraction of its passenger or freight potential. That situation has existed for almost two decades. Is the Coast Route stagnation the real Vision for the state rail network? What institutional or legislative changes are going to be undertaken to allow the Vision for the State Rail Plan to be fulfilled?

For reference, refer to the December 2022 U.S. Government Accountability Office report GAO-23-105420, *Freight Rail: Information on Precision-Scheduled Railroading* https://www.gao.gov/assets/gao-23-105420.pdf

Increasing the mode share of freight rail-

Emissions from goods movement (particularly from diesel trucks) are a significant part of California's air pollution. Diesel exhaust is a major source of greenhouse gas, particulate matter and smog-forming NOx emissions.

Reducing truck VMT should be a guiding principle of state freight planning. Compared to trucks, moving a ton-mile of freight by rail uses 1/3rd to 1/5th the energy or fuel, and produces 1/3rd to 1/5th the emissions. This is true whether the comparison is between diesel truck and diesel-electric train, or electric truck and electric train. Although intermodal rail facilities are the subject of substantial pollution complaints, the larger problem is the truck traffic associated with the facilities.

Moving freight by rail is also much safer than trucking, with far fewer accidents per mile travelled compared to road transportation. Another competitive advantage for moving containers by rail is that it is much less likely that the container moved would be involved in an accident. If properly maintained, the smoother ride of steel wheels on rails also results in less likelihood of damage to goods than shipment by truck.

Freight sprawl is the building of warehouses, distribution centers and other freight facilities on cheap land in rural areas or suburban/exurban fringes of metropolitan areas only accessible by road, and a long distance from urban centers. Freight sprawl is a major driver of increased truck VMT in California. Rail-oriented freight development, similar to rail- or transit-oriented residential development, needs to be studied. Additionally, existing rail-served industry at risk of closure and removal should also be identified.

In particular, the State Rail Plan should propose an analysis and investigation freight rail as an alternative to truck drayage between California ports and inland destinations in California and neighboring states. With frequent short- and medium-haul freight rail shuttle trains, much of this freight presently moved exclusively by highway may be shifted to rail, to reduce highway congestion and pollution. Significant numbers of import/export containers that congest ports and highways need to be transported on short-haul, inland port trains to relieve that congestion. The 2018 California State Rail Plan described the potential benefits of short-haul freight shuttle trains (pg. 168):

> Short-haul rail shuttles connecting ports with inland regions hosting substantial international trade-related distribution activity offer the opportunity to improve the velocity of the flow of goods into and out of the densely populated regions of Southern California and San Francisco Bay Area. With sufficiently high volumes, short-haul rail shuttles transfer the volume of freight truck traffic away from the already congested highways, particularly in and around the major ports. The capital investment in short-haul rail shuttle improvement can be made using the Traffic Congestion Relief Program funds, given a clear analysis of how the rail shuttle can help relieve congestion on roadways. The feasibility of short-haul rail shuttles is highly sensitive to the differential in costs between rail and highway transportation, and would require efficient operation to maximize their viability, and to capture a better rate of return on the investment of public funds.

Short and medium-haul freight rail service would build upon, and add value to, the large freight rail infrastructure investments being made by private railroad companies and public agencies. These faster, shorter freight trains are also more compatible to the scheduling and dispatching of frequent passenger trains sharing the same route.

Improved freight rail links to Nevada and Arizona-

RailPAC wants to emphasize the importance of thinking beyond California borders when it comes to the short- and medium-distance container moves (under 500 miles) to the distribution centers in Sparks, Las Vegas and Phoenix. Caltrans, the port authorities, Nevada, Arizona and the Federal government should partner on this. With public improvements at key rail bottlenecks (i.e. the third main track over Beaumont Hill on the UP Sunset route) and other investments can improve railroad return-on-investment and shift these moves to rail. Particularly important for restoring freight and passenger service between California and Phoenix is restoration of the out-of-service, UP-owned Wellton Branch in Arizona. Running passenger trains to Phoenix via the Wellton Branch benefits UP freight traffic by freeing up capacity on the Sunset Route mainline. With longer distances combined with on-dock loading these markets are feasible in the near term. If the Norfolk Southern, CSX, Georgia, Virginia and the Ports of Norfolk and Savannah can make this work on the East coast, why not also the West coast?

Northern California and Nevada would greatly benefit from short-haul freight service along the Oakland – Sacramento – Reno corridor. In the winter, I-80 over Donner Pass has dangerous driving conditions with high risk of truck delays and accidents. Numerous shippers in this lane have expressed interest to UP in using 'short-haul' rail to cross Donner Pass.

Capacity projects needed on Class I-owned rail lines-

Additional mainline capacity projects on Class I-owned track needed in California, Nevada and Arizona, to relieve both freight and passenger movement bottlenecks/chokepoints:

*projects listed in draft 2023 CSRP Appendix 3.1 Capital Projects - General Capital Projects

UP Overland Route:

California (Rosedale Subdivision)

- 2nd main track restoration- Donner Pass [study of Donner Pass tunnels]

Nevada (Nevada and Elko Subdivisions):

- 3rd main track bypassing Sparks yard
- 2nd main track various sections between Vista (MP 249) and Weso (MP 421)
- Elko run-through tracks

UP South Central Route:

- California (Cima Subdivision):
- 2nd main track, various sections between Yermo and Primm

Nevada (Caliente Subdivision):

- 2nd main track, Las Vegas (3.3 miles between Arden and Maul Ave.)
- Siding upgrades between Las Vegas and Utah

UP Fresno and BNSF Stockton Subdivision:

- Stockton Diamond*

UP Martinez Subdivision:

- Oakland to Sacramento Signal Upgrades*
- Sacramento to Roseville 3rd mainline track*
- Add turn tracks at the existing Martinez station*
- High-level Carquinez Crossing*

UP Oakland Subdivision:

- UPRR South Stockton Crossover*

UP Sacramento Subdivision:

- Phillips Siding Rehabilitation*
- South Sacramento Crossover*
- Pollock to South Sacramento Yard Extension*
- Pollock Siding Upgrade*
- The South Sacramento Siding Passenger Rail Operational and Capacity
- Pleasant Grove Siding Extension*
- Elk Grove to Philips Siding Rail Operational and Capacity Improvements*
- Thornton Siding Upgrade/Extension*
- South Sacramento Yard Rehab*
- Hammer Lane Siding Upgrade*
- Sacramento Sub – Upgrade for Rideability, Curve Improvements, Rail Engineering*

UP Fresno Subdivision:

- Merced Extension Track Work*
- Lathrop Wye*
- Calla to Ripon Siding Extension*
- Stanislaus River Bridge*
- Tuolumne River Bridge and track extension*

BNSF Stockton Subdivision:

- 2nd mainline track on BNSF main line between Stockton and Merced*
- 2nd mainline track on BNSF main line between CP East Modesto Empire to CP West Denair*
- Empire Crossover*

BNSF Bakersfield Subdivision:

- 2nd mainline track on BNSF main line between CP East Sandrini to CP West Elmo*

BNSF Cajon Subdivision:

- 4th main track, Silverwood to Frost
- 3rd main track, Martinez to Barstow

UP Mojave Subdivision:

- 2nd main track, Devore to Rancho
- 2nd main track, Palmdale to Lancaster
- 2nd main track, Tehachapi to Edison

UP Alhambra Subdivision:

- 2nd main track, Pomona to City of Industry (Los Angeles County)
- 2nd main track, South Fontana to Reservoir (San Bernardino County)

UP Los Angeles Subdivision:

- 2nd main track, completed within city of Riverside
  [UP made RCTC remove a second track bridge on this line]
- Metrolink Riverside Line Service Improvement & Capacity Study*

UP Coast Subdivision:

- Newark-Albrae Siding Connection Project*
- Honda Bluff Repair*
- Honda Siding Stabilization*
- Carpinteria Station Double Track and Second Platform*
- Cematerio Bridge Replacement*
- Hollister Ranch Repairs*
- Ortega Hill Bluff and Pipe Repair*
- El Capitan Bluff and Pipe Repair*
- Rincon Point Slope Repairs*
- South Bay Connect*

Siding projects:

- Two additional mainline sidings between Salinas and King City*
- Wunpost siding south of King City*
- Seacliff Siding Extension*
- Leesdale Siding Extension*

BNSF San Bernardino Subdivision:

- 4th main track, LA-Fullerton
- 3rd and 4th main tracks, Fullerton-Riverside-San Bernardino*
- La Mirada Lead Extension*
- Norwalk Siding Extension*
- LA-Fullerton Signal and Crossover Upgrades Design*
- Hobart-Commerce IMF Extended Lead Tracks Project*
- Esperanza Siding*
- Riverside Siding Extension*
- I710 to I-5 Rail-over-Rail Flyover*
- Los Angeles Link Union Station Freight Project (i.e. Malabar Yard)*

UP Sunset Route:

California (Yuma Subdivision):
- Colton to Coachella (76 miles) 3rd mainline track [part of Coachella Valley Rail EIR]
- Completion of 2nd main track between Indio and Coachella (~20 miles).

Arizona:
- Yuma to Wellton (31 miles)
- Picacho to Tucson (47 miles)

UP Wellton Branch (Arizona):
Refurbishment and restoration of service between Phoenix and Wellton Junction (137 miles), including new sidings/ sections of 2nd main track.

New rail routes, bypasses and tunnels in California:

Many of California's rail routes were built over a century ago, on routes which made sense given the goal was to build quickly with the limited technology of the time. However, the same slow and winding routes are used by trains today limit their ability to compete with the highway. New, more direct routes are needed, and today are made possible with 21st century engineering and construction techniques. Bypasses are also needed for tracks at risk from sea level rise. New bypass tunnels that need to be planning priorities for the state include:
- LOSSAN LA-San Diego: San Clemente, Del Mar, & Miramar/Rose Canyon
- Altamont Pass
- Cuesta Grade north San Luis Obispo
- Donner Pass "Base Tunnel(s)"

On the UP track through Tehachapi pass, as a minimum the line should be completely double tracked. This would include several short tunnels west of Tehachapi, where the rail line is in a narrow canyon with California State Route 58 on the north side and the UP on the south.

These major capital projects would pay for themselves over the decades by generating increased passenger and freight business for the railroads.

In addition to the large volume of trucks on highways between the Inland Empire and the Ports, there is also a large number of trucks to and from Mexico. A new freight line from the Mexican border at Otay Mesa, connecting to the LOSSAN Surf Line and the LA basin/Inland Empire, should also be studied. This should also be considered as part of the CHSRA's Phase 2 plans to build a line to San Diego. Future HSR track between Los Angeles, the Inland Empire, and San Diego could host lightweight express freight trains at night, such as those common in Germany.

CHAPTER 5 DECARBONIZATION & MITIGATING CLIMATE CHANGE

p. 101 - 10: 5.1 Decarbonizing Transport

p. 101: 5.1.1 Regulatory Background

p. 101-104: 5.1.2 Near-Term ZE Transition

> "Caltrans has developed a strategic implementation plan for rollout of ZE technologies and is engaged in developmentary activities to support commencement, with anticipated completion by 2025. Hydrogen propulsion systems are in development for passenger rail and not expected to be commercially viable in the United States until 2026. Until that time, Caltrans can reduce emissions on its current locomotive fleet economically by implementation of low-emissions technology."

Why is the whole plan based on hydrogen? Why can't Caltrans start planning overhead wire electrification?

Demonstrations of Redlands Arrow Stadler hydrogen multiple-unit and Wabtech FLXdrive for battery technologies need to be compared with the experience with electric catenary on the Caltrain corridor. These three demonstration projects will then inform decisions on wider use of ZE locomotive technologies.

The Redlands Arrow will provide a case study in the feasibility of hydrogen fuel-cell propulsion. A study should be made comparing the hydrogen fuel-cell technology of the Redlands line with the catenary electric propulsion of Caltrain. By 2026 this experience could inform a choice between hydrogen fuel-cell and electric catenary propulsion for wider implementation on other California rail corridors.

p. 104: 5.1.3 Mid-Term ZE Transition

Why is only hydrogen expected to be the "primary powertrain configuration for intercity passenger service."?

No rationale or explanation of this choice is given, nor is any analysis of alternatives.

> "Battery propulsion is expected to have situational use for regional rail services and switchers – circumstances that enable short travel times and/or frequent charging opportunities."

This is true, and the same could be more or less said about hydrogen.

> "Caltrans plans to pursue implementation of related ZE infrastructure, such as battery recharging stations, hydrogen refueling facilities, and opportunities for collaboration on hydrogen production facilities."

There are major environmental justice and safety issues of hydrogen tanks, pipelines and storage facilities- this needs to be discussed here.

Safety risks of hydrogen leaks and explosions to crews and passengers (hydrogen leakage in tunnels would be very risky), along with trackside communities.

> "• Battery charging could be facilitated by endpoint charging for certain operations but may require in-route charging for longer corridors
>
> • Efforts are underway to determine the preferred sources for hydrogen generation to meet California's upcoming supply demands at a competitive price point while maximizing WTW emissions
>
> Caltrans is assessing rail agencies across the State to determine the next round of ZE technology deployments once intercity passenger rail is operational.
>
> Application Examples:
>
> • The San Bernardino County Transit Authority (SBCTA) has partnered with Stadler to acquire hydrail-powered ZEMU for its Redlands corridor. Upon completion this will be the first hydrail powered passenger service in the US. Caltrans is similarly pursuing hydrail ZEMU units for several of its corridors and can look to SBCTA's efforts regarding implementation."

p. 105: 5.1.4 ZE Fleet Expansion

> "Since 2020 Caltrans DRMT has pursued the acquisition of Zero Emissions Multiple Units (ZEMUs) from Stadler, Inc. In September 2022 a major milestone was realized as Caltrans and Stadler signed a memorandum of understanding (MOU) for delivery of four ZEMUs, with the option for Caltrans to acquire up to 25 ZEMUs total. These trainsets will support Caltrans's passenger rail fleet expansion efforts and significantly contribute to Caltrans's strategic efforts to eventually eliminate diesel air pollution on its inter-city rail service."

Why did Caltrans sign this MOU before the first one has ever been delivered to and tested by SBCTA?
Were other propulsion options even considered?
What was the cost/benefit estimated for the hydrogen propulsion option, compared to
Was more conventional rail electrification even considered?
If so, what are the reasons it was not chosen?
Can the relevant documents relating this procurement be subject of a public records request?

> "This hydrail propulsion system allows the ZEMUs to be deployed for inter-city use while producing no harmful air pollutants. Initially the ZEMUs will be deployed on the new Valley Rail service between Sacramento and Stockton, with planned future expansion to other intercity lines statewide including the Antelope Valley and Central Coast corridors."

The range of hydrogen trains likely to be limited compared to diesel- In Germany the first fleet could only do 300 miles between fuelings, or half of what was promised.

"Caltrans will provide strategic oversight and technical expertise on hydrail propulsion; this will include ongoing oversight of the vehicle procurement process, and implementation of hydrail infrastructure along the Valley Rail corridor to support operational demands. Caltrans will advise on and support regulatory compliance / safety testing activities associated with ZEMU implementation; currently there is little federal regulation on hydrogen safety requirements for passenger rail. Caltrans is in ongoing conversation with the FRA to develop a safety integration
plan for the ZEMUs."

The safety issue is critical- hydrogen is a flammable and potentially explosive gas, that leaks easily. Caltrans should have done more safety evaluation before signing an MOU to purchase the Stadler hydrogen units.

> "The Stadler ZEMUs the first hydrail powered, zero emissions inter-city passenger vehicles in the US, and their planned deployment via the MOU represents an important step toward wide-scale air pollution reduction efforts. ZEMUs will eventually provide a significant portion of Caltrans's statewide rail service as their zero emissions strategy is realized and reinforces Caltrans DRMT's position as a leader in clean rail propulsion technology efforts."

Why is it already decided that hydrogen is the way trains will be powered? We don't know yet if it can prove to be a significant portion of Caltrans's statewide rail service. What is the Stadler hydrogen multiple units turn out to be expensive failures? Why is Caltrans "betting the whole store" on this one model of train?

The real leaders in clean rail propulsion are the major railroads around the world, which have operated the bulk of their mainline passenger and freight trains with electricity. Technical expertise, manufacturers, vendors and construction managers experienced in rail electrification from around the world need to be brought to California. We don't need to re-invent the wheel. The knowledge and providers of economical and reliable rail electrification technology is already out there.

The 2018 California State Rail Plan called for electrification off all the state's mainline intercity and regional passenger lines. Quote from section 3.1.7 (p. 116), Policy 4: Transform to a Clean and Energy Efficient Transportation System:

> "…The 2040 Vision intends to accommodate additional demand for trips, and grow the rail network in a manner that incorporates substantial electrification of the state network, with improvements possible on additional corridors where there is support to do so. The statewide HSR network included in the 2040 Vision will be powered entirely from renewable energy sources, providing a growing market for clean energy providers."

Quote from section 5.2.7 (p. 168) of the 2018 plan:

> "Priority should be given to rail projects that support the deployment of technologies that produce zero or near-zero air emissions. An element of the California Sustainable Freight Action Plan is that zero-emissions equipment should be deployed, where feasible, to reliably and efficiently transport freight; near-zero emission equipment powered by clean, low-carbon renewable fuels should be used everywhere else. The use of less polluting equipment reduces GHGs and other toxic emissions, and ultimately improves air quality. The freight railroads are private companies that operate in national and transcontinental markets, and therefore may be more reluctant to invest in zero and near-zero emissions

technologies to meet California-specific standards. However, the State's role in advancing the adoption of this technology is central, from both a regulatory and financial perspective, because it can help advance development of the prerequisite technology; and by providing financial incentives, support its commercialization."

Why was electrification effectively deleted from the 2023 draft plan?

p. 105- 106: 5.1.5 Caltrans Coordination

"Caltrans is currently pursuing efforts to develop ZE implementation activities among transportation agencies within California. Two of the mechanisms that support this effort include the ZE Working Group and the Zero-Emission Heavy Transport (ZEHTRANS) Group. The ZE Working Group is a Caltrans-led effort of multiple transportation agencies within (and a few external to) California. Caltrans has taken the lead on determining each group's interest in and readiness level toward ZE implementation and is helping develop strategies for each agency to go forward. Similarly, the ZEHTRANS group consists of regular meetings between Caltrans, the California Energy Commission, GO-Biz, CARB, and Caltrans's consultant subject matter experts (SMEs) to ensure that larger-scale ZE efforts are progressing as expected. Caltrans is also pursuing R&D funding, primarily in the form of TIRCP funding, to pursue ZE implementation efforts. The current TIRCP funding efforts are twofold – 1) ZE vehicles (ZEMUs or retrofit diesel locomotives) to agencies that have already expressed interest in ZE technology and would immediately benefit from implementation; Metrolink and the Altamont Corridor Express (ACE) have been identified as good candidates for this effort. 2) R&D efforts toward development of ZE trains for the intercity JPA corridors, with focus on the hydrail locomotive prototype."

Did Caltrans or any other the other public agencies even consider overhead wire rail electrification?

"CARB is in contact with other transportation agencies regarding development of strategies for compliance with the EO. The requirements for these agencies include a range of activities from ZE propulsion equipment implementation strategies and schedules for regional railroads, to determining optimal compliance strategies for long-distance freight and passenger rail. It is expected that Caltrans's intercity passenger rail ZE strategy will significantly inform the optimal approach needed for many of these agencies."

The optimal approach for long-distance freight and passenger rail is overhead wire electrification. Caltrans did not invent zero-emissions rail- it is well over a century old. Look abroad, the NE Corridor, Chicago, Denver or even Caltrain or even the California High Speed Rail project. This broad experience with proven electric from around the world, and closer to home, should inform Caltrans's intercity passenger rail ZE strategy.

p. 106- 107 : 5.1.6 Application to Freight

"Current intercity passenger rail ZE efforts will serve as the template for how ZE technology can be applied to a large section of the freight rail industry. For example, freight yard switcher locomotives can be converted from diesel propulsion to battery propulsion, similar to ongoing applications for regional passenger service; furthermore there are many similarities between intercity passenger service and short-line freight service – locomotive operating profiles, route length, etc. – and with hydrail technology functionally proven to be viable for intercity passenger

> rail, it is anticipated that there will be a straightforward transition to application of equivalent technology for shortline freight.
>
> Similar ZE efforts for long range freight rail is in development. Current ZE technology is suboptimal for longer distance travel. With continued development, these advancing technologies will support prototyping and eventual conversion of long-distance trains by the 2035 EO compliance deadline."

The assertion that "…long range freight rail is in development. Current ZE technology is suboptimal for longer distance travel" is just not true. The world's longest railroad- the 6,000 mile Trans-Siberian- has long been all electric. All long-distance mainlines in China and India are now electric. Here in the US, the Milwaukee Road was running all-electric passenger and freight trains long distances over the Cascades and Rocky Mountains starting in 1914 (or more than 120 years before 2035).

The assumption that "it is anticipated that there will be a straightforward transition" from hydrogen passenger to freight locomotives is purely speculation- the experience of the difficulties of hydrogen propulsion portend that this transition will be anything but straightforward. All the inefficiencies, expense and points of failure for hydrogen technology will be even worse for hydrogen locomotives.

> *"Freight*
> Executive Order S-32-15, signed in 2015, directs State agencies to develop an integrated freight plan that will increase efficiencies and reduce air and GHG pollutants. The executive order called for the completion of a Sustainable Freight Action Plan by July 2016 and includes the following participating agencies: CARB, Caltrans, California Energy Commission, and the Governor's Office of Business and Economics. The Action Plan is a comprehensive planning effort to integrate investments, policies, and programs across agencies to help realize a sustainable freight vision.
>
> The executive order mandates that "to ensure progress toward a sustainable freight system, these entities initiate work [beginning 2015] on corridor-level freight pilot projects within the State's primary trade corridors that integrate advanced technologies, alternative fuels, freight and fuel infrastructure, and local economic development opportunities." The cross- agency and corridor-level planning focus presents an opportunity for the Rail Plan to strengthen the policies and help deliver the actions needed for realizing the sustainable freight vision. Caltrans DRMT has begun attending the Sustainable Freight Interagency partners meetings to coordinate implementation between the Rail Plan and the Sustainable Freight Action Plan to maximize the efficiency of the state rail system, while reducing emissions from the freight sector."

Has freight rail electrification been part of the discussions described above?

Overhead wire electric rail

Electric trains, powered by overhead wires or third rail, are the most energy efficient way of rapidly moving large numbers of people over land. Overhead wire rail electrification is also often referred to as A conventional electric train does not have to store its fuel supply onboard or carry its weight. Instead, it takes its energy from an external source, on an as needed basis where the energy goes straight to the traction motors. In addition, with fewer moving parts, electric trains have proved to be much more dependable than diesel powered trains. Also, electric energy can be supplied from a variety of sources including renewables. In addition, trains can regenerate electric power during braking and feed electricity otherwise dissipated back into the grid.

Electric, zero-emissions rail transportation is a proven technology over a century old, in widespread (and growing) use throughout the world. Despite being well established, electric rail also has been called a 'future proof' technology. Not only are electric trains quieter, emit no emissions and have far greater overall energy efficiency, they can also accelerate faster than diesel-powered trains, and have lower operations and maintenance costs. This enables an increased frequency of trains, and thus more capacity for a section of track. Passenger rail lines relying exclusively on diesel-powered trains are limited in their speed, capacity, and capability.

The "sparks effect" is the phenomenon, documented around the world, of marked increase in passenger ridership following electrification due to:

- Increased train speed and frequency due to better acceleration
- Passenger comfort (quieter, smoother ride, no smoke)
- Increased reliability (fewer train breakdowns)
- Lower equipment, O&M costs means passenger railroads can invest in more frequent service

The much-needed technology of zero-emissions mainline rail propulsion is often pitched in California and the rest of America, as an "emerging technology" possible in the near future, which "we will pioneer" with our uniquely Californian/American innovative spirit and smarts. It is implied that a lot of R&D money and time (consultant hours!) will need to be spent before the dream of zero-emissions rail is possible. In fact, the USA pioneered long-distance, heavy-duty electric railroading with the Milwaukee Road (pictured below) and other major electric rail projects over a century ago. Regional electric rail systems in fact helped develop California metropolitan areas in the first half of the twentieth century. Pacific Electric freight trains in Southern California operated until the 1950s (see pic below), and the Sacramento Northern Railway between ran electric freight locomotives Oakland, Sacramento and Chico until 1965[1]. Somehow the Golden State's present-day network of light rail lines, and now the Caltrain and Central Valley HSR rail electrification projects in the works, often is forgotten in discussions on "zero emissions rail".

[1] http://www.wrm.org/about/railroad-history/sacramento-northern-railway

The Milwaukee Road was running electric long-distance freight and passenger trains on 663 miles of electrified track through the Cascades and Rocky Mountains, from 1914 to 1974.

Most of the world's largest countries have electrified their primary railway routes. China, Russia, India, and South Africa have extensive electrified rail networks powering the majority of their rail traffic, including on long-distance lines. The European Union as a whole has electrified over half of its total railroad network miles. The International Energy Agency strongly endorses rail electrification worldwide as a strategy to reduce both GHG emissions and fossil fuel consumption[2].

Over a dozen countries effectively already have all their mainlines electrified. Switzerland has been effectively 100% electric since 1967. Others are spending the equivalent of tens of billions of dollars each year in expanding overhead wire rail electrification. A wide variety of rail operations around the world, from South Africa (which operates all-electric 40,000-ton iron ore trains, twice as heavy than any U.S. freight trains), to India, China, all over Europe, Japan, Korea etc. have demonstrated that overhead catenary on main lines is overall less expensive than maintaining and operating an all-diesel fleet for an equivalent level of heavy service on main lines. This has been proven in all types of terrain and weather conditions. An electric locomotive also can have much greater power per unit than diesel, so fewer locomotives are needed on a multi-locomotive train to do the same job. In fact, the world's most powerful locomotives are all electrics. The 'fuel cost' is much less, and since electric locomotives have so many fewer moving parts they are far less costly to maintain. There are costs to maintain a catenary overhead contact system but it is more costly to maintain diesel locomotives than electrics. This works out in most cases that the overall maintenance cost of an all-electric, frequently-used railroad line is significantly less than using diesel power, including the overhead wire maintenance. Also, since electric trains require less maintenance, they spend less time in depots- resulting in higher equipment availability and even a slightly smaller fleet size.

[2] https://www.iea.org/fuels-and-technologies/rail

Railroad electrification around the world (both passenger and freight combined, as of 2022)[3]

Country	Miles Electrified (approx.)	Percentage Electrified
Ethiopia/Djibouti	470	100%
Armenia	435	100%
Switzerland	3,200	99%
Laos	256	98%
Belgium	1,900	85%
India	34,300	83%
Georgia	800	82%
Italy	8,200	79%
South Korea	2,300	78%
Sweden	7,600	76%
Netherlands	1,400	76%
Japan	12,500	75%
Taiwan	800	73%
Bulgaria	1,800	71%
Portugal	1,100	71%
Austria	2,400	69%
North Korea	2,400	68%
Norway	1,600	68%
Spain	6,900	68%
China	62,000	67%
Poland	7,500	65%
Azerbaijan	790	60%
Bosnia and Herzegovina	350	56%
Germany	14,000	55%
Finland	2,000	55%
France	9,700	54%
Russia	27,200	51%
Morocco	630	49%
South Africa	5,900	47%
Ukraine	5,800	47%
Slovakia	1,000	44%
Turkey	3,400	43%
Uzbekistan	1,600	39%
United Kingdom	3,800	38%
Israel	155	18%
Iran	1,400	17%
United States	**1,500**	**< 1 %**

[3] References on rail electrification statistics by country:
https://www.cia.gov/library/publications/the-world-factbook/fields/2121.html
http://uic.org/IMG/pdf/synopsis_2015_print_5_.pdf
http://statbel.fgov.be/fr/statistiques/chiffres/circulation_et_transport/transport/ferroviaire/
https://core.indianrailways.gov.in/
https://www.sciencedirect.com/science/article/abs/pii/S0360544221006125
https://www.infraestruturasdeportugal.pt/pt-pt/infraestruturas/rede-ferroviaria
https://en.wikipedia.org/wiki/List_of_countries_by_rail_transport_network_size

Electric freight trains were once a common sight in California:
Local freight train pulled by electric locomotives in **South Los Angeles, 1953, operated by the Pacific Electric Railway, which was then owned by the Southern Pacific Railroad.**
(Photo: Pacific Electric Railway Historical Society)

The total length of mainline railway electrified in the US is about 1,500 miles. In the Northeast US, the Northeast Corridor is electrified for 457 miles between Washington, D.C. and Boston, along with the Keystone Corridor between Philadelphia and Harrisburg, parts of the SEPTA system around Philadelphia, New Jersey Transit, Metro North and the Long Island Railroad. The Chicago area is served by two regional electric rail lines (the Metra Electric and the South Shore Line). More recently, Denver RTD has constructed a 25-kV electric regional rail system over 54 miles in length. The 39-mile, 50 kV Deseret Power Railway in Colorado and Utah carries coal from a mine to a power plant, and is isolated from the national rail network. A handful of similar isolated electric coal railroads around the country have been shut down in recent years.

The main drawback to electrification is the upfront capital cost of overhead wire and supporting electrical infrastructure. In the case of the recent Caltrain electrification project between San Francisco and San Jose, the cost was about $14 million/route mile, much higher than the world average and easily the most expensive rail electrification project (per mile) in history. However, many of the reasons for this is limited experience in the U.S. with electric mainline rail technology and its construction. Also important is a industrial supply chain and ecosystem of experienced (and competing) contractors, manufacturers and vendors who know how to provide rail electrification economically. In Germany for example, the labor pay scales, material costs and environmental regulations are not much different from California, yet the cost of overhead wire catenary and supporting infrastructure is much less (as low as $2 million/route mile).

The reasoning that overhead catenary wire is too expensive to install and maintain is not borne out by the evidence of rail operations around the world. It must be emphasized that the many countries who have electrified their rail networks did so primarily because it proved to be more economical than diesel power on heavily-used lines while improving performance. With their better acceleration , with overhead wire electric propulsion, more trains per hour can go down a particular stretch of track, especially one with mountain grades or frequent station stops. Historically, rail electrification schemes were not built for sake of being zero-emissions, but because it was just a better way to run a railroad. However, smoke-free

operation was always a well appreciated quality, and in more recent times that has become a more primary consideration.

Battery power

The first electric locomotive ever built, in 1837, was in fact a battery-powered locomotive. Lightweight railcars or multiple-unit trains were battery powered on a few lines from the early to late 20th century in the US, New Zealand, Ireland, the UK and Germany. Small battery-powered trains were first used in underground mines in 1917. Battery-powered maintenance trains have long been used by large urban rail transit agencies around the world, for maintenance and repair work when the traction power system is de-energized. But there is a reason that starting in the late 1800s, electric trains powered by an external source (overhead wire or third-rail) are what reason caught on.

Batteries of course have far more energy and power capability today, and are steadily improving. For several years, Alstom battery-catenary hybrid switcher locomotives have been working in European freight yards. Alstom light battery trains, for local branch passenger rail service, have been in revenue service in Germany since early 2022. Here in the US, several locomotive manufacturers have demonstrated full-sized battery electric freight locomotives. However, even if the current state of battery technology were to double in energy density or onboard storage capacity, locomotives or multiple units powered by batteries alone will only have a small fraction of the range of those powered by diesel.

Therefore, it is important not to get carried away with the idea of batteries powering a 'full-sized' train. The energy density of on-board battery energy storage means realistically that for a mainline, large freight train (or even a long passenger train like the 16-car consist of the *California Zephyr* in 1990s), only short distances are possible for the batteries would need to be recharged (realistically at most a few dozen miles).

Any time a battery pack is introduced to a train, the cost goes up. Battery trains are about twice as expensive than a standard EMU: ~ $5 million per 'US-length railcar' (based on recent order of € 100 million for 11 'three-car' Alstom battery trains in Germany). Operations and maintenance costs of a locomotive or multiple-unit with a battery pack will always be higher than that of an equivalent 'straight-electric' unit without one, and overall energy efficiency will be somewhat less. There are also environmental problems unique to batteries: the impacts and GHG emissions from their manufacture and material sources, and recycling and disposal.

In addition, due to the cost of the batteries, battery electric train sets cost more much more than electrics powered by overhead catenary wire, or overhead contact systems (OCS), and are much more expensive to maintain and operate. There is the cost of battery mid-life replacement and used battery disposal (necessary after only a few years of use). Also, due to mid-trip charging requirements, more battery electric train sets would be required. To facilitate a fast recovery from a service outage, even more battery train sets will be required (since they are constrained from a quick reversal at stations by the need to charge batteries). All of these additional costs must be included and they will erode much, if not all, of the perceived cost advantage of the battery electric system.

The key factor favoring OCS technology is the impact of weight and speed on the power requirements. The critical advantage of the overhead catenary system is its ability to "offload" the power source to stationary power sources. This "off-loading" avoids significant vehicle weight by eliminating thousands of pounds of fuel cell, hydrogen fuel or batteries. Simply put, batteries and hydrogen fuel cells will never be light enough, or have the on-board energy storage density to match the power efficiency of overhead electrification for high-speed rail operations. Overhead electrification is "off the shelf" technology with

decades of proven service and continuous technological improvements. In addition, there is ready pool of manufacturers experienced in the rail electrification technology and trains.

In the end, it is laws of physics which prevent trains powered by battery alone from providing higher speed rail travel for any reasonable distance. Only OCS will give California a zero-emissions intercity transportation system that is fast enough to get people out of their cars, and out of airplanes for travel within the state.

While battery electric propulsion service can start on a small scale, the trade-off between battery weight/train performance, battery expense, range, time required for charging, and the significant off-site expense of meeting high electricity demand at the terminal charging facility can create operational issues longer-term. It becomes a significant challenge (operational performance vs. battery weight, battery expense) trying to cram enough batteries in the rail car to get sufficient performance for acceleration and climbing grades while having enough range to complete the route. Extremes in temperatures are also a factor negatively impacting range. If charging time is required during the daily schedule cycle then equipment utilization is negatively impacted and additional trainsets are required to maintain published schedules. One factor that must be considered is that OCS trains pull their power load balanced across the utility's multiple power grid circuits as the train travels along its route. Battery electric trains would pull a high power load at specific terminal endpoint charging stations in the range of several megawatts (MW). This would require a substantial investment in utility electrical infrastructure beyond the rail line. Current technology requires at least several hours for a battery train to be fully recharged. Battery-powered trains have lower overall energy efficiency than OCS electric trains, so more electrical energy from the grid would be required for the same level of train service.

Finally, the safety hazards of on a large onboard battery pack cannot be overlooked. Due to the laws of thermodynamics, 'thermal runaway' causing fires and explosions is a much higher risk with a multi-MW battery pack than a smaller one for an electric car, as a train battery pack would be greater 'thermal mass' which requires more cooling systems. EV batteries regularly catch on fire spontaneously. A battery train crash or derailment would be particularly hazardous, and could require a haz-mat clean-up operation.

While there is often a comparison between the flexibility of battery electric propulsion vs. the operational efficiency of complete electrification, there is a blended alternative that combines the advantages of both while at the same time mitigating many of the challenges involved with each technology. Using battery power on an electric locomotive or multiple-unit in a hybrid combination with an overhead pantograph enables it to move between sections of overhead wire. This eliminates the need to electrify each mile of track no matter whether it's a terminal service track, low volume connecting track or siding, etc., and in select sections bypasses opposition to catenary through historic neighborhoods, scenic line segments, etc.

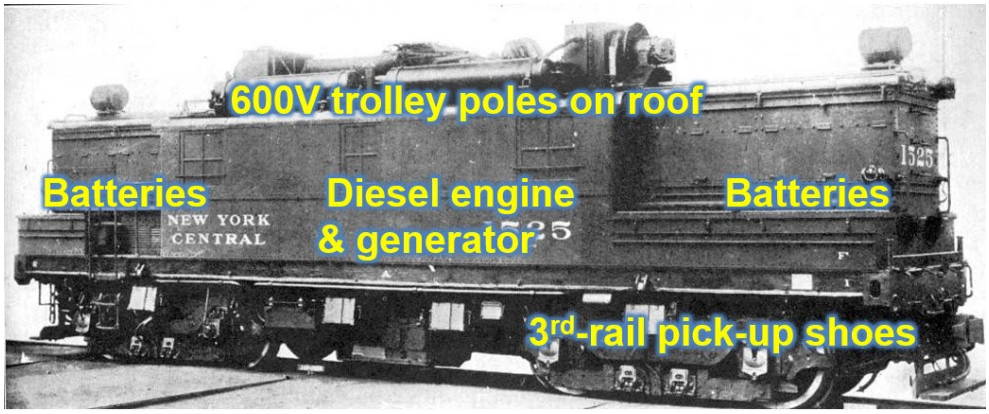
Electrifying selected line segments, incremental electrification, combined with battery electric propulsion can potentially address many of the shortcomings of both technologies. The first step would be to target initial electrification at terminal station tracks, stations with high-acceleration requirements and the key grades of the route. This significantly reduces the cost of catenary electrification and allows electrified operation to begin with battery electric trainsets. However, with the availability of catenary power in high power demand line segments and battery recharging as trains travel along key route segments, the number of on-train batteries would be decreased reducing weight, thus improving efficiency, and reducing vehicle cost. Also with segment catenary at high power demand points and enroute charging, range and full utilization during the service day would not be possible since the trains would not have to stop and charge for a few hours.

As train frequency increases and to improve acceleration to reduce travel times and to improve operations, additional miles of catenary can be added. Segment electrification with battery electric

trainsets also facilitates lower cost through service to lower volume branches and secondary lines which do not have the train frequency to warrant investment in overhead wire. Another benefit of segment electrification is that it can reduce the risk of lawsuits from lineside stakeholders over catenary construction. These lawsuits have been a major barrier to rail electrification projects in the past. With traditional electrification a lawsuit delays the entire project, costs rising, until the lawsuit is settled. With the incremental staging of electrification and the flexibility of battery operation, the remainder of the project can continue and service begun while the lawsuits are resolved. However, in addition to battery-hybrid technology there needs to be new policies or laws which mitigate NIMBY lawsuits against rail electrification. In California's case, an exemption to the California Environmental Quality Act (CEQA) for overhead catenary wire rail electrification infrastructure is long overdue.

While there is commercial operating experience with battery combined an external power source (catenary or third rail) dating back over a century, this operational experience is very limited. Battery-catenary hybrid electric, 75-ton locomotives were introduced to the Utah Copper Company rail line in the late 1920s, capable of up to six hours of 'off wire' operating time. Around the same time, the New York Central was using a 'three-power boxcab' locomotive capable of being powered by either a diesel engine, batteries, overhead trolley wire or third rail (see photo below).

All-electric locomotive operation has been required, & hybrids used, in New York City since the 1920s



GE "three-power boxcab", 1928
New York Central #1525

Despite these early battery rail innovations, from the late 1800s until the present, railroads around the world have electrified in logical, incremental phases (while phasing out steam or diesel) without the need for any form of battery propulsion as a "bridge" while the overhead wire infrastructure was built out in stages. Diesel-catenary or third rail electric hybrids have existed for a long time also. A notable example are the Bombardier ALP-45 diesel-catenary hybrids used by New Jersey Transit, which also turned out to have significantly higher upfront and maintenance costs than a straight-electric locomotive.

It must be carefully weighed for the particular rail line and service scenario, the cost of overhead wire infrastructure vs. the higher costs of O&M and new rolling stock, which also is an upfront capital cost. Saving costs by reducing the length of a section of catenary wire installation may end up being "pennywise but pound foolish" in the long run if such savings are offset by the higher upfront cost and

O&M costs of rolling stock equipped with batteries. In much of the world, the cost of a mile of overhead catenary would be around the same cost as adding batteries to a single electric locomotive or EMU.

The use of battery electric locomotives for high-speed rail, or heavy mainline freight rail, is not tenable. Reliance on battery technology creates an extremely high risk because there is no viable fallback. Currently there are no prototypes or designs for battery electric high-speed rail trainsets. The handful of battery-electric locomotives and battery-electric train sets that exist in the world today only have a range of at most 50 miles (at moderate speeds) before needing to be recharged. Improvements in battery technology over the next ten to fifteen years may possibly increase this range to perhaps 100 miles.

The Class Is can be challenged on electrification

In discussion about rail electrification in North America, private track ownership is assumed to automatically nix electrification. Its seems the Class I always come up with an excuse not to electrify.

North American Class I railroads have a history of rolling out experimental, highly publicized (and publicly subsidized) “green” locomotives which then fail, or at least turn out to be a major disappointment, in real-world revenue service. These results are then used as an excuse to say “we tried that and it didn’t work, so we can only do diesel”, while throwing up their hands and say conventional electrification is prohibitively expensive. They never show any real economic analysis of why that is so, despite it being proven to be more economical than diesel all over the world for moving heavy freight. The powers that be in America buy the “that experimental thing didn’t work, electrification is too expense” explanation as it fits nicely with Wall Street's need to minimize railroad capital expenditure, and then keep using only diesel locomotives. This cycle has repeated itself several times since the energy crisis of the 1970s. Meanwhile the portion of rail powered by electricity keeps growing in the rest of the world, while here in North America (aside from a handful of exceptions) its diesel everywhere. Diesel emissions and fuel economy per mile of North American railroad operations have improved somewhat, but diesel exhaust is still awful pollution and GHG emissions that can be easily eliminated with electrification.

Utilizing whatever the alternative fuel or propulsion technology trendy at the time (diesel multi-gensets, CNG, LNG, hydrogen) these locomotives put up by the Class I railroads are a distraction, intended to fool the public, government officials and even environmental groups into thinking we don’t have to do mainline rail electrification. They usually take the bait, as North Americans are so unfamiliar with electric rail technology as it is practiced around the world. Especially with the climate crisis, times are changing so such out-of-date assumptions must be challenged with facts.

There are tens of thousands of electric locomotives operating freight and passenger trains all over the world each day, very reliably and economically. There are many experienced vendors, manufacturers, etc. around the world who know how to provide reliable and economic electric rail. There are no experienced providers of hydrogen locomotives, just a handful of dubious locomotive-scale experiments, and the lightweight Stadler and Alstom hydrogen multiple units. Battery rail propulsion is not much better. When it comes to heavy rail, we cannot waste precious time tinkering with technologies that we already know in the end wont be a real solution. We need to start planning for overhead wire installation on the nation’s main rail lines, and quick.

The problem in North America, is the financial/political bias against any kind of capital expenditure by private railroad companies that does not have an ROI payback period of 5 years or less. This has hampered development of electrification but also increased track capacity, new freight terminals that would increase market share, etc. This an arbitrary business situation, imposed largely by Wall Street,

that needs fixing on the Federal policy level. The rest of the world's railroad tracks are publicly owned for the most part, so you can do longer-payback capital investments like electrification that are ultimately better for the railroad and society.

Whatever technical/safety issues that the Class Is bring up can be resolved. Overcoming the Class I resistance to overhead electrification is not impossible. It has been done, and it is being done. US Class I railroads have long operated freight, and double-stacked container trains at that, under electrified wire on the Northeast Corridor. BNSF Railway has accepted at least two of the tracks between LA and Fullerton will be electrified on the right-of-way it owns, as part of the California High Speed Rail project. UP will continue to operate freight trains on the Caltrain corridor under the electric catenary wires, as well as under HSR wires between LA and Burbank.

Especially since the Class I railroads are feeling regulatory heat of late, its past time to vocally push back against the tired old corporate intransigence against electrification. The Class I's bluffs are being publicly exposed with the recent Senate hearings, Surface Transportation Board cases on Gulf Coast passenger rail, Justice Department litigations, poor customer service and of course safety. The arguments they make against electrification can be similarly debunked with facts and case studies from around the world. Similar to their "arguments" about reducing crew numbers and sick days would have no effect on reliability or safety.

The "Class Is are adamantly opposed" knee-jerk argument has been used for years and years by US public agencies and many others as the excuse for why we cannot even think of overhead wire electrification here in America. It seems that putting up catenary wires over tracks owned by BNSF or Union Pacific is so unthinkable and assumed to be so horribly expensive that it could never, ever be considered as an option for California corridor and regional trains. So working backwards from that assumption, the only "zero emissions" rail technology that could possibly be considered are unproven hydrogen and battery technology. The practicality of these two options for rail applications however is severely limited by the laws of physics: hydrogen or batteries alone just cannot move a large heavy train very far compared to diesel, and never as fast or as far as an all-electric train. There is also the fact of poorer energy efficiency, especially so for hydrogen.

Hydrogen and battery(only) powered locomotives and multiple units will have their applications in lightweight and relatively short distance zero-emissions applications (railyard switching, branch lines). For heavy freight or genuinely high frequency or fast passenger rail going any reasonable distance, you need the overhead wire. Period. And no, technological advancements will not change this very much. In the end, it is laws of physics which prevent battery-powered trains from providing fast enough intercity rail travel for any reasonable distance. It is simply irresponsible to keep chasing the illusion of it being viable for heavy or long distance mainline trains.

Its also past time that freight railroads pay back their debts to society- in particular effects of dirty diesel pollution on people who live near the tracks and railyards. The environmental justice pushback to the freight railroads is picking up political and widespread popular support, especially in the wake of the East Palestine disaster. People are tired of being treated as "externalities" with serious health problems, even death, caused by railroad operations. The kids with asthma growing up next to railyards don't care about Class I's vague PR statements on how the greater energy efficiency of rail means that they should be allowed to continue burning diesel fuel forever. More elected leaders are starting to take notice of railroad pollution harming their constituents.

Rail electrification for freight will prevail in the end, especially on heavy mainlines between California ports and inland terminals- the physics and environmental reasons are too strong. The question is if it can happen soon enough.

The railroad industry will have to face up to the fact that future traction options available to it will be forced on it externally, and won't be part of an internal industry transition (like steam to diesel). It will need guidance, advice and analysis to support investment decisions and make informed choices.

Hydrogen

Despite the state of California's embrace of hydrogen rail technology, the laws of physics mean the hydrogen-trains will always inferior energy efficiency and be more complex (with higher O&M costs and poorer reliability) compared to conventional electric trains using an overhead wire. The primary problem with using hydrogen to power trains is the element's low energy density compared to other fuels, and poor overall energy efficiency of producing hydrogen, then storing it energy-intensive compression or cooling, and then running it through a fuel cell, which then mostly charges a battery, which then goes to the traction motors[4].

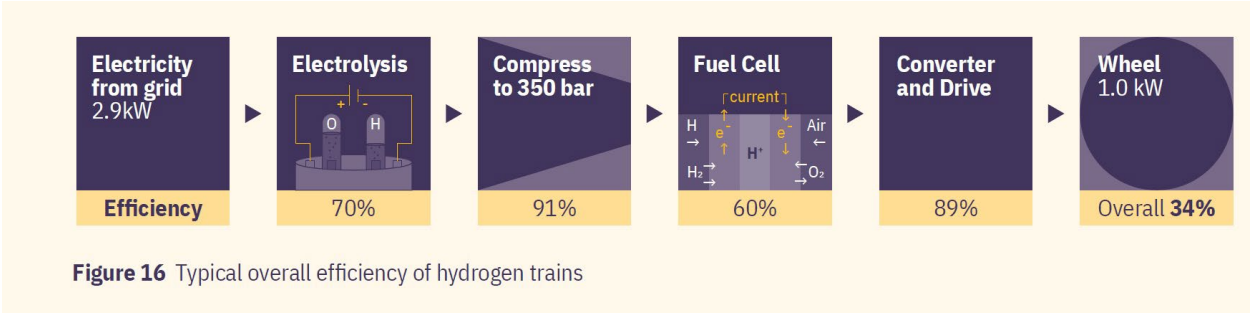


Figure 16 Typical overall efficiency of hydrogen trains

Hydrogen trains have the worst roundtrip energy efficiency on any rail propulsion technology: it takes *3 to 4 times the amount of electricity* to produce renewable hydrogen, which would have the same useful train-propulsive energy as powering a train directly with renewable electricity directly. [diagram from UK Railway Industry Association, *Why Rail Electrification?* report, 2021]

In terms of overall energy efficiency, conventional electric trains are about three times more efficient than diesel or hydrogen, and about 1.2 times more efficient than battery trains[5]. According to a March 12, 2023 *Railway Age* article by Mike Iden[6], total 'input-to-wheel' energy conversion locomotive efficiency was calculated to be:

- Catenary wire electric- 90%
- Catenary wire electric with battery tender- 86%
- Battery electric- 77%
- Green hydrogen- 39%
- Diesel with battery tender- 36%

Even if the hydrogen comes from green sources, it would require three times the amount of overall energy compared to an electric train connected directly to the grid[7].

Hydrogen trains are about four times more expensive than a standard EMU: ~$11 million per 'U.S.-length railcar' (based on recent order of € 500 million for 27 'two-car' Alstom hydrogen trains in German).

[4] https://riagb.org.uk/RIA/Newsroom/Publications%20Folder/Why_Rail_Electrification_Report.aspx
[5] https://www.rssb.co.uk/en/research-catalogue/CatalogueItem/T1145
[6] https://www.railwayage.com/mechanical/locomotives/follow-the-megawatt-hours-hydrogen-fuel-cells-batteries-and-electric-propulsion/
[7] https://www.riagb.org.uk/RIA/Newsroom/Why_Rail_Electrification_Report.aspx

Other disadvantages stem from the inherent complexity of hydrogen supply chains, on-board storage systems, and power (fuel cell+battery) drivetrains. More complex systems onboard mean more potential points of failure, higher equipment costs and higher O&M costs than a conventional electric train. While hydrogen technology is still emerging, future technological developments will not change these fundamental physical facts.

The hydrogen-powered Alstom and Stadler multiple-unit trains now entering the market are very much in the category of 'light rail': actually closer in power and weight to a large bus than they are to a locomotive. The much-hyped Alstom iLint hydrogen trains in Germany have proven to be a disappointment. At a March 2023 conference in Los Angeles put on by DB, the CEO of the Hamburg/ Lower Saxony region rail operator EVB gave a presentation about running the world's first commercial hydrogen train fleet of 14 iLint hydrogen trains. He had a lot of candor about the difficulties they have faced, and gave these interesting facts:

- In the first few months of operation, as the units were going through acceptance trials, the average availability of 14 iLint fleet was only about 20% (though reliability after acceptance was reported to be 95%). The current target is full reliability & 90% availability by the end of 2024, a significant delay.

- They had to continue operating the existing diesel fleet of similar size, which cause a big strain on staff and facilities to maintain/fix, etc, both fleets at the same time. The severity of overall O&M cost increases for the EVB operations was unexpectedly high, and the time period of keeping *all* the diesel fleet in operation was unexpectedly long. For introducing new hydrogen trains a "high level of dedicated resources" is needed, and additional costs and delays are to be expected.

- The actual practical range of the iLints in real-world operating conditions was about 300 miles on a full tank of hydrogen- less than half of what was promised. This is a major factor in their low availability rating, and the need to keep the diesel trains running to compensate.

- The fueling station was more expensive and complex than expected. The trains run on gray (dirty) hydrogen, from one of the large chemical complexes in the region- sourced from fossil fuels. The plan is to have an electrolyzer built at the site of the fuel station, powered by wind power. In three years hopefully it would then be "just add water". A trucking company interested in hydrogen trucks ask if they could co-locate a truck fueling station and the train hydrogen station, but the difference in setups made this impossible.

- For EVB, the deal overall turned out to be "too expensive for just 14 trains".

He concluded that the most important way passenger rail can reduced carbon emissions is winning new customers for public transport, independent of propulsion technology. In other words, don't let flashy new technologies distract from the primary mission of providing passenger rail service that fits people's needs.

Railroad companies and public agencies have used the promise of future hydrogen trains as an excuse not to electrify, and hydrogen locomotives are actively promoted by oil and gas companies[8]. Environmental advocates are coming out against using hydrogen as transportation fuel[9]. Compared to conventional

[8] https://www.chevron.com/newsroom/2021/q4/caterpillar-bnsf-and-chevron-agree-to-pursue-hydrogen-locomotive-demonstration

[9] For further reference see these Sierra Club articles on the disadvantages and environmental harms of hydrogen: https://www.sierraclub.org/articles/2022/01/hydrogen-future-clean-energy-or-false-solution

electric rail technology, hydrogen trains and locomotives are inherently much more complex and more expensive to maintain, with far more potential points of failure- many of them dangerous considering hydrogen leaks easier than natural gas. Hydrogen-powered fuel cells alone cannot provide enough instantaneous power to accelerate a train. So an onboard battery pack is also needed in addition to the hydrogen tanks and fuel cells, taking up even more space and weight. There have only been about a dozen hydrogen full-sized locomotives ever built, none of which have entered regular commercial service. It is not known yet if a hydrogen locomotive could approach the performance standards of conventional diesel and electric locomotives - so we do not know yet if could even hydrogen an appropriate fuel for long distance freight trains, especially on routes with a lot of inclines. The Alstom iLint hydrogen multiple unit trains introduced recently to branch line passenger service in Germany have been plagued by reliability problems, particularly in cold weather[10]. By contrast, there are tens of thousands of electric locomotives operating heavy trains (and many thousands more electric multiple unit trains) around the world each day, very reliably and economically. There are many experienced vendors, manufacturers, etc. around the world who know how to provide reliable and economic electric rail. There are only a handful for hydrogen rail technology, which remains an unproven and very expensive technology.

A recent report from the state of Baden Wurttemberg in Germany concluded that they will no longer consider hydrogen for rail propulsion as it is more expensive than battery or hard wire electrification by as much as 80%[11]:

> "The positives for hydrogen were: minor impacts upon introduction and during operation, and no changes required to the rail infrastructure. But the negatives were: costly filling stations; low efficiency, high energy consumption and high cost; the possible need to increase the number of trains because the range would not be sufficient for a whole day of travel; limited availability of green hydrogen; and the need to continually resupply the hydrogen filling stations."

In addition to the overall energy efficiency of green hydrogen being very poor, the fresh water needed to produce hydrogen by electrolysis may not be in sufficient supply in dry regions such as California. Using seawater as a source would have the same siting issues and environmental opposition faced by coastal desalination plants. As described by Mike Iden in a recent *Railway Age* article[12]:

> Looking at a fuel cell-for-diesel replacement scenario, in 2019 BNSF reported pumping up to 300 million gallons of diesel fuel annually at Belen, N.Mex. (population 7,423). Assuming all diesels through Belen were replaced with fuel cell locomotives, the 300 million gallons of diesel would be replaced by 300 million kg of hydrogen. Making that much hydrogen will require 12-to-20 million gallons of water every day (4.4 billion to 7.3 billion gallons every year), equal to 18% of neighboring Albuquerque's water demand for 563,000 people. Recall that the Santa Fe Railway first dieselized across Arizona and New Mexico 1940-1942 to overcome the lack of "good" boiler water. And the southwestern U.S. is now in a monumental drought. Will there be enough water and renewable electricity? "Maybe" is not a sufficient answer for a major project.

The promises made by hydrogen promoters has already led to some bad excuses in rail planning, in California and elsewhere: "we don't have time or the interest to electrify, so lets use hydrogen instead." But hydrogen isn't proven, and the supporting infrastructure is also extremely expensive, and take years to develop , which exactly what the hydrogen promoters (the oil and gas industry) claim is so bad about

https://www.sierraclub.org/press-releases/2023/03/california-ej-and-climate-advocates-urge-greater-transparency-and-community

[10] https://www.trains.com/trn/news-reviews/news-wire/hydrogen-powered-trains-struggle-with-winter-weather/

[11] https://www.hydrogeninsight.com/transport/will-no-longer-be-considered-hydrogen-trains-up-to-80-more-expensive-than-electric-options-german-state-finds/2-1-1338438

[12] https://www.railwayage.com/mechanical/locomotives/follow-the-megawatt-hours-hydrogen-fuel-cells-batteries-and-electric-propulsion/

overhead wire electrification. And where will all that fresh water come from? …we will just have to keep using dirty hydrogen from fossil fuels until we figure that out, which is exactly what is happening with the world's first operating hydrogen rail fleet in Germany.

In general, no one really knows how much a comprehensive green hydrogen infrastructure would cost. We do know that the cost of building just the fueling station SBCTA's demonstration hydrogen multiple-unit train ballooned to $53.2 million at the end of 2022, up from a prior estimate of $37.5 million. This is for just one fueling station for a hydrogen fleet size of one 2-car multiple unit. For the same amount of money, the entire 9-mile Arrow track between San Bernardino and Redlands could have been electrified, and a full fleet of six electric multiple units purchased. Mike Iden, in the aforementioned article, estimated that building a hydrogen fueling station for BNSF at Belen would have a capex of roughly $7.5 billion. Not including the cost of a new hydrogen locomotive fleet or continual costs of providing the fuel itself, a hydrogen fueling station network for the entire BNSF Railway would be well north of $100 billion. Who knows what it would cost for all of North America. SBCTA's hydrogen fueling station adjacent to the San Bernardino main train station is located less than a thousand feet from homes in a disadvantaged community that is already heavily impacted by pollution and accident risk.

It is important for public transportation and infrastructure policy to not waste precious time and money going up technological dead-ends when it should have been spent on what is proven to work: a rail system with conventional electrification as its backbone (with catenary-battery hybrids for relatively short unelectrified sections). In the Greater Toronto region GO Transit wasted precious time and money looking into hydrogen propulsion (which they decided against after reviewing the evidence, which unnecessarily delayed and drove up the costs of the inevitable electrification project. As concluded by a 2021 report by the UK Railway Industry Association:

> Evidence does not support the view that electrification is unnecessary, thanks to hydrogen and battery systems improving rapidly: hydrogen trains are inherently less efficient than electric trains, due to the physical properties of the gas. Expert opinion predicts that battery capability might double by 2035. *Yet, whilst this might affect the hydrogen / battery traction mix required for decarbonisation, it is unlikely to change significantly the requirement for electrification.*
>
> The laws of nature make electrification a future-proofed technology that is a good investment, offering large passenger, freight, and operational benefits. Furthermore, railways cannot achieve net-zero carbon emissions without a large-scale electrification programme.

Similarly, Network Rail's 2020 *Traction Decarbonisation Network Strategy* report concluded that, for the currently unelectrified lines in the UK, rail decarbonisation requires electric, hydrogen and battery traction operating on respectively 86%, 9% and 5% of the rail network[13].

As part of the "in-use locomotive" regulation approved by the California Air Resources Board technology re-evaluation is planned to occur in 2027. This was proposed review results of the hydrogen and battery locomotive demonstrations and pilot departments. However, in addition there should be evaluation of 25 kV overhead catenary electrification projects currently under construction (Caltrain, Central Valley HSR, and Brightline West).

[13] https://www.networkrail.co.uk/wp-content/uploads/2020/09/Traction-Decarbonisation-Network-Strategy-Interim-Programme-Business-Case.pdf

Conventional rail electrification, using an overhead wire, is more environmentally friendly than hydrogen propulsion in almost every respect:

- It requires more than three times the amount of electricity to electrolyze hydrogen, store it and use it to propel a train compare to just using that same electricity to directly power the same train. This means that whatever the environmental impacts are of producing the electricity, there is *three times* the environmental impact than using hydrogen generated by electrolysis.

- A hydrogen-powered train requires both batteries and fuel cells, which require rare materials that require mining (lithium, platinum, rare earth elements), requiring significant embodied carbon and local environmental impacts of mining, processing and shipment. Directly powering a train with electricity, using an external source (overhead wire or third rail), avoids the 'embodied' environmental impacts of hydrogen fuel cells and batteries.

- Leakage of hydrogen from pipelines and storage tanks is a serious problem- hydrogen itself is an indirect greenhouse gas. Hydrogen storage and fueling stations pose dangers to residents living near them. For example, the SBCTA Arrow hydrogen fueling station in San Bernardino is being constructed less than 400' from homes. Delivering hydrogen to rail fueling stations with trucks also poses dangers to the wider public.

- Producing hydrogen from electrolysis requires fresh, distilled water. Thus in regions where water is scarce, like California, the environmental impacts and available water supply are serious issues. Making hydrogen from saltwater or brackish requires desalination, with all the energy consumptions and local environmental impacts that entails.

- All hydrogen trains in use today get their hydrogen from fossil fuel sources, with overall carbon intensity per passenger-mile on par with normal diesel-powered trains. There are promises to produce all the hydrogen required by these trains using electrolysis by renewables, but this has not happened yet. We are told to wait a few years, while fossil fuel sources will continue to supply hydrogen. However, hydrogen promoters have been continually promising the economical green hydrogen is "only a few years away" for decades now.

Perhaps the biggest danger of hydrogen, aside from its explosivity, is the opportunity cost of the money, time and resources that will be wasted on it, compared to conventional rail electrification. While a lot of recent transportation planning has emphasized implementing advanced technology as a goal, one cautionary factor is that the pursuit of new technology could become an end in itself, resulting in a deferral of investment in proven systems. In addition, we need to have a global perspective when viewing passenger and freight rail investments. For example, high quality passenger rail service levels (and fast frequent freight trains) which many Americans may consider as being 'futuristic' or 'unrealistic', are, in fact, what Europe and Asia have had available for decades. There is a wealth of global experience and proven "off the shelf" technology that the U.S. can utilize to address its transportation issues, particularly for rail electrification.

The state needs to develop and implement policies that will electrify the California rail network, state should also emphasize conventional overhead wire electrification for interregional rail, instead of hydrogen locomotives, which are not a proven technology and have very limited range compared to conventional diesel locomotives.

The electrification of the Caltrain corridor between San Francisco and San Jose (and subsequent CHSR plans) provides a model for statewide passenger rail electrification, by providing experience in

electrification construction, implementation and operations. For example, electrification and other upgrades to the Burbank-LA-Anaheim corridor by CHSRA, in collaboration with those made by other public agencies and BNSF, would be a great public benefit to both passenger and freight rail service. The heavy train traffic of this corridor would lead to improved economics and higher utilization of electric rail infrastructure, if used by both electric passenger and freight trains sharing the corridor.

Electric freight rail also needs to part of the state's plans. It should be investigated to see if California high-speed rail infrastructure can be shared with lightweight express freight trains running late at night or other off-peak times on HSR tracks. U.S. freight railroads have mostly given up on short haul service and expedited delivery.

The 'blended' CHSRA Burbank-Los Angeles-Anaheim-Irvine corridor could serve as a catalyst for electric regional passenger and freight rail for the rest of Southern California. An existing model for "blended services", combining electrified higher-speed / high-speed passenger trains and express freight trains, can be found in Germany and other countries. Freight trains in Germany operate in mixed traffic with commuter, regional, long distance, and high-speed passenger trains on lines with maximum speeds of up to 150 mph. Electric freight trains in Germany typically operate at 60-70 mph. German 90 mph freight trains were common in the past, but that speed was found to be too costly to be beneficial to the commercial service.

In Europe, many HSR lines share some of the track with conventional passenger trains or even freight trains, at least in terminal areas. Where the track is shared with other types of traffic, the HSR trains are generally limited to no more than 155 mph. Almost all high-speed rail trains in Europe access city terminals on the conventional network at conventional speed. The general characteristics of freight trains in the US and in Europe generally prohibit such shared operation. US freight trains are very long, heavy, and slow for political and business reasons. However, there is a large amount of lightweight and time-sensitive freight currently hauled by truck in the US that could be moved on trains similar to European freight trains, allowing the shared use of conventional trains and some HSR trains. Freight-passenger combination trains should also be investigated for California. Express or lightweight freight trains could offer passenger service to underserved rural areas of the state such as the Central Valley and the Central Coast.

p. 108 - : 5.2 Coastal Sea Level Rise Guidance

p. 109 -112: 5.2.1 Sea Level Rise Impact Analysis

p. 112 - 115: 5.2.2 Responding to Sea-Level Rise UP Martinez and Coast Sub

p. 113: Southern California Coastal Inundation

"Two publicly-owned railroad subdivisions in Southern California—the SCRRA Orange Subdivision and the NCTD San Diego Subdivision—have already begun experiencing the impacts of Climate Change and Sea Level Rise. Both subdivisions are located directly alongside the coastline in certain places and are under immediate threat from erosion.

In September of 2021, a landslide South of San Clemente shut down the rail line for nineteen days while emergency repairs were done. This closure prevented both passenger and freight rail trips between the

Los Angeles and San Diego regions. As sea level rise continues, coastal erosion will continue to impact vulnerable rail infrastructure unless serious mitigation work is done.

The State Rail Plan identifies the rail corridor between the Los Angeles and San Diego regions as a critical piece of the 2050 vision. By 2050, both intercity and regional/commuter rail service frequencies will be greatly increased from their current levels to run on a half-hourly pulse frequency. In addition to the phased investments that will be necessary to develop additional capacity, significant sea level rise mitigation will also be necessary, requiring large investments. In some cases, smaller-scale interventions such as more robust sea walls may be effective. However, it is also in the state's interest to study possible realignments of the corridor, moving the most vulnerable parts of the route inland to avoid damage and disruption from coastal inundation."

Caltrans and OCTA need to start doing engineering and environmental studies for inland tunnels to bypass San Clemente and San Juan Capistrano underneath I-5.

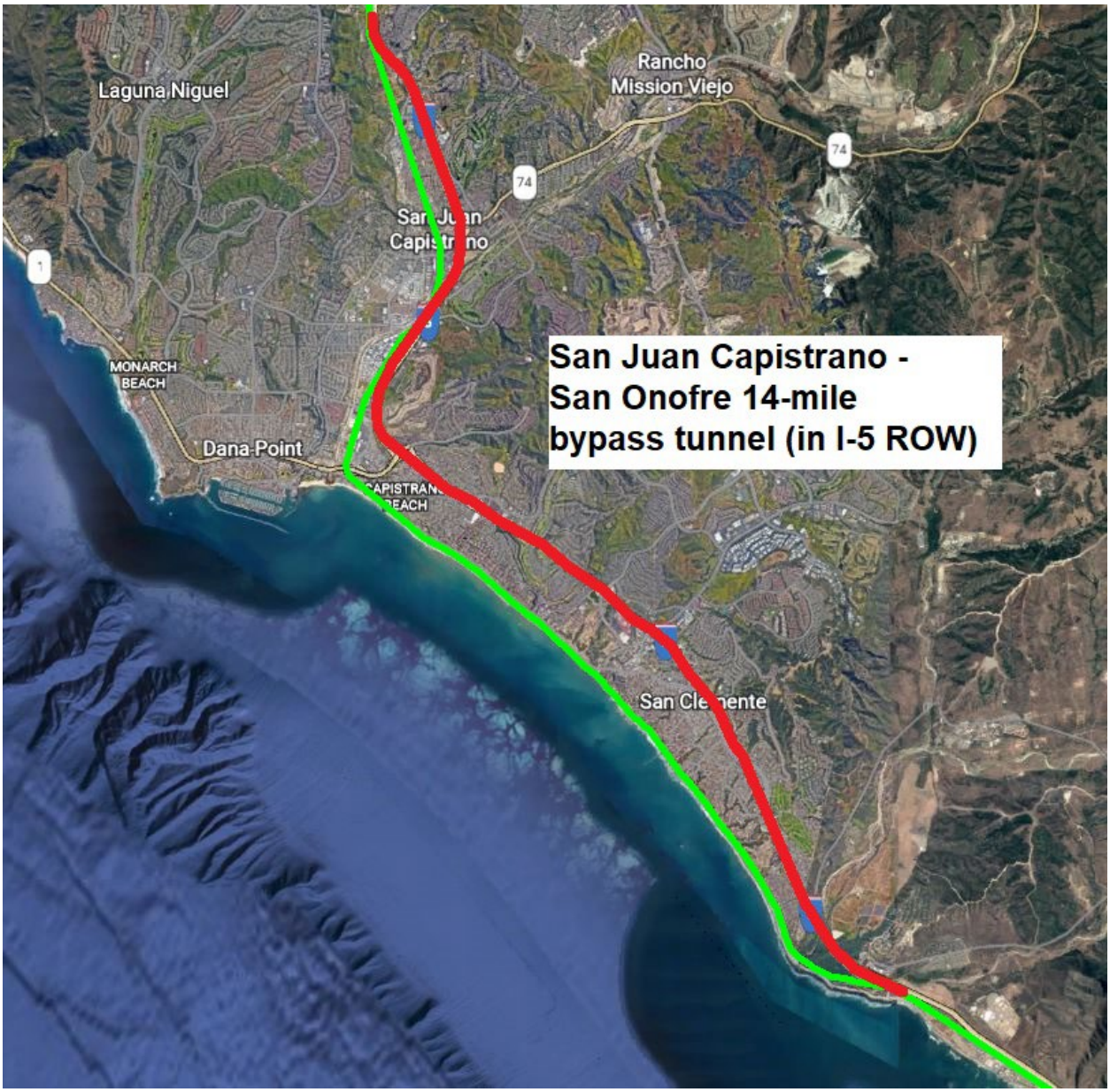
"It's time to relocate the Surf Line railroad track inland, and build the San Clemente bypass tunnel"
https://railpac.org/2023/01/12/its-time-to-relocate-the-surf-line-railroad-track-inland-and-build-the-san-clemente-bypass-tunnel/

It is of critical importance to address the land slippage and coastal erosion threatening rail service on the coastal railroad section in San Clemente. Train service through southern Orange County has been temporarily suspended because of the instability of the land beneath the tracks. This is a transportation emergency that must be taken seriously by local, state and federal stakeholders, both in the near- and long-term. The cost of past inaction is catching up to us now.

The "Surf Line" is both a key regional and intercity rail route boasting the 2nd highest intercity ridership in the nation. For 130 years the Surf Line has provided travelers between Los Angeles and San Diego a convenient and efficient alternative to the automobile. Passenger rail is also the most environmentally friendly way to move large numbers of people rapidly between the nation's 2nd and 8th largest cities. Per passenger-mile travelled, the greenhouse gas emissions of riding even a diesel-powered train is only a fraction of that going by car. It is also a vital freight route that supports the regional and national economy and reduces truck traffic on parallel I-5, further reducing pollution and wear and tear on the roads. Because it is the only direct rail link connecting the principal mainland port of the U.S. Navy Pacific Fleet and Camp Pendleton to the rest of the nation, it has been designated part of the U.S. military's Strategic Rail Corridor Network. But until repairs are completed, the San Diego-Tijuana bi-national metro area (population 5 million) will lack a railroad connection with the rest of North America.

The first priority is to stabilize and maintain the existing Surf Line tracks through San Clemente to be an operable railroad for as long as geologic conditions allow. The Orange County Transportation Authority (OCTA), as steward of this vital regional, state and national asset, has begun this project to restore train service as before. It is expected to take until March at the earliest before Amtrak and Metrolink can resume full service along this section.

But concurrently, planning must proceed to relocate the tracks inland. No amount of reinforcement of the bluffs overlooking the Pacific Ocean will prevent the inevitable loss of the tracks. After all, this particular stretch of coastline has been naturally eroding eastward for thousands of years. Human-induced climate change and rising sea levels, along with sediment flows into the ocean reduced by flood control infrastructure and other factors, are accelerating these natural processes. What is required is to develop a new alignment away from the shoreline, most likely via a bypass tunnel underneath I-5.



Google Earth perspective of alignment for potential relocation of LOSSAN rail line: a bypass tunnel underneath the I-5 right-of-way (ROW) from San Juan Capistrano to San Onofre.

The San Clemente bypass megaproject will take years to plan and build so OCTA and Caltrans should begin preparing for it without delay, starting with environmental studies and preliminary designs. The bypass tunnel should be electrified and designed to accommodate increased train capacity and reduced travel time, so as to stimulate more non-highway travel between Los Angeles and San Diego, support regional economic growth, and aid military preparedness.

Both programs - stabilizing the existing tracks and planning the bypass - will need funding through state and federal grants. OCTA should aggressively pursue financing for both projects now since the current window of opportunity for funding must be leveraged before it closes. Competition for funding grants is based on the value of the project: its projected ridership. A passenger rail project's ridership forecast starts with the existing ridership as a baseline. If current ridership numbers are low because of service issues, a lower future ridership will be projected. This could create a financing shortfall for the planning, design, and construction phases.

To maximize available funding for the rail bypass, strategic planning and investment will be needed to generate high ridership numbers on the existing Surf Line once full service is restored. Bringing passengers back in force means establishing promotional programs, convenient scheduling, and high standards of service excellence and reliability. For California and the nation it is vital that the railroad linking Los Angeles and San Diego be secure and endure for future generations.

[*an earlier version of this piece was published in Voice of OC on December 19, 2022*]

CHAPTER 6. VISION IMPLEMENTATION

6.1 Network Phasing

p. 117-118:

6.1.1 Future Planning Studies

6.1.2 Near-Term Investments

6.1.3 Mid-Term Investments

6.1.4 Long-Term Investments

For near-, mid-, and long-term investments, “high level” maps showing general corridors and key project locations would be helpful.

For all of the above, rail project delivery (development and construction timelines) needs to be improved in California, informed by international best practices.

6.1.5 Operating Costs

> “..more efficient train rolling stock, largely through electrification and modern DMU trains that are cleaner and lighter than traditional diesel locomotive-hauled trains;”

This means electrification with overhead wires, not hydrogen- the O&M costs of which are not yet fully known.

p. 120- 121:

6.2.2. Benchmarking Peers

Switzerland is effectively 100% electrified. It has far few people than California, but where it has very frequent train service are urban areas with similar population densities as California cities.

6.2.3. Achieving State Goals for VMT Shift

In addition to passenger transportation, this section should also discuss freight mode shift, from truck to rail?

6.4 Funding the Rail Plan Vision

p. 124- 130 :6.4.2 Federal Funding

California should support a Federal trust fund, or long-term stable funding source, rail and transit operations, including for Amtrak National Network.

p. 132 - 141: 6.4.3 State Funding

State Transit Assistance Program:

The State of California, in the near, mid- and long terms, needs to greatly step up financial support of regional and local rail/transit agency operating expenses. Stable, predictable long-term operational funding is vital to rail and transit mobility at all levels and types, especially since it usually cannot be supported sustainably by local sources alone. Public transportation agencies nationwide in the post-pandemic period are facing looming fiscal cliffs in the next few years. This can be avoided in California with more guaranteed annual state funding for transit operations.

SB743 mitigation banks should be sought as a source of funds for rail projects.

Grade crossing projects should be funded from more general sources such as road/highway funding, as opposed to solely “rail-oriented funding sources.