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16. ABSTRACT

California invests billions annually into capital transit infrastructure across a fragmented network of over 200 local agencies. Transit delivery at this scale involves significant inherent complexity, driven by layered funding mechanisms, shifting political landscapes, rigorous engineering challenges, and the need for continuous stakeholder coordination. Because these transit agencies vary significantly in their institutional maturity and mega-project delivery capacity, infrastructure outcomes run the gamut from on-time success to severe cost overruns and delays. While we recognize that the specific factors affecting project outcomes are extensive and highly localized, the overarching challenge is to isolate the systemic common denominators of success and failure. Identifying these core issues is a critical first step toward driving actionable policy changes at the state level.

The primary objective of this report is to evaluate capital transit project delivery practices across California to identify opportunities for improvement. To achieve this, the study examines three completed projects: the Mid-Coast Trolley Extension in San Diego, the Peninsula Corridor Electrification Project in Northern California, and the Tempo Bus Rapid Transit (BRT) in Oakland and San Leandro. These case studies were selected to provide a diverse cross-section of project scopes, geographies, and procurement methods. Because these transit systems are fully operational, the research leverages the advantage of hindsight through extensive public documentation and formal post-project assessments. While the small sample size precludes quantitative statistical modeling, the scope of this work focuses on an in-depth qualitative analysis. By examining these cases, the project traces downstream cost and schedule outcomes back to their organizational drivers, isolating the common threads that link diverse capital delivery projects of this size and scope in California

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Best Practices in Project Delivery for Transit

Final Report

Contract No.: 65A1258

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0. Executive Summary

California invests billions annually into capital transit infrastructure across a fragmented network of over 200 local agencies. Transit delivery at this scale involves significant inherent complexity, driven by layered funding mechanisms, shifting political landscapes, rigorous engineering challenges, and the need for continuous stakeholder coordination. Because these transit agencies vary significantly in their institutional maturity and mega-project delivery capacity, infrastructure outcomes run the gamut from on-time success to severe cost overruns and delays. While we recognize that the specific factors affecting project outcomes are extensive and highly localized, the overarching challenge is to isolate the systemic common denominators of success and failure. Identifying these core issues is a critical first step toward driving actionable policy changes at the state level.

The primary objective of this report is to evaluate capital transit project delivery practices across California to identify opportunities for improvement. To achieve this, the study examines three completed projects: the Mid-Coast Trolley Extension in San Diego, the Peninsula Corridor Electrification Project in Northern California, and the Tempo Bus Rapid Transit (BRT) in Oakland and San Leandro. These case studies were selected to provide a diverse cross-section of project scopes, geographies, and procurement methods. Because these transit systems are fully operational, the research leverages the advantage of hindsight through extensive public documentation and formal post-project assessments. While the small sample size precludes quantitative statistical modeling, the scope of this work focuses on an in-depth qualitative analysis. By examining these cases, the project traces downstream cost and schedule outcomes back to their organizational

drivers, isolating the common threads that link diverse capital delivery projects of this size and scope in California.

This research employed a robust, mixed-methods approach to reconstruct the lifecycle of each case study and isolate the root causes of schedule and budget variances. The process began with a macro-analysis of headline cost and schedule data across 49 rail, Bus Rapid Transit (BRT), and electrification projects in California to identify three representative cases. Following this selection, the team conducted a comprehensive archival review of environmental impact documents, agency oversight reports, and public records to track scope changes and establish an objective timeline of milestones. This documentary evidence was then triangulated with targeted qualitative interviews involving agency officials, contractors, consultants, and transit advocates. By synthesizing these primary and secondary data sources, the research successfully reconstructed the operational realities of each project, allowing for the derivation of cross-cutting insights that form the basis of the final conclusions and recommendations.

Based on these three case studies, we find that inter and intra-agency coordination and agency capacity are crucial drivers in transit delivery outcomes, specifically cost and schedule delays. We conclude with four recommendations to improve capital project delivery. First, capital project delivery should be shifted away from operations-only transit agencies and centralized within highly experienced entities to build continuous, state-wide delivery expertise. Second, the state must implement standardized third-party agreements with legally enforceable review timelines to eliminate bottlenecks in local permitting. Third, to minimize delays originating from unforeseen site conditions, California should establish a centralized, accessible utility mapping program and mandate

rigorous advanced subsurface planning prior to construction. Finally, the state must enforce granular financial transparency and standardized record-keeping across all projects, ensuring every contract modification and timeline variance is trackable to facilitate accurate benchmarking and prevent the optimism bias that plagues future transit estimates.

1. Introduction

The State of California and its counties support capital transit projects through a variety of multi-billion-dollar funding streams like the Transit and Intercity Rail Capital Program (TIRCP), Los Angeles County's Measure M, 2008's Proposition 1A to fund California High-Speed Rail, and others. California is home to over 200 transit agencies that range in size from LA Metro that directly operates 1,817 vehicles over a 1,433 square-mile service area to Solano County Transit that contracts out all of its operations over a 40 square-mile service area. With billions of dollars available for capital project delivery each year and agencies of differing sizes, maturity, and capacity tapping those dollars, California's overall experience with capital transit project delivery runs the gamut from on time and on budget to severely delayed and over budget [1][2][3].

The existing literature on capital transit project delivery explains these different outcomes via two distinct categories: First, there are the political explanations that identify chronic underfunding, a lack of authority, legal difficulties, third party coordination challenges, and overly optimistic planning analyses that over promise project benefits and under estimate costs in order to win support and funding. Second, there are more technical explanations that emphasize unanticipated construction challenges, expensive design decisions, and limited agency expertise to execute these large capital projects.

In this report, we take a more holistic view to examine three projects in California to better understand project delivery practices and identify opportunities to improve outcomes across the state. To better assess project delivery outcomes, we examined Mid-Coast Trolley Extension in San Diego, Peninsula Corridor Electrification Project (PCEP) in northern California, and Tempo Bus Rapid Transit (BRT) in Oakland and San

Leandro. Each project and agency is unique, the ground conditions in San Diego differ from those in Oakland, but we also found overarching similarities across projects. Based on our review of these projects, we found that agency capacity and coordination structure the magnitude of cost and schedule delays across all three projects. Since all projects face challenges–differing site conditions, costly design decisions, and unforeseen circumstances–it's the agencies that can adapt to those uncertainties that are able to keep projects on schedule and on budget.

We used a variety of methods to carry out this research. First, we collected estimated and final headline cost and schedule data on 49 rail, BRT, and electrification projects in California between the 1980s and 2030s. After analyzing the data, we selected three case studies, focusing specifically on projects completed within the last five years. Second, we read everything we could find about the three projects. We read the media coverage, environmental documents, agency and project management consultant reports, and other documents to establish project scopes, changes, schedules, costs, and key moments in each project. Third, we conducted 18 semi-structured interviews with agency officials, contractors, consultants, academics, and advocates who understood the nuances of each project. When necessary, we also followed up with email correspondence and additional phone calls or Zoom/Teams meetings. By combining these methods, we recreated the basic outline of each project and were able to derive insights across the cases to inform recommendations.

Our analysis is supported by a comprehensive dataset we collected on capital transit projects in California [4]. We collected document archives for each case study, as listed in Table 1. The San Diego Association of Government's (SANDAG) Mid-Coast

Trolley Extension report repository consists of approximately ten years of monthly progress reports. Reports were collected from October 2011 to November 2021, with only a single report (March 2012) missing. In total, the dataset includes 121 monthly reports. It captures key project milestones, including the groundbreaking and start of construction in October 2016, as well as the commencement of revenue service in November 2021.

Table 1. Overview of the datasets and report sources used in this study.

Case	Item	Quantity and Source
Case 1: Mid-Coast Trolley Extension	PMOC monthly reports	121 PMOC monthly reports from 10/2011 to 11/2021 (except 03/2012)
	FTA quarterly review meeting reports	22 FTA quarterly review meeting reports
	PMOC quarterly reports	4 PMOC quarterly reports in 2022
Case 2: Tempo Bus Rapid Transit (BRT)	Staff reports before 2019	214 reports from https://www.actransit.org/archived-reports
	Staff reports after 2019	67 staff reports and meeting minutes from https://actransit.legistar.com/Legislation.aspx
Case 3: Peninsula Corridor Electrification Project (PCEP)	PCEP monthly reports	98 monthly reports (missing 05/2022)
	PMOC reports	38 PMOC reports
	PTC Monthly Progress Reports	8 PTC monthly progress reports
	Source	https://www.caltrain.com/electrification-document-library

For the BRT project in Oakland, the dataset is composed entirely of publicly available administrative records, including staff reports and meeting minutes. These

documents include detailed discussions about project development, decision-making processes, contract approvals, and implementation updates, offering a longitudinal view of project evolution from planning through revenue service.

For PCEP, the dataset consists of both agency-reported and oversight documentation. Specifically, we collected 98 PCEP monthly progress reports, with only the May 2022 report unavailable on the official website, along with 38 Project Management Oversight Consultant (PMOC) reports. Together, these documents provide comprehensive coverage of project planning, construction progress, risk management, and system integration over time.

As California continues to spend billions of dollars per year on transit infrastructure, it is worth reflecting on contemporary projects and finding ways to achieve better outcomes. Below we outline each case study's cost, schedule, contracts, procurement method and project scope. In the discussion section we draw on our interviews and project data as shown in Table 1 to show how agency capacity and coordination added costs and time to each project.

The report is organized as follows. Next, we provide an overview of the three case studies and explain why we selected them. In the Discussion section, we delve into each case and show how agency capacity and coordination across and within agencies impact project schedule and costs. Finally, we conclude our study by re-iterating key drivers and make four recommendations to improve project delivery in California.

2. Project Background and Selection

We selected the Mid-Coast Trolley Extension, Tempo BRT, and Caltrain electrification to capture variation in geography, mode, procurement method, agency type, and delivery outcomes. The case studies were chosen based on sufficient public documentation, diverse project types and delivery methods, high dollar value, and their ability to provide clear lessons on costs, schedule, and project delivery. Entire books have been written about LA Metro and BART, and since Los Angeles and San Francisco are large media markets, those agencies and projects receive ample scrutiny [5][6]. Our selected cases, while firmly in the outer reaches of the Los Angeles and San Francisco penumbra, provide valuable insight into how capital project delivery works and how it can be improved. In this section, we describe why we selected each project and their developing project scopes and costs, before delving into our analytical analysis of the cases in the discussion.

In selecting our cases, we addressed geographic, modal, procurement, and agency variation. Our three cases include light rail, bus rapid transit, and intercity rail electrification. Each agency used a different procurement strategy, and the agencies responsible for delivering each project vary by authority, responsibilities, and expertise.

As we examined the California light rail cost and schedule data, we gravitated toward Mid-Coast because it adhered, more or less, to the project schedule and budget. Furthermore, SANDAG is primarily a capital delivery agency with extensive capital project delivery experience. SANDAG also differs significantly in responsibilities and governance structure from other agencies in California. SANDAG is the region’s Municipal Planning Organization (MPO) and has consolidated powers that are not inhibited by local regulations; thus, SANDAG can override a local municipality building code. Unlike

Caltrain and Alameda-Contra Costa Transit (AC Transit), SANDAG does not operate the Mid-Coast trolley, even though it did deliver it.

In deciding which BRT project to study, we selected AC Transit's Tempo because it has true BRT features, namely all-door boarding and dedicated infrastructure, from new traffic signals to center-running bus lanes. Other "BRT" projects in California, such as Fresno's FAX Q, are better described as BRT-lite because they haven't fully committed to the BRT concept. Building Tempo was a new frontier for AC Transit. As a bus-only agency with limited capital construction experience, AC Transit had to revamp itself and build out the project delivery expertise to deliver Tempo.

Caltrain, like AC Transit, is an experienced operator. Caltrain inherited the historic Southern Pacific service, which already had a well-established right-of-way, signals, and stations. Caltrain did improve those elements over time, such as rehabbing stations and building bypass tracks, but those tasks paled in comparison to the scale of electrification. Passenger rail electrification, however, is critical to driving ridership gains post-pandemic. Caltrain electrification has driven enormous ridership gains post-covid and offers a model for other domestic commuter railroads struggling to attract passengers [7].

With billions of dollars available for capital projects and worthy projects up and down the state, it makes sense that agencies would stretch themselves to pursue these projects. Based on this research, it is clear that these smaller agencies, in particular, with limited capital experience, need assistance delivering them on time and on budget.

2.1. Mid-Coast Trolley Extension

As shown in Figure 1, the Mid-Coast Trolley Extension extended the existing Blue line from Downtown San Diego to University City. The project scope included 10.92 miles

of new guideway, 9 new stations, 36 light rail vehicles, 13 traction power substations, and 1,170 parking spaces.[1] The 10.92-mile alignment breaks down further into 6.84 miles of at-grade track, 4.05 miles of elevated viaduct, and .03 miles of underground underpass. Available project materials also identify several major output categories, including approximately $200 million for the precast viaduct and approximately $80 million for aerial stations.

[1] It is worth noting that when the FTA accepted Mid-Coast into the Preliminary Engineering phase of the New Starts grant process in 2011, the project scope included 8 stations rather than 9. It was in this early stage that the overall parking estimate was revised from 340 parking spaces to 1,170, or 830 more parking spaces. The additional cost was estimated at $55 to 82 million (October 2011 Monthly Progress Report, pp.4-5). When the Final Supplemental EIS was published in 2014, the project's estimated costs were $1.8 billion. As noted above, the final cost grew to $2.17 billion. All of these estimates were adjusted in 2016. It is common for schedule and costs to change as projects develop and contingency and soft costs get layered into the cost projections.

Figure 1: Map of the Mid-Coast Corridor Transit Project. The extension follows a north–south corridor connecting major activity centers including Old Town, Tecolote Road, Balboa Avenue, Clairemont Drive, and the UC San Diego campus. Newly constructed stations are indicated along the extension, while existing trolley lines are shown for context.

Figure 2 shows the main project milestones and timeline. Mid-Coast was originally conceived in 1987, but as the project worked its way through planning and environmental review, it was broken up into two phases. While the first phase was built, the second phase was put on hold as other projects tapped into local funding, the TransNet half-cent sales tax for transportation projects. In April 2005, San Diegans voted to extend the TransNet tax, which made it possible to complete the initial Mid-Cost project. In 2011, the

Mid-Coast Corridor Transit Project was included in SANDAG's fiscally constrained Long-Range Transportation Plan (LRTP), confirming its financial feasibility within regional funding limits.

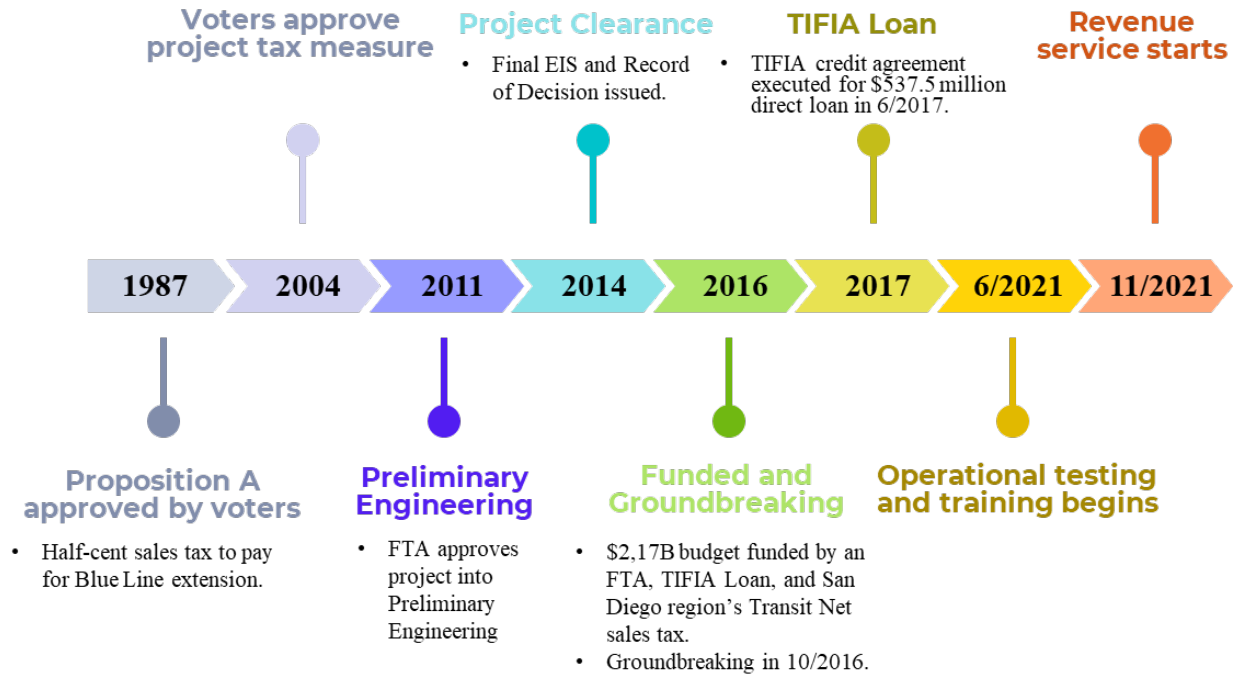

Figure 2: Timeline of key milestones for the Mid-Coast Corridor Transit Project from 1987 to 2021. Major phases include voter approval, preliminary engineering, environmental clearance, funding and construction, financing, and the start of revenue service. The project progressed from early voter-approved funding in 1987 to operational service beginning in November 2021.

In September 2016, the project received a Full Funding Grant Agreement (FFGA) from the FTA and SANDAG awarded a Construction Manager/General Contractor (CM/GC) contract to the Mid-Coast Transit Constructors. The FFGA committed $1.043 billion in federal funding toward the project's total estimated cost of $2.1 billion. Pre-construction activities began in 2016, and groundbreaking occurred in October 2016, marking the start of full construction. In June 2021, the San Diego Metropolitan Transit

System (MTS) assumed responsibility for the system from SANDAG, and operational testing and staff training commenced.

The overall funding package totaled $2.17 billion and comprised a $1.043 billion FFGA from the FTA, a $537.50 million Transportation Infrastructure Finance and Innovation Act (TIFIA) loan, and $590.32 million in local funding via the TransNet regional sales tax that funds all SANDAG projects [8].[2] When we standardize costs and net out rolling stock and financing charges, so that we can more easily compare Mid-Coast to other light rail projects, the headline construction cost is $1.75 billion or $160 million per mile in 2019 dollars. When we adjust for inflation, the project costs are $2.26 billion in 2026 dollars or $207 million per mile.[3]

SANDAG delivered Mid-Coast using an alternative procurement model rather than a conventional design-bid-build where the agency first hires a designer to design the entire project, and then solicits bids for fully-designed construction packages. SANDAG took advantage of SB 762, a law that allowed agencies to procure projects using a best-value CMGC procurement process rather than awarding solely to the lowest responsible bidder. This allowed SANDAG to consider contractor qualifications, experience, and ability to collaborate on constructability, schedule, risk, and cost issues. Based on interviews and project documentation, this procurement approach supported Mid-Coast's success, alongside SANDAG's delivery experience and timely decision-making. Mid-Coast was delivered by Mid-Coast Transit Constructors, a joint venture between Stacy

[2] While financing is not the focus of this report, SANDAG refinanced its TIFIA loan in 2021 in order to take advantage of historically low interest rates. It is projected that this accounting change will save SANDAG more than $123 million over the life of the 25-year loan [8].

[3] All capital costs tend to be reported in Year of Expenditure dollars. We anchor all costs at the mid-point of construction, in this case 2019, and then convert to 2026 dollars.

and Witbeck, Herzog, and Skanska. The initial $921.8 million Construction Manager/General Contractor (CMGC) contract was awarded to MCTC in 2016. Based on our interviews and project documentation, it is clear that those closest to the project believe the procurement strategy is central to the project's success.

2.2. Tempo Bus Rapid Transit

The Tempo BRT project introduced a new bus service running every 10 minutes in the peak periods along International Boulevard from downtown Oakland to San Leandro. The final project scope [10], which was modified over time, included 9.5 miles of curb-to-curb pavement, 8 miles of new bicycle lanes, 34 BRT stations, 46 total raised platforms, including San Leandro Terminal, 35 new signals, 515 curb ramps, 13 miles of fiber optic cables used to power the system, 450 new crosswalks, 254 street trees, and 27 articulated buses with dual doors, as shown in Figure 3.[4]

[4] Some key changes: Service frequency has scaled back from 5 and 7 minutes in the peak period to 10 minutes. The initial alignment was to run from Berkeley to San Leandro, a total of 17 miles. Additionally, the construction timeline shifted multiple times. When the Final EIS/EIR [11] was certified in 2012, it was anticipated that construction would begin in 2014 and conclude in 2016.

Figure 3: Map of the Tempo BRT project. The route runs primarily along International Boulevard and connects major stations including Uptown, Fruitvale, Coliseum, and San Leandro BART. Stations are classified as curbside or median stations. The system includes dedicated bus lanes and frequent service during peak hours.

The Tempo BRT timeline and milestones are shown in Figure 4. In 2014, AC Transit received a Small Starts Grant Agreement (SSGA) from the FTA. The overall funding package totaled $174,167,885 and combined a diverse source of funds: a $49,999,999 SSGA from the FTA, $57,414,137 from Regional Measure 2 bridge tolls, $25,000,000 from the FTA for bus and bus facilities, $13,854,796 from Alameda County

sales tax revenues, $9,544,741 from State Transportation Improvement Program funds, $8,046,437 from State Assembly 664 Bridge Toll funds, $6,000,000 from the Congestion Management and Air Quality Improvement Program funds, $4,026,393 from State Public Transportation Modernization, Improvement, and Service Enhancement Account Program bond funds, and $281,382 from AC Transit's local option tax revenues [12]. It's worth noting that AC Transit's funding stack is much more varied than SANDAG's and empowered more stakeholders.

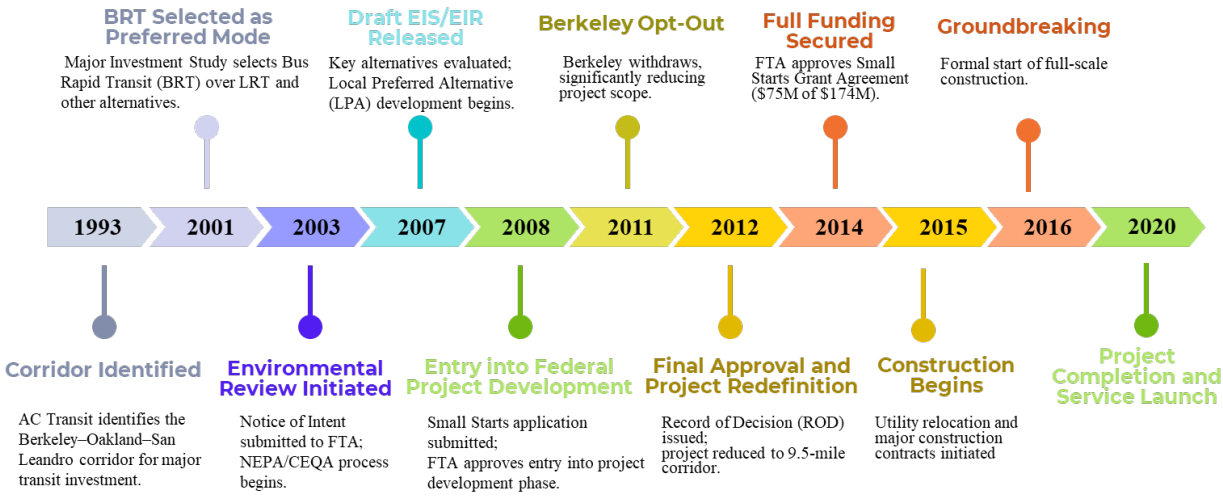

Figure 4: Timeline of key milestones for the AC Transit Tempo Bus Rapid Transit (BRT) project from 1993 to 2020. The project progressed from initial corridor identification and mode selection through environmental review, federal approval, funding acquisition, construction, and eventual completion and service launch.

AC Transit used a conventional design-bid-build procurement strategy to deliver Tempo. As noted earlier, AC Transit is a bus-only agency with limited capital project delivery experience. As such, it procured the services of multiple consultants and contractors to design, manage, and build Tempo. During the procurement process, it became clear that the final project cost and schedule would eclipse the allotted $174,167,885 and that the 2017 projected revenue service date outlined in the SSGA

would slip, and this is even before accounting for delays and change orders. The main project contracts were a $15,919,000 contract to Gannett Fleming for project manager and construction manager services, a $7,203,206 contract to Parsons Transportation Group for design services, a $6,791,823 contract to CH2M for construction management services, a $7,700,894 contract to McGuire and Hester for advanced utility relocation, a $3,400,062 contract to Redgwick Construction for the construction of parking lots and Fruitvale Bypass, a $5,272,336 contract to WSP for construction management services, and a $108,112,000 contract to O.C. Jones as the prime construction contractor. AC Transit also ordered 27 New Flyer buses for $33,172,819. The project opened in 2020 and ended up costing $232 million; thus, it was 3 years behind schedule and nearly $60 million over budget, a 34% increase.

2.3. Peninsula Corridor Electrification Project

As shown in Figure 5, Caltrain's PCEP revamped commuter rail service on the Peninsula Corridor between San Francisco and San Jose. Like Mid-Coast, the initial idea for PCEP, and the larger Caltrain Modernization (CalMod), stretches back to at least the 1990s [13]. The first CalMod contract was tendered in 2011 to design the Communication Based Overlay Signal System (CBOSS) Positive Train Control (PTC) via a design-build procurement, and it took another 5 to 6 years to begin PCEP construction in earnest. Challenges designing the PTC system created funding, legal, managerial, and technical uncertainty that increased costs and delayed PCEP delivery. Caltrain's PCEP timeline and milestones are shown in Figure 6.

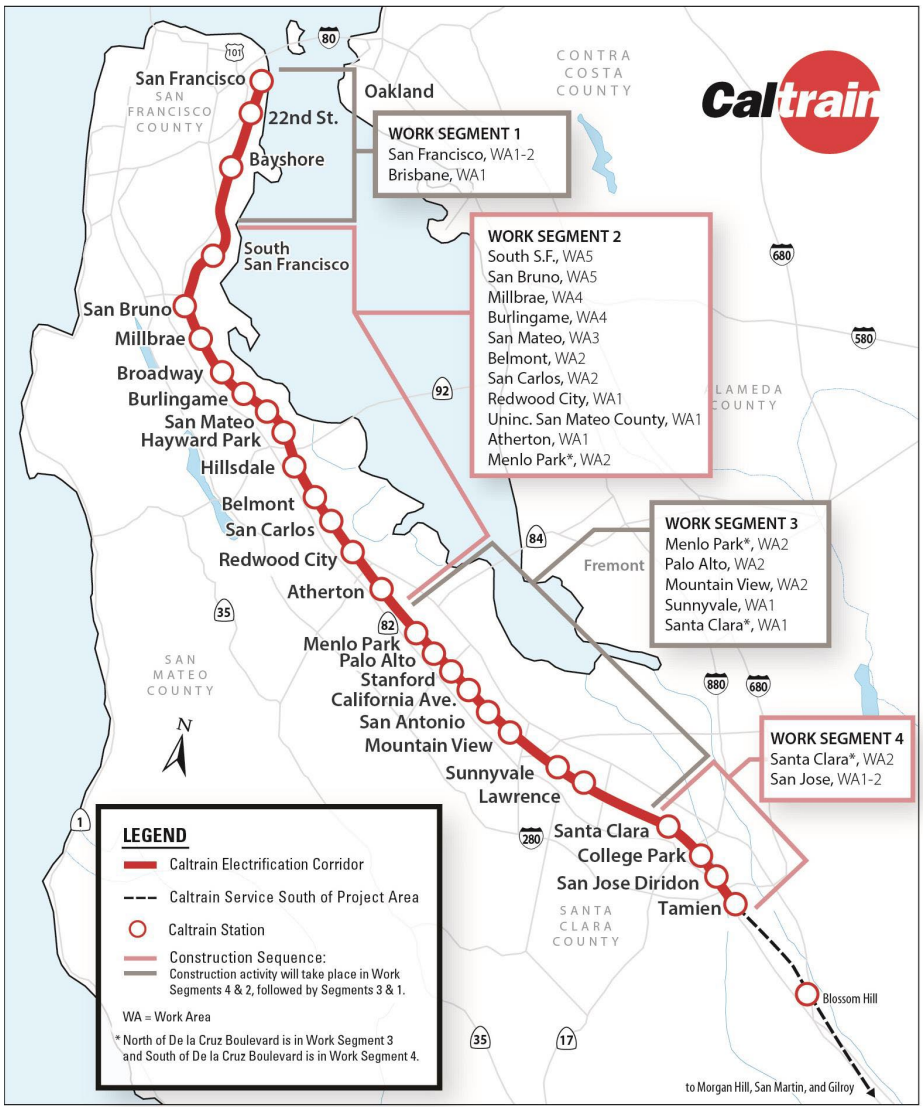

Figure 5: Map of the Caltrain Modernization. The corridor is divided into four work segments, each covering a portion of the alignment. The project includes electrification infrastructure along the existing rail line, with construction sequencing organized by segment.

Electrifying Caltrain enabled it to increase service from 46 to 57 trains per day/per direction, a 24% service increase. Thanks to the electric trains' faster acceleration, relative to the existing diesel rolling stock, trip times fell from 115 to 83 minutes, a 28% reduction. The final project scope, which changed over time, included the electrification of 51-miles of double track commuter rail between San Francisco and San Jose, 2 traction

power substations, 1 switching substation, 7 paralleling substations, tunnel modifications, 3,154 foundations, 2,587 Overhead Contact System (OCS) poles, changes to the Central Equipment and Maintenance Facility, and the design and purchase of 96 bi-level Electric Multiple Units (EMUs) to run the new electric service [14].

In 2016 and 2017, Caltrain signed an FFGA with the FTA and broke ground on construction. The overall funding package for PCEP totaled $1,930,670,000.[5] As early as 2019, there were reports that the project schedule was slipping due to several interrelated challenges, including PTC and signal-system uncertainty, utility conflicts that affected foundation and Overhead Contact System (OCS) construction, track access constraints within an active rail corridor, and related change orders. In 2021, Caltrain announced that the project would be completed in 2024, and the FTA accepted Caltrain's new schedule and $2.44 billion budget in 2023.

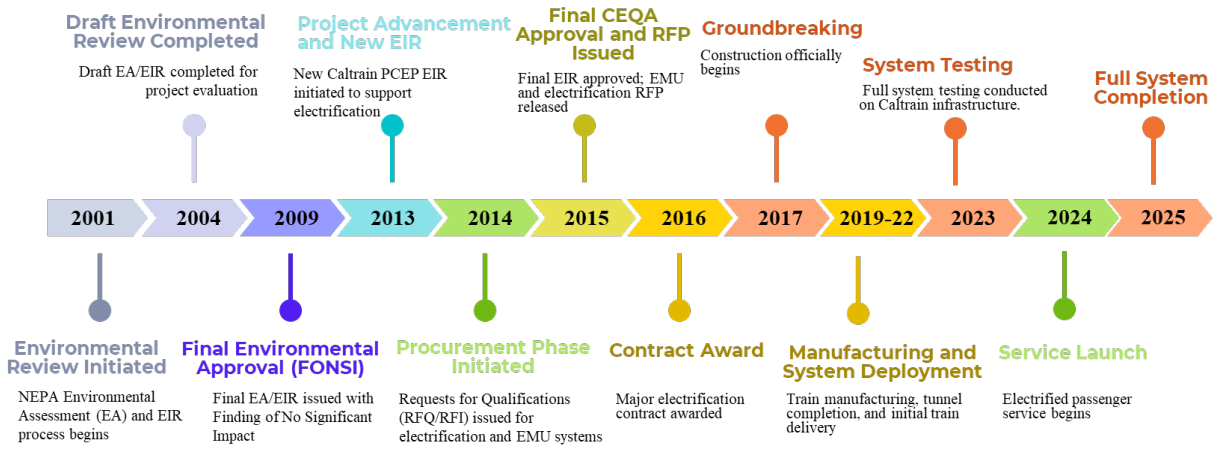

Figure 6: Timeline of key milestones for the Caltrain Peninsula Corridor Electrification Project (PCEP) from 2001 to 2025. The project progresses through environmental review, planning and design updates, procurement, construction, system testing, and eventual service launch and completion.

[5] The projected project cost in 2016, pre-FFGA, was $1.7 billion [15].

The funding package for PCEP included federal, state, and local money. The federal contribution included a $647 million core capacity grant and $287.15 million Urbanized Area Formula Funds. The State of California contributed a total of $748.61 million, including $600 million from Proposition 1A California High-Speed Rail Bonds, $6.61 million from Proposition 1B, $9 million from Low Carbon Transportation Operations Cap-and-Trade funds, $20 million from TIRCP, and $113 million from High-Speed Rail Cap-and-Trade funds.. Funding also came in at the local level: the Joint Powers Board member Agency Funds added $128.51 million, the Carl Moyer Program Funds provided $20 million, the Metropolitan Transportation Commission's Bridge Toll funds committed $39.4 million, and another $60 million flowed from the Joint Powers Board Agency Funds.

Caltrain, like AC Transit, had limited experience with a capital project as large as CalMod. To electrify the corridor, it, too, secured the services of multiple consultants and contractors to design, manage, and deliver the project. It pursued a design-build (DB) procurement strategy. As the agency prepared to tender the DB contract, it hired consultants to manage the overall program and its sub-components, the design and construction of the rolling stock and the electrification infrastructure. Balfour Beatty Infrastructure, Inc. (BBII) received a $696,610,558 DB contract in 2016 to design and construct the 25kv AC OCS, OCS poles, and the electrical infrastructure to power the system. Balfour Beatty, PGH Wong Engineering, and STV comprised the BBII team. In 2017, ARINC was brought on to supply the SCADA equipment. In 2021, Caltrain approved three change orders totaling $346,675,328 [16] to compensate BBII for design changes, delays, and additional costs. Stadler was awarded a $550,899,459 rolling stock contract to build the 96 EMUs. ProVen Management was the sole bidder on the tunnel

modification contract and the OCS installation within the four modified rail tunnels. ProVen bid $61,477,391 for the work, which was 55% over the engineer's estimate of $39,652,411. ProVen was also awarded $6,550,777 to redesign the Central Equipment and Maintenance Facility to accommodate the new rolling stock. New Caltrain service debuted in 2024. It was two years behind schedule, and the final $2.44 billion budget was $510 million greater than the estimated cost, a 26% increase.

3. Discussion

These three projects provide a lens into capital project delivery in California. Below we examine how agency capacity and coordination affect costs and schedule across all three projects. First, we see that not all agencies are created equally. SANDAG, which has a wide statutory remit, from broad regional planning to project specific planning to design and project delivery, builds roads, bicycle lanes, and transit projects. Unlike AC Transit and Caltrain, it does not operate trains or buses but has and does deliver capital projects on an ongoing basis, such as the Mission Valley East light rail, LOSSAN corridor improvements, and the SR 125 toll road project. Without that experience to fall back on, agencies like Caltrain and AC Transit depend on consultants to carry out these projects.[6] This approach allows agencies to maintain a small staff, a boon for long-term liabilities. This approach makes it difficult for agency staff that don't have deep expertise and experience to manage and provide technical direction to consultants.

Second, transit projects exist in a fragmented landscape. For new builds, like Tempo and Mid-Coast, rights-of-way need to be acquired or permits need to be granted by other agencies, like Caltrans or municipalities, like Oakland and San Leandro. Even if a project exists entirely within an agency's right-of-way, like Caltrain, internal dynamics, from operational demands to agency culture, need to be oriented toward the project, if schedule and budget are priorities. Agencies routinely underestimate the time and costs associated with third parties that have little incentive to accede to transit agency demands

[6] This is not to say that agencies like SANDAG go without consultants. They also rely on consultants, but they have more experience working with them. The CMGC team building Mid-Coast, for instance, was also working on separate SANDAG projects, such as LOSSAN corridor improvements, as it built Mid-Coast.

and may not be familiar with how to manage internal dynamics when the capital project's schedule and budget hang in the balance.

3.1. Agency Capacity

Enhancing state capacity, the ability of agencies to perform work themselves rather than contracting out to consultants, has become a central theme of the nascent "abundance movement" [17]. Authors, practitioners, and academics like Jennifer Pahlka [18], Donald Moynihan [19], John Dilulio [20], Zachary Liscow, Marianna Mazzucato [21], and others have documented how government agencies that depend on consultants to carry out tasks like planning, project management, and construction management have higher project costs than those managed by experienced agency staff. Agencies with limited staff and experience struggle to define their scopes clearly, make decisions quickly, and guide consultants effectively. The only solution to this problem is to strengthen in-house staff so that it has the technical expertise and project experience to define project scopes, make decisions, and manage consultants when questions emerge. Caltrain and AC Transit, specifically, faced challenges with each of these tasks, which drove schedule delays and costs, because they were both understaffed and had little relevant in-house domain expertise. SANDAG, while not over-staffed by any measure, had the internal capacity to evaluate engineering solutions proposed by its consultants and contractors.

3.2. The Need for Prompt Decision-Making

Caltrain's electrification project was transformative. As noted above, it decreased travel times and increased ridership, a huge victory for passengers and Caltrain. Despite these immense achievements, the project execution experienced numerous challenges. Based on our interviews and review of the PMOC reports, monthly progress reports, and

board actions, it is clear that Caltrain was overwhelmed by the project. We were told by Caltrain staff that the Caltrain team that managed PCEP was “small and very lean” (Personal Interview 2026a). Thus, Caltrain was supported by at least eight consultant firms who provided services that included construction management, rolling stock procurement, systems safety, and project management.

This consultant-heavy approach is common in the United States. When agencies need to expand their capacity to deliver a new project, they rely on consultants rather than staff up and take on the long-term liabilities that come with new employees. In the January 2025 PMOC report, once Caltrain was in revenue service, the authors included a high-level lessons learned chapter that focused on four primary areas: General Planning of the PCEP, Management Capacity and Capability, DB Contract Lessons, and Problems Managing the Work. The through line across each of these areas is that Caltrain had limited staff capacity, which made it impossible to manage its consultants and ensure the project was delivered on time and on budget. The PMOC writes that “The lack of prompt decision making by [Caltrain] was identified as a significant risk prior to the commencement of construction. This problem was apparent throughout the life of the project” [22]. This finding echoes what we found in our interviews.

Caltrain, in its own lessons learned document, also identified these same issues. When we discussed the issue of experience and staff capacity with a senior manager who worked on the project, she[7] explained that these issues often manifested themselves as paralysis, making decisions slowly or hoping things would resolve on their own. She described the lesson learned to us as “It’s important not to have a head-in-the-sand

[7] All of our interviews were not for attribution. As such, we refer to all interview subjects using female pronouns so as to maintain anonymity.

approach because problems never go away unless you deal with them early" (Personal Interview 2026a). This was not a general proclamation about capital project delivery. It was a direct reference to the signaling problems that vexed the project and was extended to BBII's slow progress building foundations and installing OCS poles.

Her insight is supported by the documentary evidence. The December 2017 PCEP Monthly Progress Report [23] report references the "conflict" between relocating cables in the area of planned OCS foundations and the construction of those foundations. Without first removing the cables or other obstructions, BBII couldn't build the foundations, which meant it couldn't erect the OCS poles, which made it impossible to hang the electrical wires to power the new rolling stock and run the proposed service. Three months later, these same kinds of conflicts continued to hinder foundation construction [24].

Rather than promptly solving this ongoing problem, which jeopardized the project's critical path, the problem deteriorated over time. The July 2020 PCEP Monthly Progress Report [25], includes a helpful chart, reproduced below, that shows the uneven progress building foundations month by month. 2018, in particular, saw months with 0 foundations constructed, July and August, and others with as many as 83, October. What is most helpful about this chart, however, is that it shows how the historic production rate relates to the broader project schedule. The initial schedule had BBII finishing in April 2020, but as foundation construction lagged, that date had to be pushed back to February 2022, and BBII achieved substantial completion on May 3, 2024.

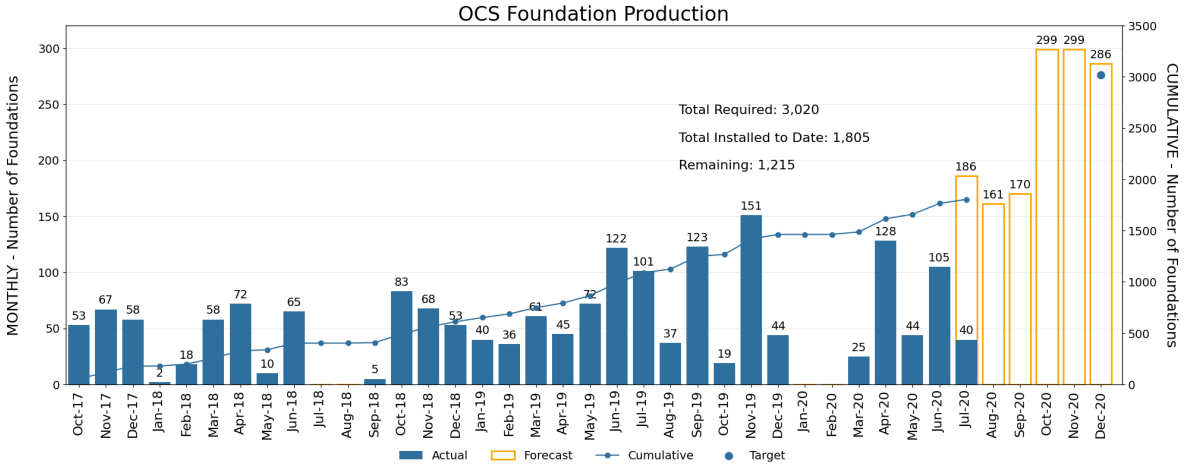

Figure 7: Chart reproduced from July 2020 - PCEP Figure 2-5 OCS Foundation Production. The chart compares actual installation rates with forecasted values and shows cumulative progress toward the total required foundations. By mid-2020, 1,805 foundations had been installed out of a required total of 3,020, with the remaining work projected through the end of 2020.

Ultimately, BBII and Caltrain entered into dispute resolution to solve this and other ongoing problems. BBII believed it was entitled to compensation for the differing ground conditions, all of those unexpected cables that needed to be relocated, and track access delays (more on this later), which contributed to its laggard construction pace. The three change orders, totaling $346,675,328, that were approved in December 2021 compensated BBII for all of its time delays and extended its contract by three more years. While the change order encompassed more than foundation delays, the foundation delays are emblematic of the types of problems that went unresolved because Caltrain and its consultants, the ones who were supposed to represent them, didn't address them proactively. Instead, the project fell behind schedule and this specific contract grew by 50%.

3.3. Consultant Dependency

Caltrain's experience is not unique. Delivering capital projects differs from running trains and buses in obvious ways: designing a train station and signaling system or securing and managing permits with multiple agencies requires different tasks and expertise than route planning and dealing with operator shortages. Agencies that primarily operate buses and trains, like AC Transit and Caltrain, struggle to expand their agency's capacity to also deliver large-scale capital projects.

When AC Transit began to consider building a BRT, its board acknowledged that it too had these same deficits. At the July 29, 2009 board meeting, the board approved hiring a Project Management/Project Controls (PM/PC) consultant. In the board memo recommending the action, it details the proposed consultant's responsibilities:

The PM/PC firm would have general oversight, including budget, scope and schedule for the following tasks:

- Environmental FEIS: Record of Decision (ROD), Amendments to ROD, California Environmental Quality Act (CEQA) mitigation program;
- Project Design: Including preliminary engineering and final design (plans, specifications and estimates);
- Construction bid document preparation;
- Technical Capacity: Evaluation of District resources, procedures. Closely advise executive staff. Formal evaluations of technical capacity by FTA for Small Starts through real world needs of the agency for implementation;
- Management of Construction Manager: Provides an additional level of security and oversight;
- Implementation: Integration of technology and best practices, training, testing, operations; carried through implementation until one year following opening.

We have included this list of responsibilities to underscore just how much assistance AC Transit expected it needed to complete this project. Handing over general oversight of budget, scope, and schedule for each core task meant that AC Transit was *dependent* on its consultants to complete Tempo rather than using its consultants to

augment the agency's expertise and experience to improve project delivery. This is not a surprise, based on our interviews, we were told that the AC Transit planning department only has one engineer on staff (Personal Interview 2026b; Personal Interview 2026c).

The difference between being dependent on consultants and relying on them to build up capacity is an important distinction. Experienced agency staff evaluate consultant quality and scrutinize recommendations to ensure technical requirements are met. They verify that consultants can clearly justify how their proposed solutions align with both the project goals and the agency's needs. When the consultants become the agency capacity and the agency has little relevant domain experience, trouble ensues. Mazzucatto and Collington [21] argue that consultant dependency emerges when public agencies begin to contract out key tasks, like engineering and project management, and stop performing those key functions, "This loss of knowledge means that public sector managers are often left no choice but to go to an external contractor for support." Liscow et al. [26] empirically demonstrate that State DOTs with greater capacity, measured by both headcounts and engineer quality, have lower costs on road projects than those with less agency capacity:

[S]tates with fewer or less experienced employees outsource work to consultants and do not invest in high-quality project plans. A lack of specificity in project plans increases uncertainty for contractors, which will be priced into their bids, directly leading to higher costs. This also necessitates ex-post changes to the materials and work needed to complete the project (change orders), which lead to higher costs through delays and costly renegotiation.

When agency staff cannot define project scopes, it likely means they cannot adequately manage the technical consultants who design drainage and curbs or need

guidance when differing site conditions make it impossible to install a traffic signal. AC Transit faced all of these challenges, and when it looked to its consultants for most answers, it didn't receive the advice and expertise to keep the project on schedule and on budget. One consultant we interviewed who worked on the project told us that "[t]he program management consultant was not managing on behalf of AC Transit… Ultimately, the consultant didn't provide the value AC Transit needed" (Personal Interview 2026b). When we spoke with AC Transit staff about these challenges, they were more circumspect, but they pointed to areas where the consultant could have done more during the design phase to ensure construction went smoothly. Specifically, the consultant could have collected accurate on the ground information about existing conditions, such as the street elevation along the corridor, rather than relying on previous studies and aerial imagery. Getting the street elevation correct is critical to ensuring level boarding for passengers, a BRT hallmark. Since the roadway was not uniformly flat or crowned, this created avoidable construction challenges and delays when it came time to construct the platforms so that they were at the right height to enable level boarding (Personal Interview 2026c; Personal Interview 2026d). By not getting this right in the design phase, change orders that added costs and delay were issued in the construction phase.

AC Transit hired Gannett Flemming to provide program and construction management services in 2012.[8] The $15,919,000 contract came up for a routine no cost extension in 2016. In the January 27, 2016 staff report, AC Transit staff explained to the board that it was dependent on the consultant to advance the project, even though the project schedule had already slipped more than a year and a half, from April 2016 to

[8] WSP would eventually take over these responsibilities, which created understandable friction and delays.

November 2017, and was on the verge of slipping an additional two years because of delays bidding out construction package 3 thanks to local permitting challenges. In the short alternatives analysis offered at the end of the report, where the staff considers alternatives, it explains why AC Transit was unable to carry out the work itself: “The magnitude of the on-going work and the broad array of technical specialties required would overwhelm the capacity of [AC Transit] staff before additional staff could be hired.” Thus, even though the project was already behind schedule an about to fall even farther behind, AC Transit lacked a viable pathway forward without its consultant. Since hiring Gannett Flemming in 2012, it had not gained the expertise it needed to self-perform the work. AC Transit extended Gannett Flemming’s contract not because it had met expectations and the project was on budget and on schedule, but because it was dependent on its consultant.

3.4. Experience Matters

While Caltrain and AC Transit are both operations-first agencies, SANDAG is a delivery-first agency. More important, SANDAG staff, limited as it was and heavily reliant on consultants just like AC Transit and Caltrain, had more relevant project delivery expertise to manage the project team than either Caltrain or AC Transit. Agency staff leading Mid-Coast had decades of experience delivering transit projects, bicycle lanes, and roads (Personal Interview 2025a; Personal Interview 2025b). Mid-Coast, like any project, had its surprises and unforeseen challenges, but project leadership made decisions quickly and worked with its consultants and contractors to solve technical, commercial, and political difficulties as they emerged rather than letting them fester.

It is intuitive that experience matters, but for both AC Transit and Caltrain, they didn't have or hire seasoned experts to manage their projects. Instead, they relied on consultants, of mixed quality, managed by "lean" in-house teams who had never delivered a BRT or electrification project. SANDAG, conversely, brought its deep San Diego-specific experience to the project. SANDAG's Chief of Capital Programs worked on the Mission Valley East light rail project and the Director of Engineering and Construction also had decades of relevant project delivery experience. This filtered down to SANDAG's lower levels, such as the Systems Manager. Even the in-house project lawyer was a trained engineer (Personal Interview 2025c; Personal Interview 2026e).

The megaprojects literature also recognizes the value of experience and the reality that most project organizations don't value it enough. Flyvbjerg [27] explains that project managers tend to see their projects as unique; thus, limiting their ability to recognize helpful patterns from other projects or seeking the guidance of more experienced professionals who may have helpful advice. Uniqueness bias, or maybe better understood as "this is how we do things here," takes root when managers focus on the "inside view," the details of their particular project and institutional arrangements, rather than asking, "Does this make sense?" and assimilating valuable insights from beyond the project.

More experienced managers draw on the lessons learned from previous projects, at a minimum, and combine the technical knowledge they learned in school with their experiential knowledge from the field. Flyvbjerg and Gardner [28] argue that:

> Highly experienced project leaders…overflow with tacit knowledge about the big projects they oversee. It improves their judgement profoundly. Often they will feel that something is wrong or that there is a better way without quite being able to say why… This is "skilled intuition," not garden-variety gut feelings, which are unreliable. It is a powerful tool only

> available to genuine experts–that is, people with long experience working in their domain of expertise.

In SANDAG's case, they understood the value of moving quickly even when design uncertainty remained, paying contractors and consultants promptly, discussing big decisions with their contractor, elevating issues to board members when they needed help, and getting the right stakeholders at the table in order to avoid delays.

Mid-Coast, like any other project, encountered difficulties. Procuring elevators proved more difficult and more expensive than expected. In the baseline budget, elevators were estimated to cost $16,807,615, but by project close that number had grown to $31,888,905, a 90% increase. The CMGC team convinced SANDAG to allow them to construct the UTC viaduct using precasting instead of cast-in-place construction as a cost-saving measure, and it wasn't (Personal Interview 2025d; Personal Interview 2026e).[9] Decisions about retaining walls changed after SANDAG received its FFGA (Personal Interview 2025b). A property owner across from the Clairemont Drive station proved difficult because it wanted to develop its property rather than have it condemned via eminent domain and used as an MTS parking lot [29][30][31].

Despite these challenges, challenges that most projects face, Mid-Coast was delivered on time and within its budget. When we spoke to the contractors, who have and continue to work on other transit projects in California about Mid-Coast, they credited the on-time and on-budget performance to "the entire team's willingness to solve problems quickly. [The SANDAG staff was] able to work through time and cost proposals and make decisions" (Personal Interview 2025e). As prosaic as it sounds, it is clear that making

[9] Precasting provided additional valuable benefits, namely minimizing disruption and being much faster to build. In our interviews, contractors and agency staff believed that precasting shaved a year off of the construction schedule even though it wasn't cheaper.

informed decisions quickly rather than waiting for additional input or sign off from another layer of bureaucracy, or 100% design is critical to keeping consultants and contractors on schedule and on budget.

Inter-Agency, Intra-Agency, and Third-Party Coordination Challenges

While the shiny new infrastructure gets all of the attention, capital projects are also about turning over earth, relocating existing utilities, acquiring private property, hauling muck, and securing the appropriate permits to perform all the necessary work so the new trains and buses with dual doors and eye-popping paint jobs can move passengers. Goldwyn et al. [31] interviewed a Canadian transit agency manager who described the transit capital delivery projects she has worked on as, “very large utility projects with a bit of rail added on. The lion’s share of my work is moving pipes and ducts out of the way for a very quick and easy installation of some concrete and rail.” Since these projects touch so many stakeholders, the coordination needs are immense. On paper, every project prosecutes coordination similarly. There are scoping meetings to define and refine the project, regular stakeholder meetings to ensure everyone is on the same page, community meetings to provide regular updates and receive feedback, interagency meetings to review designs and plan needed outages, and so on. In practice, and as we see in these three projects, these processes produced different outcomes.

The Outside Game: Inter-Agency Coordination

Coordination challenges are downstream of the agency capacity problems described above. Since capital projects take place over months and years and partnering agencies and third parties have other priorities, agreements made at the outset often change over time as funding disappears, emergencies develop, or priorities change.

Without dedicated staff managing these relationships and legally binding documents that assure each party of their rights, capital delivery projects are subject to unexpected changes inside and outside of their agencies that increase costs and delays.

AC Transit's BRT project experienced these challenges firsthand. In the 2014 SSGA baseline schedule and budget, AC Transit estimated that utility-related costs would be $7,753,134. In 2017, as the project was battling delays and mounting costs, AC Transit published a revised budget and schedule and project completion plan that estimated utility-related costs at $26,445,110, a 241% increase [32]. AC Transit pointed to discrepancies between as-built drawings and the actual, on-the-ground site conditions and an unanticipated two-year long East Bay Municipal Utility District (EBMUD) waterline replacement project in the right-of-way as the main drivers of delay and cost growth.

As-built drawings are notoriously inaccurate. Oakland's date to the 1950s, even though the installation of fiber and other telecom-related infrastructure has been added since then. Relying on them for design was clearly a mistake that relates back to the observation earlier about the Project Management consultant not pushing AC Transit to spend more time and money potholing (i.e., preconstruction verification of underground utility locations) and making sure the design consultant had accurate information. One consultant we spoke to who worked on the project explained how this problem manifested itself succinctly, "Everybody had to do their job twice" (Personal Interview 2026b). Construction followed a stop, wait, and go pattern: traffic light installations, for instance, had to be designed and then redesigned; construction began, paused, and then restarted; and permits were approved, revised, and re-approved. In addition to the obvious frustration this created, each new task and approval introduced an opportunity for

additional delay and cost. We can see these costs grow as the consultant teams needed to be extended and add more hours, soft costs grew from $53,815,712 to $58,713,853. We also see demolition, clearing, and earthwork increase from $4,001,251 to $9,074,779 as more sites and labor need to be expended to install traffic lights and station platforms.

Third-party coordination plagues every project. The California High-Speed Rail Authority has seen its costs soar by more than $115 million just in construction package one because coordination challenges with PG&E and AT&T [33]. The Metropolitan Transportation Authority in New York estimated that utility coordination added $250-300 million to the final cost of Phase 1 of the Second Avenue Subway, an estimate that doesn't account for time delays [34].

In AC Transit's 2017 Project Completion Plan we see this most acutely with permitting delays from local municipalities and Caltrans and an unanticipated EBMUD waterline project. Delays that occur after a contractor has been mobilized often triggers change orders and increases project costs. In this instance O.C. Jones, the contractor for construction package three, which was already delayed, was issued a Limited Notice to Proceed in March 2016 while AC Transit waited for approvals and encroachment permits. All of these permits were finally secured in January 2017, eight months later.

More worrisome was EBMUD's unexpected and extended waterline project. What began as a six-month project that would impact only one of the 16 construction zones, quickly grew into a nine-month project and then a one-year project that eventually created a two-year delay and affected three construction zones. In reflecting on these challenges, a senior AC Transit staff member told us that "Utilities [were] like a wooden stake to a vampire on this project" (Personal Interview 2026d). She explicitly stated that even though

they had weekly utility meetings with EBMUD, the EBMUD representative at those meetings didn't have the authority to address the waterline project; thus, AC Transit had to find other ways to get information about the project. Making sure the right people are in the weekly utility meetings is central to managing inter-agency coordination relationships successfully.

With greater visibility into EBMUD's project schedule and more timely responses from Caltrans and impacted municipalities, perhaps, AC Transit could have better utilized O.C. Jones and avoided delays that inevitably triggered costly change orders, totaling $39 million. By the end of the project O.C. Jones' contract increased from $108,112,200 to $147,112,200, or 36% [35]. While it's impossible for us to disentangle all of the additional costs, a careful review of the change order log shows that at least $10.6 million was spent on changes related specifically to EBMUD, design modifications, additional work time, and unforeseen conditions [36].

The Inside Game: Intra-Agency Coordination

Caltrain's PCEP project got off to a difficult start. After tendering contracts to BBII and Stadler, Caltrain learned that its $647 million Core Capacity grant would be delayed. Caltrain issued Limited Notices to Proceed, which in turn triggered contractor claims, including $9,702,667 to its design-builder, BBII [37][38]. External coordination challenges are clear project hazards, as outlined above, but coordination within agencies also contribute to delays and additional costs. Operations staff often lobby for more generous back-of-house space in stations, overbuilt maintenance yards, or other amenities that are nice to have but not strictly necessary [31].

Caltrain, from the outset of PCEP, committed to maintaining regular commuter service during construction. This was a worthy and laudable goal for an operations-first agency like Caltrain. BBII's contract spelled out specific work windows where it could work in the existing right-of-way. As construction began, however, it was clear that operations and capital construction were competing for the right-of-way and that the contract specifications were inadequate. BBII filed track access claims in the fourth quarter of 2016, first quarter of 2017, second quarter of 2017, third quarter of 2017, fourth quarter of 2017, and so on [39]. The November 2020 monthly progress report change order log includes nine change orders, one every quarter, totaling $2,386,259. These track access delays connect back to the earlier discussion about differing site conditions which delayed foundation construction and OCS pole erection. Track access delays drove construction delays, because during the limited time contractors had to work, they were busy doing remedial work rather than advancing the construction schedule.

Caltrain eventually carved out more time for BBII to do its work, but it came at great cost. First, in December 2021, Caltrain agreed to three change orders equaling $346,675,328. One of the three change orders, the $136,337,784 Global Project Cost Resolution Contract Change Order settled all change order disputes prior to October 31, 2021; thus, it is fair to assume that some portion covered additional track access claims that Caltrain had withheld [40]. Second, in order to expedite construction, Caltrain agreed to provide uninterrupted access to the right of way. Working closely with rail operations, Caltrain agreed to suspend rail service in priority locations over 31 weekends and provide parallel bus service to keep passengers moving up and down the peninsula [41]. Despite the necessity to suspend service, it took until February 2023, for Caltrain to agree to

prioritize capital project delivery ahead of operations [42]. When we asked Caltrain about why it was so slow to make this decision, we were told that “We didn’t fully understand the tradeoffs of having larger work windows. It became a breaking point, so we had to do bus bridges” (Personal Interview 2026f). When we asked why these tradeoffs weren’t examined earlier on, we were told that Caltrain’s consultants, those representing Caltrain’s interest, “weren’t empowered to represent Caltrain” (Personal Interview 2026f). Thus, because it had been made clear that Caltrain didn’t want to disrupt operations, no one wanted to deliver the bad news to Caltrain that it had to disrupt operations to carry out PCEP.

Managing internal coordination challenges means making difficult decisions, such as suspending service to allow construction to proceed faster. It is reasonable that Caltrain wanted to minimize service disruptions, but as it agreed to pay out track access change orders over nine consecutive quarters, it should have prioritized solving that problem much more quickly. The first track access change order was submitted in 2016 and the bus bridge debuted in 2023. What is both promising and worrying about solving the track access issue, is that the solution was obvious. The challenge was overcoming agency norms and objectives.

Having the right people at the table

Large linear projects invariably affect multiple stakeholders with different agendas and rights. It is critical to coordinate with the utility companies, freight railroads, universities, and government agencies whose projects are impacted by the project. While Caltrain, AC Transit, and SANDAG followed the same playbook, regular meetings, SANDAG achieved more workable results. As noted earlier, AC Transit and EBMUD

couldn't get on the same page despite meeting every week. SANDAG had, via its consultants, a dedicated third-party lead who had worked for the city for 21 years, the University of California San Diego (UCSD), and Caltrans. Similarly, SANDAG's project principals had extensive experience dealing with San Diego's mix of stakeholders from earlier projects. This experience allowed them to get the right people from each agency to attend their weekly meetings. Furthermore, when challenges emerged, they knew who to call and the relationships to find common ground and get a deal done. It is also worth noting that this specific project had a relatively simple funding stack: FTA money, local money via TransNet tax, and a TIFIA loan. AC Transit and Caltrain had much more convoluted funding stacks that invited in additional stakeholders and oversight to those projects. SANDAG also benefits from consolidated powers over capital construction, planning, and permitting that afford it greater stature and latitude when negotiating these agreements [43].

UCSD, like many universities that have managed light- and heavy-rail projects, had multiple concerns about Mid-Coast. SANDAG met regularly with UCSD, but rather than meeting with a low-level staffer in the government affairs office, the University's Vice Chancellor attended its meetings (Personal Interview 2026e). It also didn't shy away from conflict. When UCSD requested payment for access to campus land for construction, SANDAG refused (Personal Interview 2025a; Personal Interview 2025c). SANDAG did agree to improvements, a slippery slope no doubt, but regional infrastructure improvements, namely a bridge connecting the campus across I-5 provides real regional benefits versus funneling money to the University. This decision to stand firm came from the top. SANDAG's executive director insisted that UCSD contribute its land to the project

because the project brought riders to UCSD; thus, UCSD shared in the project benefits, which outweighed the land costs. This was especially valuable to UCSD because a successful Mid-Coast meant it could mitigate congestion, avoid building expensive parking structures, and optimize campus shuttle bus service [44].

SANDAG's experience in the region and its consolidated powers gave it the gravitas and authority to get things done. Just like AC Transit, Caltrain, and every transit project, third parties had their own agendas, but by working with empowered stakeholders, it was able to execute agreements and move the project forward. One senior level contractor told us that SANDAG excelled at coordinating with its major stakeholders, and that by getting buy-in from the different parties, "there was momentum and a positive feedback loop that pushed the project forward" (Personal Interview 2025d). When we contrast this experience with AC Transit, Caltrain, Sound Transit, LA Metro, Dallas Area Rapid Transit, GoTriangle, MTA, California High-Speed Rail Authority, or other capital projects we have studied, we see that SANDAG manufactured its success.

4. Conclusion

Large linear infrastructure projects will always pose technically, politically, and commercially difficult challenges that public agencies need to address. We have shown in this report that agency capacity and coordination with outside stakeholders and within an agency influence cost increases and schedule delays. AC Transit and Caltrain have historically been operations focused agencies that extended themselves to deliver capital projects that tested their agencies' capacity to manage outside experts and coordinate with project stakeholders and different departments in their agencies. SANDAG, conversely, had the capacity and relationships to navigate these routine challenges adroitly. As California considers how it delivers capital transit projects, even with a small sample of three case studies we focused on in this report, we argue that it should follow these four recommendations to speed up project delivery and reduce costs.

First, it is unreasonable to expect operations-only agencies with limited capital experience to deliver non-routine capital projects, like electrification or light-rail construction. Instead of awarding mega-projects to agencies with limited experience, larger agencies with more experience like LA Metro, SANDAG, and BART or even an MPO or an autonomous unit within the state like the California State Transportation Agency (CalSTA) could provide planning and design support in the project development phase, procurement assistance during the procurement phase, construction management oversight during construction, and overall assistance with rolling stock design, procurement, and commissioning.

Caltrans, too, could create a team of planners, engineers, and construction managers to help agencies across the state. Each project needs a local touch when it

comes to coordinating stakeholders, but managing BRT station platform construction in Oakland is similar to managing BRT station platform construction in San Bernardino. By consolidating expertise within Caltrans or drawing on another agency's expertise has two benefits: First, it enables operations-focused agencies to stretch and manage project elements that are beyond their ken. Second, it allows the project delivery experts to work continuously and build even more knowledge and expertise, which will speed up project delivery and keep costs low into the future.[10]

Second, Local permitting drives delays and costs. California should prioritize developing a standardized third-party agreements process that has legally enforceable timelines for reviews and approvals. The goal is to encourage third parties to be more responsive to agencies delivering public projects. Other countries have already adopted such models, from Italy to Canada, and California has passed similar legislation for housing [45][46].

Third, all three projects encountered differing site conditions that slowed down progress and triggered change orders. This is common in linear projects. Everyone we spoke to for this research stressed the importance of potholing and more advanced planning before going into construction. California should create a program to help cities and counties create and maintain utility mapping that transit agencies, utilities, and city agencies can access and update as they plan and build their projects. Singapore has been a pioneer in building and maintaining shared utility ducts and common services

[10] Agencies like Caltrain and AC Transit have developed some of this expertise honestly. If other agencies want to pursue electrification or BRT projects, Caltrain's and AC Transit's lessons learned and expertise should be leveraged to help other agencies execute their projects. Rather than having future agencies reinvent the process.

tunnels that consolidate underground utilities and services and make it much easier to document changes [47].

Fourth, greater transparency and detailed record keeping allows agencies to document and share valuable project-specific information that can help other agencies benchmark their projects against other projects and contextualize their projects rather than fall into the traps of uniqueness bias and the “inside view” described by Flyvbjerg. This recommendation is far-reaching: while collecting data for this project, we ran into challenges accounting for every dollar spent across the three projects. Some agencies worked hard to be as transparent as possible, and others clearly just didn’t have all of the data we wanted readily available. At a high level, it is critical that all spending be accessible so that agency staff and researchers can track how contracts change over the life of a project. At a more granular level, it would be enormously helpful to track more prosaic matters, such as how long does it takes an agency to approve a change order, pay contractors, or secure local and federal permits.

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