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Alternative Project Delivery Methods in California: The Path Forward

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January 2026

A publication of the
Mineta Transportation Institute
Created by Congress in 1991

College of Business
San José State University
San José, CA 95192-0219

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. 25-28	**2. Government Accession No.**	**3. Recipient's Catalog No.**	
4. Title and Subtitle Alternative Project Delivery Methods in California: The Path Forward		**5. Report Date** January 2026	
		6. Performing Organization Code	
7. Authors Ghada M. Gad, PhD: 0000-0002-1246-6639 Maria Calahorra Jimenez, PhD: 0000-0002-1981-8828 Chaimae Nacir Ronald Shrestha		**8. Performing Organization Report** CA-MTI-2455	
9. Performing Organization Name and Address Mineta Transportation Institute College of Business San José State University San José, CA 95192-0219		**10. Work Unit No.**	
		11. Contract or Grant No. SB1-SJAUX_2023-26	
12. Sponsoring Agency Name and Address State of California SB1 2017/2018 Trustees of the California State University Sponsored Programs Administration 401 Golden Shore, 5th Floor Long Beach, CA 90802		**13. Type of Report and Period Covered**	
		14. Sponsoring Agency Code	
15. Supplemental Notes 10.31979/mti.2026.2455			

16. Abstract

Alternative Project Delivery Methods (APDMs) are increasingly being recognized as effective alternatives to the traditional Design-Bid-Build (DBB) approach for transportation projects. As APDMs gain traction among California's transportation agencies, understanding the legislative frameworks that enable their use and the characteristics of each method is critical. This study benchmarks the existing use of APDMs in California transportation agencies of varying types and sizes, while considering the characteristics (advantages and barriers/challenges to implementation) of each APDM and the authorizations enabling its implementation. Based on these findings, it also provides recommendations for key factors to consider in APDM selection and implementation. The study used a four-pronged mixed-methods approach, including a literature review, content analysis of 30 APDM-related bills (1999–2024), a statewide agency survey, and eight in-depth case studies. Findings reveal growing legislative support for broader APDM adoption with fewer restrictions than in the past, but findings also highlight disparities in implementation between agencies of different types (e.g., state vs. county agencies). Public and private sectors show differing levels of APDM maturity (experience and readiness) and future adoption plans, with greater interest in the Construction Manager/General Contractor (CM/GC) and Progressive Design-Build (PDB) methods than Design Build (DB). Key barriers include limited internal capacity, legislative constraints, and a lack of staff training, particularly among smaller agencies. The study also identifies a strong need for industry-wide awareness and strategic method selection based on project complexity and agency readiness. This study contributes actionable recommendations for legislators, agencies, and contractors to support effective APDM implementation. It lays the groundwork for future research into the effect of agency governance structures and decision-making cultures on APDM implementation and the development of tools to assess agency readiness and support informed APDM selection. This report supports the California State Transportation Committee (CSTC) and the State Legislature's decisions by providing a state-of-the-art exploration of the APDMs used in California and can help shape future APDM legislative directions. By helping agencies understand different project delivery methods, this research supports faster, more cost-effective, and higher-quality transportation projects that better serve California communities.

17. Key Words Project delivery methods, design-build, construction manager/general contractor, progressive design-build, legislation, California transportation agencies.	**18. Distribution Statement** No restrictions. This document is available to the public through The National Technical Information Service, Springfield, VA 22161.		
19. Security Classif. (of this report) Unclassified	**20. Security Classif. (of this page)** Unclassified	**21. No. of Pages** 252	**22. Price**

Form DOT F 1700.7 (8-72)

DOI: 10.31979/mti.2026.2455

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ACKNOWLEDGMENTS

The research team would like to acknowledge the research project advisors, Ms. Melissa White, Principal Consultant, Senate Transportation Committee, and Ms. Kimberly Slaughter, Transportation Leader, North America, TYLin for their guidance and support throughout the research project. We would also like to extend sincere appreciation to the survey respondents, as well as the case study participants from the different agencies (including Caltrans, LA Metro, SANDAG, Santa Barbara Association of Governments, Placer County Department of public works, Sonoma County Department of Public Works, Fresno County Transportation Commission, and the City of Santa Cruz). We would also like to acknowledge Dr. Hilary Nixon who provided the research team with valuable advice on the procedures to be followed on this grant.

This project was funded by the California State University Transportation Consortium (CSUTC) through the State of California's Road Repair and Rehabilitation Act of 2017. The authors want to acknowledge the support of the CSUTC and the Mineta Transportation Institute.

Any opinions, findings, and conclusions or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of the California State University system in whole or part, the Trustees of the system, or Caltrans.

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Executive Summary

Alternative project delivery methods (APDMs) have emerged as viable delivery alternatives for transportation projects, replacing the conventional Design-Bid-Build (DBB). DBB separates the design and construction phases creating a disconnect between design and construction and limiting collaboration and innovation. As APDMs shift traditional roles and responsibilities, their successful implementation requires enabling legislation tailored to each method and clearly understanding their unique characteristics. This study thus benchmarks how California's state, regional, county, and city transportation agencies are using Construction Manager/General Contractor (CM/GC), Design-Build (DB), and Progressive Design-Build (PDB); identifies the advantages, disadvantages, opportunities, and barriers of each method; and identifies the key considerations that should guide agencies when selecting and implementing an APDM. Four research questions (RQs) framed the work:

RQ1. What enabling legislation and policies exist for APDMs implementation?

RQ2. What is the current state of practice for APDMs?

RQ3. What are the advantages, disadvantages, opportunities, and barriers of APDMs?

RQ4. Which factors should drive APDM selection and successful implementation?

A four-pronged, mixed-methods design underpinned the investigation. The team (1) reviewed academic and industry literature, (2) performed content analysis of 30 APDM-related bills (1999–2024), (3) surveyed 86 public- and private-sector transportation organizations, and (4) conducted eight in-depth case studies across agencies of different sizes and governance levels. Survey data were examined with descriptive and inferential statistics, while legislative texts and interview transcripts underwent thematic analysis. Findings from the four streams were synthesized to answer each research question as follows:

RQ 1 – Enabling legislation: California's legislature has steadily expanded authority, reduced cost thresholds, and widened project eligibility for CM/GC, DB, and, most recently, PDB—reflecting growing confidence in collaborative delivery. Newer bills emphasize flexibility (e.g., Qualification-based or Best-Value procurement) and require performance reporting to inform future reforms.

RQ 2 – State of practice: DBB remains dominant, yet overall adoption of APDMs is generally increasing. Agencies report the greatest maturity in DBB, moderate uptake of DB, growing use of CM/GC for complex/high-risk projects, and early experimentation with PDB. Private firms are generally further along the learning curve than public owners, and there is a growing trend among private industry that prefers CM/GC and PDB instead of DB.

RQ 3 – Advantages, disadvantages, opportunities, and barriers: Across methods, the most-cited advantage is the ability of owners, designers, and contractors to collaborate during the pre-construction stage, resulting in innovation and risk mitigation. CM/GC and PDB particularly reward early contractor involvement. A key advantage of DB is faster project delivery. Key drawbacks of APDMs relate to the inherent complexity of the methods, unfamiliar contract administration, and a lack of experienced and skilled staff that can lead to the change implied in the use of APDMs.

RQ 4 – Selection and implementation factors: Key factors leading to the selection of CM/GC are complexity related to the means, methods, and risks associated with the project. This method has been effective when coordination and staging are critical and when funding is phased in. DB should be selected if project speed is the priority, but to be successful, it is important that owners have a clear scope, all the funding up front, the risks are clearly allocated, and contract specifications clearly reflect the owners' expectations. PDB is more suited for projects with evolving scope that require design flexibility and are time-sensitive.

Findings from the research lead to the following recommendations for legislators, agencies, and contractors. ***Legislators*** are encouraged to reflect on the current APDM authorization bills' landscape and evaluate the possibility of creating legal frameworks that cover and provide authorization requirements to all the local agencies that have the capacity to design and build transportation projects. Further, as project development depends on funding, the current fiscal programming requirements should be reviewed since they are overly rigid, demanding detailed plans and budgets far in advance. This restricts the flexibility required by some APDMs, where the scope is not entirely defined when the contractor is onboarded in the project. More adaptable funding mechanisms, including reforms to SB1 cost overrun policies, would improve financial risk management. Finally, pilot programs for PDB should be pursued to explore its potential in enhancing project delivery and offering agencies more tools for achieving cost-effective, timely, and successful infrastructure outcomes.

Local transportation agencies are advised to enhance their internal capacity for APDM implementation by investing in workforce training, developing standardized selection criteria, and adopting a more strategic approach to method selection based on project characteristics and organizational maturity. Agencies should foster a collaborative culture, enable early contractor involvement, and establish clear performance metrics for APDM projects beyond cost and schedule, such as innovation, stakeholder effective and productive engagement, and risk management from design to construction. If needed and depending on the APDM, agencies should also hire Independent Cost Estimators (ICEs) to confidently work on evolving costs with the contractor. Smaller agencies in particular are encouraged to leverage partnerships, seek technical assistance, and advocate for clearer procedural guidelines that accommodate their resource constraints. Additionally, documenting lessons learned from past projects can create institutional memory and inform future procurement decisions.

Contractors are encouraged to align their strategies with the collaborative nature of APDMs by emphasizing early engagement, transparent cost estimation, and proactive risk-sharing. Contractors must train professionals working in APDMs on the importance of building trust through open communication, joint problem-solving, and a willingness to work within Qualifications-Based or Best-Value selection frameworks. Contractors should also invest in training their teams in APDM-specific roles and expectations and help educate agency partners during project initiation phases. By actively participating in pilot projects and performance evaluations, contractors can contribute to the refinement of procurement practices and help shape a more adaptive and effective project delivery environment across California's transportation sector.

This study contributes to the body of project delivery methods and pertinent legislation by describing the current legislative landscape and its effect on APDM implementation, as well as the practical challenges agencies face, especially the disparities between different agency types (state, county, etc.) and between public and private sectors. By combining legislative analysis, survey data, and case studies, the research provides targeted, actionable recommendations for legislators, agencies, and contractors. Thus, the research enables legislators and policy makers to make informed decisions that support broader APDM adoption, support agencies to recognize when and how to use each APDM based on project characteristics and organizational readiness, and encourage contractors to align their strategies with the collaborative nature of APDMs. Ultimately, the research equips all stakeholders with the insights needed to align policy, practice, and procurement strategy to improve project delivery. Additionally, the research identifies critical areas for future investigation. This includes investigating the internal structure, governance, and decision-making cultures of different agency types (particularly smaller and less APDM-experienced agencies) and the performance of APDM beyond the traditional cost/schedule aspects, as well as developing an agency APDM readiness assessment and decision support tool.

1. Introduction and Study Background

1.1 Problem Statement

Alternative project delivery methods (APDMs) have emerged as viable delivery alternatives for transportation projects in the United States, replacing the conventional Design-Bid-Build (DBB). The traditional DBB project delivery method separates the design and construction phases into two distinct contracts. This segmentation often creates a disconnect between design and construction, limiting opportunities for contractor input during the design phase. The three most popular APDMs nationwide are construction manager/general contractor (CM/GC), design-build (DB), and progressive design-build (PDB). As stated by the Associated General Contractors of America (AGC & NAFSA, 2020), APDMs alter the contractual duties of construction parties as well as the manner projects are conceived and constructed in comparison to DBB. These adjustments may better suit certain transportation project requirements that DBB cannot provide, such as early contractor engagement and better price and schedule certainty. There is a plethora of research that addresses APDMs and the various procurement selection methods in terms of their pros, cons, selection factors, and project performance compared to DBB, DB, and CM/GC (Ellis et al., 1991; Ernzen & Schexnayder, 2000; Warne, 2005; FHWA, 2006; Minchin et al., 2013; Gad et al., 2015; Hashem Mehany et al., 2018; Gad et. al., 2022).

As APDMs shift traditional roles and responsibilities, their implementation requires enabling legislation tailored to each method. Back in 2008, Ghavamifar and Touran (2008) examined the legislative status of APDMs across state DOTs nationwide, tracing their origins and levels of authorization. Many case studies have looked at how APDMs are used in the United States, including performance reviews of building facilities (Adamtey, 2019), comparisons of DB and DBB based on project details in Washington State (Okere, 2018), design management practices at the Washington State Department of Transportation (WSDOT) (Gatti et al., 2014), and the successful use of PDB in Maryland's I-270 project (Alleman & Tran, 2020), but they usually concentrate on particular methods, areas, or types of facilities. CalInfra (2023) has contributed valuable insights through a compilation of eight California-based APDM projects across sectors such as transportation, buildings, and water/wastewater treatment. A recent study by Elkind et al. (2022), which focused on rail transit projects in California, identified the choice of PDMs as one of the primary factors influencing the projects' cost-effectiveness and timely development. The study recommended using delivery methods that structure and emphasize early collaboration and place more significant risks on the contractor, such as CM/GC. However, all these efforts remain broad and do not fully explore the legislative status and implementation practices of APDMs, the pros and cons of APDMs, and APDM project performance specific to California's state and local transportation agencies.

With such significant prospects for APDMs usage, and as more public agencies in California begin to experiment with and deploy APDMs on their projects, the transition to APDMs has been

enabled by new legislation that is critical to APDMs employment. It thus becomes important to understand how and why these laws are being developed, why agencies are selecting these APDMs, and what the challenges and barriers are faced in expanding APDM selection and usage in California. This chapter will set the stage for the chapters to follow by providing background on how transportation agencies are set up in California and the basic principles and definitions of PDMs, including their advantages, disadvantages, and challenges to implementation retrieved from literature.

1.2 Objective and Research Questions

The purpose of this study is thus the following: (1) to benchmark the existing use of APDMs in local transportation agencies of different types and sizes in California, while considering the characteristics of each APDM and the authorizations enabling its implementation; and (2) provide recommendations for key factors to consider in APDM selection and implementation by California's local transportation agencies. The following research questions were addressed:

1. What are the current enabling legislation and policies to implement APDMs in local transportation agencies in California?

2. What is the current state of practice of the use of APDMs in California's local transportation agencies?

3. What are the advantages and disadvantages of APDMs, as well as the opportunities and barriers for their use?

4. What key aspects should be considered in the selection and implementation of APDMs in local transportation agencies?

1.3 Transportation Agencies Background

A key aspect of the legislative framework is the clear understanding of the governance structure of transportation agencies in California. The transportation system in California is supported by a complex and multi-tiered network of agencies that operate at state, regional, county, and city levels, each with distinct responsibilities, governance structures, and regulatory frameworks. At the state level, the California Department of Transportation (Caltrans) is responsible for the planning, construction, and maintenance of California's state highway system (SHS) and major interregional routes (Caltrans, 2025). Caltrans plays a critical leadership role in implementing statewide policies, responding to legislative changes, and piloting innovative PSMs, such as CM/GC, DB, and PDB. Complementing this role, the California Transportation Commission (CTC) (2017) provides critical oversight of transportation funding and project delivery by adopting the State Transportation Improvement Program (STIP), allocating state and federal funds, and approving major capital investments across the state. As a statutorily established body, the CTC also plays a

key role in implementing legislative mandates and shaping statewide transportation policy through its oversight and programming authority.

At the regional level, California is served by Regional Transportation Planning Agencies (RTPAs), which are established by state law (California Government Code Section 29532 et seq.) to address regional transportation needs across the state. While California has 58 counties, not every county has its own standalone RTPA; some RTPAs serve multiple counties or operate through joint powers and authorities. RTPAs are locally known by various titles, including county transportation commissions, local transportation commissions, councils of governments (COGs), and associations of governments, depending on the governance structure of the area they serve (Caltrans, 2017). These agencies are responsible for developing Overall Work Programs (OWPs) and Regional Transportation Plans (RTPs) and for selecting and programming projects in Transportation Improvement Programs (TIPs) (CTC, 2024b).

Among the 44 regional planning agencies, 18 are designated as Metropolitan Planning Organizations (MPOs), while the remaining 26 are rural RTPAs (CTC, 2024a, 2024b). As shown in Figure 1, these agencies are distributed across the state and aligned with specific Caltrans districts and regional boundaries. The designation of MPOs is governed by federal law, which mandates their formation in urbanized areas with populations exceeding 50,000 (Title 23 U.S.C. Section 134). MPOs are responsible for long-range transportation planning and project selection in compliance with federal regulations, including air quality conformity and fiscal constraint (CTC, 2024a). While MPOs and RTPAs generally perform similar transportation planning functions, MPOs are uniquely responsible for developing a Sustainable Communities Strategy (SCS) under SB 375 to meet greenhouse gas reduction targets (CTC, 2024a). In contrast, non-MPO RTPAs, which primarily serve more rural or less densely populated areas, are not subject to federal MPO requirements but remain vital in ensuring regional transportation needs are reflected in statewide planning efforts. These RTPAs must still comply with all state and some federal guidelines through their RTPs, which are required by California Government Code Section 65080 and guided by the CTC (CTC, 2024b). This layered structure of MPOs and RTPAs enables California to adopt tailored, place-based approaches to transportation investment, ensuring that the unique mobility, environmental, and economic needs of both urban and rural communities are addressed. Furthermore, this governance framework directly influences how APDMs are adopted and managed at the regional level, in alignment with both state policy goals and federal requirements.

Figure 1. California RTPAs and MPOS Map (CTC, 2024a)

In addition to regional planning agencies, transit operators in California play a crucial role in both providing public transportation services and executing significant capital infrastructure projects aimed at enhancing and expanding the state's transit network. These agencies operate primarily at the regional and local levels, collaborating with state entities such as Caltrans and securing funding from various sources, including a combination of local sales taxes, state grants, and federal funds. Notable transit operators include Los Angeles County Metropolitan Transportation (LA Metro), Bay Area Rapid Transit (BART), and San Diego Metropolitan Transit System (MTS). While transit operators may not always fall under the same regulatory framework as MPOs or RTPAs, they are integral to the project delivery ecosystem, particularly as many adopt APDMs to efficiently manage complex infrastructure improvements.

At the county and city levels, California's 58 counties and 482 cities each play a vital role in transportation infrastructure delivery through their respective public works departments. These local agencies are responsible for over 335,000 lane-miles of roads, significantly more than the

51,000 lane-miles managed by the state (Caltrans), and handle project delivery, land-use decisions, and traffic enforcement. Many counties also operate transportation authorities funded by local-option sales taxes, contributing to nearly $17 billion in annual local transportation revenue (Taylor, 2018). Their adoption of APDMs is ultimately shaped by the flexibility of local governance, institutional capacity, and the extent of legislative authority available to implement such methods.

In addition to these internal governance factors, the ways in which agencies collaborate externally also play a critical role. A formal intergovernmental agreement functions as a legal contract which two or more public agencies establish together. The document defines the obligations and responsibilities of each party along with their funding requirements and operational collaboration methods for public projects including transportation planning and construction. These agreements create legal boundaries while promoting teamwork and establishing mutual responsibility.

Beyond governance structures and collaborative agreements, successful project delivery ultimately depends on the ability of transportation agencies to secure adequate resources. To execute capital projects, transportation agencies rely on a combination of local, state, and federal sources, with a substantial portion of the funding being provided through voter-approved local sales tax measures. A key feature of California's funding landscape is the role of "self-help counties"—25 counties that have enacted such measures, commonly referred to as transportation sales taxes (SHCC, 2024). These measures are authorized under the Transactions and Use Tax Law, codified in Part 1.6 of Division 2 of the California Revenue and Taxation Code (Sections 7251–7279.6). This law enables counties to propose local sales taxes, typically at a rate of 0.25% or a multiple thereof, provided they stay within the allowable tax rate ceiling and secure voter approval.

Agencies such as the Fresno County Transportation Authority (FCTA), which manages Measure C revenues, fund capital projects by leveraging state and federal dollars. While FCTA is not an RTPA (that role in Fresno is held by the Fresno Council of Governments [FCOG]), in some cases, such as LA Metro and the San Diego Association of Governments (SANDAG), the same agency serves as both the RTPAs and the local funding authority. These self-help agencies are supported by coalitions such as the Self-Help Counties Coalition (SHCC), which advocates for stable local funding and implementation flexibility. Similarly, organizations such as the California Association of Councils of Governments (CalCOG), the League of California Cities, and the California State Association of Counties (CSAC) provide legislative coordination and technical assistance to member agencies across governance levels.

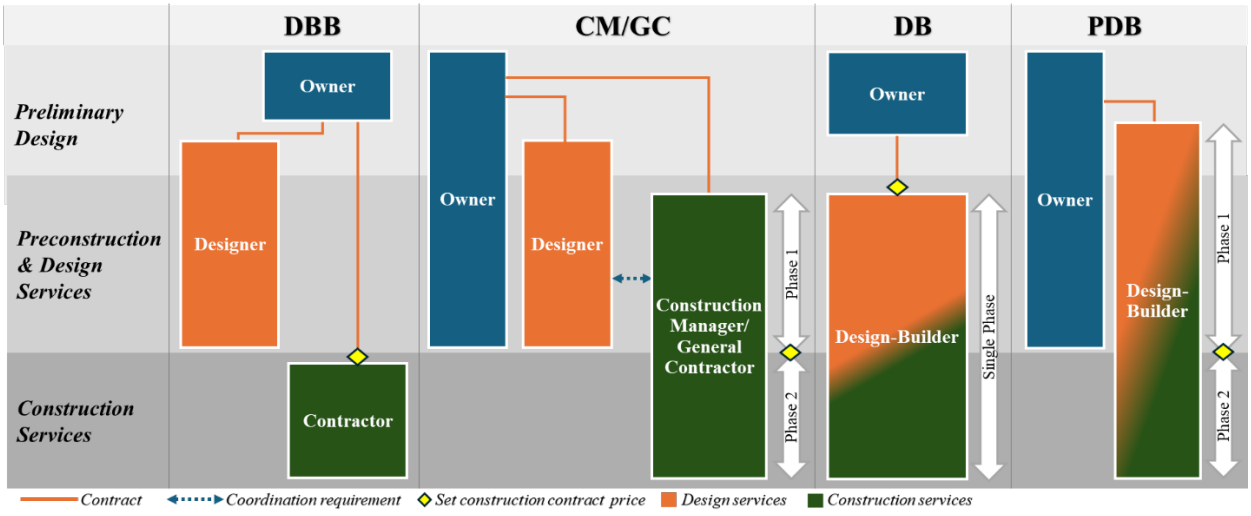
This layered structure ensures that transportation decisions reflect the needs of California's diverse geography and population—from dense metropolitan areas to rural and coastal communities. For this reason, this research study considers the full spectrum of transportation agencies to reflect the varied realities of project delivery and regulation. This description of different types of agencies is also key in determining the target population and sample of the study in the various data collection tools used (content analysis, surveys, and case studies) and capturing how different types of

agencies across governance levels interpret, respond to, and implement APDMs. The surveys will provide a system-wide view of current practices and challenges, coupled with case studies which will offer deeper insight into how APDMs function in specific agency contexts. This comprehensive approach will allow the assessment of not only how alternative methods perform but also how their implementation is shaped by institutional roles, jurisdictional authority, and legal frameworks. Understanding this ecosystem is critical for developing realistic and scalable recommendations for improving project delivery across California.

1.4 Alternative Project Delivery Methods (APDMs)

APDMs (also known as alternative contracting methods [ACMs]), such as CM/GC (construction manager at risk [CMAR]), DB, and PDB (shown in Figure 2), define the contractual organization of owners, designers, and contractors, as well as the sequencing of design and construction stages. In contrast to DBB, APDMs integrate or overlap the design and construction processes by restructuring contractual roles and responsibilities between the project owner, designers, and contractors (CalInfra, 2023), allowing for cooperation between the designer and the constructor in design development while also fostering constructability, value engineering, and innovation (Ashuri et al., n.d.; Chenault, 2021; Gransberg & Molenaar, 2019). This section details the advantages, disadvantages, challenges, and opportunities of each of these APDMs based on cited literature.

Figure 2. Project Delivery Methods, Contracts, Phases, and Services



1.4.1 Construction Manager/General Contractor (CM/GC)

The CM/GC method represents an APDM wherein the owner enters distinct contracts with both a design professional and a CM/GC. The CM/GC is engaged during the design phase and offers preconstruction services. Once the design progresses to a stage where the guaranteed maximum

price (GMP) can be determined, the CM/GC assumes the responsibilities of the general contractor and finalizes the construction process (Gransberg et al., 2010). CM/GC is mostly selected based on Best-Value (BV) or Qualification Based Selection (QBS). The QBS process involves the selection of the awardee based on their qualifications and expertise rather than cost, thereby ensuring the selection of the most competent team for complex projects. BV includes price as an additional component in the selection criteria.

Advantages. Below is the list of CM/GC advantages retrieved from literature:

- CM/GC minimizes expenses through the implementation of practical designs and the assurance of effective construction, incorporating vital insights from seasoned contractors (Adamtey, 2019; Gransberg & Gransberg, 2020; Shrestha et al., 2020).

- Early contractor involvement enhances the identification and management of risks, as well as the execution of value engineering (Diab & Ii, n.d.; Minchin, 2009; Sanboskani et al., 2024).

- CM/GC facilitates a more efficient schedule and accelerates development by streamlining processes (R. E. Minchin, 2009; Sanboskani et al., 2024; Sullivan et al., 2017).

- Enhanced cost security and accountability foster effective communication and coordination within teams (Clawson & Dickinson, n.d.; Gransberg & Gransberg, 2020; Sanboskani et al., 2024).

- CM/GC mitigates risk through the implementation of supervision and professional management, enabling owners to maintain oversight of the design (Diab & Ii, n.d.; R. E. Minchin, 2009; Shrestha et al., 2020).

- Implementing a GMP guarantees that the building management is responsible for any possible budget excesses and that owners are fully informed of their expenses (Clawson & Dickinson, n.d.).

Disadvantages. Below is the list of CM/GC disadvantages retrieved from literature:

- Overseeing two contracts can present challenges, and designers are not obligated to adhere to the construction manager's suggestions, potentially leading to issues of design accountability (Adamtey, 2019; Dang & Shane, 2018; Gransberg & Gransberg, 2020).

- Until the GMP is established, the precise cost remains uncertain; consequently, allocating contingencies can prove to be difficult and may result in excessive contingencies for unforeseen circumstances and incomplete design components (AGC

& NAFSA, 2020; Clawson & Dickinson, n.d.; Gransberg & Gransberg, 2020; Shrestha et al., 2020).

- When a single entity operates as both the Construction Manager and General Contractor, there is a tendency to undervalue the expenses associated with preconstruction services, potentially leading to conflicts of interest. Increased expenses may occur if projects are not subjected to competitive bidding, and the involvement of CM/GC may not lead to enhanced design quality (Adamtey, 2019; AGC & NAFSA, 2020; Dang & Shane, 2018; Patterson et al., 2023).

Challenges. The CM/GC challenges retrieved from literature included:

- During the procurement process, it is essential for owners to meticulously assess a contractor's capabilities in both the preconstruction and construction phases which can be complex and demanding.

- The transition from conventional low-bid procurement to a QBS process necessitates a transformation in perspective for both owners and contractors (Clawson & Dickinson, n.d.).

- The limited experience of agencies, owners, and employees with CM/GC necessitates the training of personnel (Diab & Ii, n.d.; Gransberg & Gransberg, 2020; Shrestha et al., 2020). The necessity for training multiple groups of individuals prior to the implementation of CM/GC may serve as a deterrent to its adoption (Adamtey, 2019).

- The implementation of enabling legislations and requirements is likely to be more intricate, owing to the lack of familiarity (Sanboskani et al., 2024).

- The complexity of implementation, the necessity for cultural and procedural adjustments, and the intensity of resource allocation require substantial management efforts and resources (AGC & NAFSA, 2020; Sanboskani et al., 2024). To surmount these challenges and achieve successful project outcomes, it is essential to foster effective communication, collaboration, and trust among all stakeholders involved in the project (City of San Diego, 2003).

Opportunities. The CM/GC opportunities retrieved from literature included:

- Collaborative partnerships represent a significant opportunity in CM/GC. Partnering constitutes a collaborative effort among teams, facilitating the attainment of shared objectives. The inherent characteristics of CM/GC necessitate collaboration among stakeholders throughout both the preconstruction and construction phases (Adamtey, 2019).

- The collaboration between the construction manager, designer, and owner fosters a cooperative environment that minimizes disputes and ensures the timely delivery of a high-quality project (AGC & NAFSA, 2020).

- CM/GC offers a chance to improve constructability throughout the design phase (Gransberg & Gransberg, 2020).

- CM/GC is thus suitable for projects that require early cost assurances (City of San Diego, 2003).

1.4.2 Design-Build (DB)

The DB method enables the early involvement of contractors. Owners create a distinct agreement with the design-builder entity, which may consist of a single firm, a consortium, a joint venture, or another organization specifically established for the project (FHWA, 2025). Departments of Transportation (DOTs) employing DB methodologies initiate project designs and establish performance requirements at an early stage. Subsequently, they award a singular contract that reflects the best overall value, taking into account the qualifications of the proposer, alternative technical concepts (ATCs), and GMP bids (Gaikwad et al., 2021; Molenaar et al., 2010).

Advantages. Below is the list of DB advantages retrieved from literature:

- DB culminates in a unified point of accountability for the design-builder firm (Gaikwad et al., 2021; Migliaccio et al., 2019; E. Minchin et al., 2014; Molenaar et al., 2010).

- The DB approach accelerates delivery timelines by streamlining schedules, thereby shortening construction durations, enhancing the procurement process for long-lead items, and removing the necessity for a distinct bidding phase for construction contractors.

- DB enhances cost certainty, minimizes expenses related to construction engineering and inspection, mitigates design rework, fosters improved team collaboration, shortens response times to change requests, boosts constructability, and promotes safety (Gransberg et al., 2006; Gransberg & Molenaar, 2008; WSDOT, 2016).

- From a risk perspective, DB transfers project-related risks to the design builders while allocating cost and design risks to the contractor. The DB approach also reallocates schedule risk to the contractor, leading to a more dynamic process of risk distribution (WSDOT, 2016).

Disadvantages. Below is the list of DB disadvantages retrieved from literature:

- A significant concern is the allocation of lump-sum expenditures prior to the completion of a finalized design, which could result in increased costs and unresolved design challenges (WSDOT, 2016).
- DB diminishes the owner's control (Migliaccio et al., 2019; WSDOT, 2016) and heightens the potential for conflicts of interest when contractors engage inspection consultants (Okere, 2018).
- DB may necessitate further training for the existing personnel (WSDOT, 2016).
- The specific qualifications required for DB can restrict competition, thereby rendering the DB method more appropriate for larger projects that entail greater financial risks (Park & Kwak, 2017; WSDOT, 2016).

Challenges. The DB challenges retrieved from literature included:

- The project scope is frequently inadequately defined during the procurement phase, which poses a risk of ambiguity if the Request for Proposal (RFP) is not carefully prepared (Migliaccio et al., 2019).
- The two-stage selection process, which encompasses Requests for Qualifications (RFQ) and RFP, necessitates a greater level of effort compared to DBB (Okere, 2018).
- The selection of a suitable DB team is essential yet complex, as it significantly influences communication and collaboration.
- Initial cost estimates present significant challenges owing to the limited design development at preliminary stages, while permitting obstacles further exacerbate the complexity of the process (Hannon et al., 2014; Migliaccio et al., 2019).
- Unexpected occurrences following procurement can influence both the timeline and expenses, potentially leading to claims for extra compensation if the site conditions deviate from those outlined in the RFP (Brogan et al., 2023; Castro-Nova et al., 2017).
- Disparities in experience between agencies and contractors regarding the DB method may lead to conflicts (WSDOT, 2016).
- Regulatory agencies frequently encounter constraints related to staffing and experience difficulties in the review and coordination of DB projects, especially in relation to incomplete designs and permit modifications necessitated by proposed design alterations (Hannon et al., 2014; Migliaccio et al., 2019; Minchin et al., 2014).

Opportunities. The DB opportunities retrieved from literature included:

- DB approach can foster innovation and improve the utilization of advanced technologies and equipment (Alleman & Tran, 2020; Gatti et al., 2014; Gransberg & Senadheera, 1999).

1.4.3 Progressive Design-Build (PDB)

The PDB method represents a sophisticated iteration of the DB and CM/GC delivery approaches (Gad et al., 2019; Alleman & Tran, 2020). In the DB method, the agency advances the design to about 30%. Conversely, the PDB approach integrates design and construction responsibilities into a single contract from the initial planning stage, utilizing CM/GC strategies for contractor selection based on their qualifications. The PDB approach highlights the significance of early contractor involvement, facilitating a more collaborative project development process, equitable market construction pricing, and the establishment of negotiated construction agreed prices (CAP) or guaranteed maximum price (GMP) (Alleman & Tran, 2021).

Advantages. Below is the list of DB advantages retrieved from literature:

- PDB offers enhanced management of project scope, budget, and timelines. The adaptability of scope within PDB facilitates the development of innovative, project-specific solutions that enhance creativity and optimize value for money across the entire life cycle (Alleman & Tran, 2020).

- The collaboration between agencies and contractors is significantly improved through the utilization of the contractor's expertise in technology and construction management, as well as by acquiring insights from real-time cost data (Anderson, 2022).

- The flexible characteristics of PDB position it as a viable choice for expediting projects, ensuring cost predictability (Scarlett, 2023).

- The inclusion of an “off-ramp” option represents an additional characteristic that facilitates flexibility throughout the design and construction phases (Gransberg & Molenaar, 2019).

- PDB provides project owners with timely alerts when the project scope surpasses the budget, alleviates administrative responsibilities, and ensures that the design-builder is accountable for any potential design errors, leading to a reduction in claims and a decrease in the severity of disputes (Alameri & Esmaeili, 2023).

Disadvantages. As for PDB disadvantages, below is a list based on retrieved literature:

- Awards of contracts based solely on qualifications may not yield the most cost-effective options (Anderson, 2022).
- There may be increased administrative burdens and reduced control over the design process.
- These factors may restrict the project's overall cost competitiveness (Scarlett, 2023).

Challenges. As for PDB challenges, below is a list based on retrieved literature:

- Legislative restrictions and policy constraints on its utilization,
- Negotiation challenges,
- The exclusion of price as a selection criterion,
- Inadequate owner education and industry engagement,
- Difficulties in team integration, and
- A requirement for increased owner participation (Gad et al., 2019; Alleman & Tran, 2020, 2021).

Opportunities. The PDB opportunities retrieved from literature included:

- PDB is inherently based on partnering principles where the owner and design-builder are working collaboratively in an open-book negotiation environment to achieve the overall project objectives. This environment can further enhance collaboration and project performance.
- Improved constructability due to the early design-builder involvement provides opportunities for cost savings and better risk allocation strategies (Alameri & Esmaeili, 2023; Alleman & Tran, 2020, 2021; Gad et al. 2019; Gransberg, 2023; Gransberg & Molenaar, 2019)

Table 1 presents a summary of the advantages, disadvantages, challenges, and opportunities identified in the literature concerning CM/GC, DB, and PDB. The citation frequency indicates the number of research papers that explicitly addressed these aspects in their analysis. Minchin et al. (2014) noted that the CM/GC model offers advantages such as innovation and flexibility in risk allocation. Okere (2018) argued that the DB approach limits the owner's control over the project. Additionally, Alleman and Tran (2020) identified significant challenges with PDB,

including price negotiations and legal and policy constraints. The count reflects the frequency with which specific advantages, disadvantages, challenges, or opportunities were emphasized in the reviewed studies, rather than simply tallying keyword occurrences. This guarantees that the data reflects significant discussions in literature instead of cursory references.

Table 1. APDMs: Cited Advantages, Disadvantages, Challenges, and Opportunities

	Aspect considered	Citation frequency			References
		CM/GC	DB	PDB	
Advantages	Speed of delivery/reduced schedule/ schedule compression/ fast track project delivery/ time saving	6	31	3	Anderson, 2022; Castro-Nova et al., 2017; City of San Diego, 2003; Ernzen & Feeney, 2002; Gaikwad et al., 2021; Gransberg & Gransberg, 2020; Migliaccio et al., 2019; Minchin, 2009; Mitchell & Chen, 2022; Okere, 2018; Park & Kwak, 2017; Patterson et al., 2023; Sanboskani et al., 2024; Sullivan et al., 2017; Tran et al., 2016; WSDOT, 2016
	Innovation	2	20	5	Adamtey, 2019; Alameri & Esmaeili, 2023; Alleman & Tran, 2020, 2021; Dang & Shane, 2018; Gransberg & Senadheera, 1999; Migliaccio et al., 2019; Mitchell & Chen, 2022; Scarlett, 2023
	Lower costs/ cost saving	7	17	2	Adamtey, 2019; Alleman & Tran, 2020, 2021; Anderson, 2022; Dang & Shane, 2018; Gaikwad et al., 2021; Gransberg & Gransberg, 2020; Mitchell & Chen, 2022; Okere, 2018; Patterson et al., 2023; Sanboskani et al., 2024; Shrestha et al., 2012, 2020; Tran et al., 2016
	Reduced/mitigated risk/more efficient risk allocation	8	10	1	Adamtey, 2019; Brogan et al., 2023; Clawson & Dickinson, n.d.; Diab & Ii, n.d.; Gad et al., 2015; Gaikwad et al., 2021; Gransberg et al., 2006; Gransberg & Shane, 2015; Gransberg & Gransberg, 2020; Migliaccio et al., 2019; R. E. Minchin, 2009; Scarlett, 2023; Shrestha et al., 2012, 2020
Disadvantages	Loss of owners control over design	-	8	1	Migliaccio et al., 2019; E. Minchin et al., 2014; Okere, 2018; Scarlett, 2023; WSDOT, 2016
	Complex risk allocation at procurement stage/difficulty to allocate contingencies	3	3	-	Adamtey, 2019; Dang & Shane, 2018; Gaikwad et al., 2021; Gransberg et al., 2006; Gransberg & Gransberg, 2020; Migliaccio et al., 2019
	Potential higher project cost due to not having design completed with contractor's involvement	4	1	1	Adamtey, 2019; AGC & NAFSA, 2020; Dang & Shane, 2018; Patterson et al., 2023; Scarlett, 2023; WSDOT, 2016
Challenge	Negotiation/ qualification-based procurement/legal policy constraints	3	2	3	Alleman & Tran, 2020, 2021; Dang & Shane, 2018; Gransberg & Gransberg, 2020; Okere, 2018; Sanboskani et al., 2024; WSDOT, 2016

	Aspect considered	Citation frequency			References
		CM/GC	DB	PDB	
	Limited agencies experience/ training to develop APDMs/ organizational resistance	5	4	3	Adamtey, 2019; Alameri & Esmaeili, 2023; Alleman & Tran, 2020, 2021; Diab & Ii, n.d.; Gransberg, 2023; Gransberg & Shane, 2015; Gransberg & Gransberg, 2020; Hanna, 2008; Migliaccio et al., 2019; E. Minchin et al., 2014; Shrestha et al., 2020
Opportunities	Improved constructability	3	8	4	AGC & NAFSA, 2020; Alameri & Esmaeili, 2023; Alleman & Tran, 2020, 2021; Gransberg, 2023; Gransberg et al., 2006; Gransberg & Molenaar, 2019; Gransberg & Gransberg, 2020; Mitchell & Chen, 2022; Shrestha et al., 2020
	Partnering: formal and informal partnering can enhance collaboration and project performance	9	5	4	Adamtey, 2019; AGC & NAFSA, 2020; Alleman & Tran, 2020, 2021; Anderson, 2022; City of San Diego, 2003; Clawson & Dickinson, n.d.; Ernzen & Feeney, 2002; Gransberg, 2023; Gransberg & Molenaar, 2019; Gransberg & Shane, 2015; Gransberg & Gransberg, 2020; Hanna, 2008; R. E. Minchin, 2009; Patterson et al., 2023; Sanboskani et al., 2024; Shrestha et al., 2012

2. Research Approach

2.1 Introduction

As detailed in Chapter 1, this research project aims to benchmark the existing use of alternative project delivery methods (APDMs) in local transportation agencies of different types and sizes in California, while considering the characteristics of each APDMs and respective authorization enabling its implementation. The research also provides recommendations for key factors to consider in APDMs selection and implementation by California's local transportation agencies. To achieve the proposed objectives, the research team employed a four-pronged method as shown in Figure 3, with data obtained from multiple sources including the following: literature review, content analysis of enabling legislation and agency policy documents, survey of local transportation agencies and case studies representing the use of APDMs in agencies of varied sizes and with different constraints. Data from these multiple sources were synthesized, compared, and contrasted for validation and interpretation. Both descriptive and inferential statistics were used to analyze and interpret the survey data. Thematic analysis was conducted for the content analysis of the policies and legislations as well as the case studies.

Figure 3. Research Approach

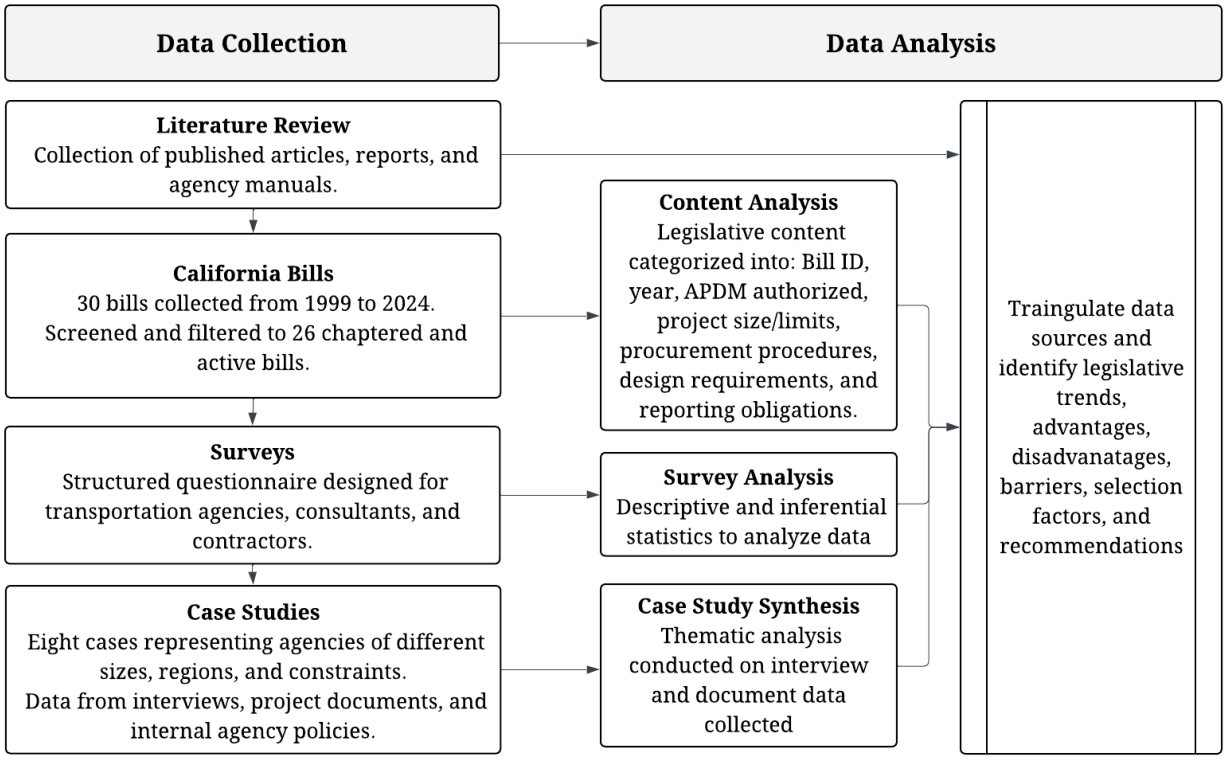


Table 1 outlines how each research question was addressed through a combination of literature review, legislative content analysis, surveys, and case studies. It demonstrates the alignment between research objectives and the multi-method approach used in the study. This chapter will detail each of the research methods utilized.

Table 2. Research Questions and Corresponding Data Sources

Research Question	*Literature Review*	*Content Analysis of Legislation*	*Surveys*	*Case Studies*
1. What are the current enabling legislation and policies to implement APDMs in California transportation agencies?	Academic publications and DBIA surveys on enabling legislation and policies	26 bills analyzed from 1999–2024.	Questions on agency legislation, procurement constraints, and approval processes related to APDMs use	Industry insights on legislative constraints affecting implementation
2. What is the current state of practice of APDMs in California's local transportation agencies?	Limited references on California state-of-practice	Captured authorization trends but doesn't reflect actual usage rates	Questions on APDMs adoption levels, project frequency, and future APDMs use plans	Examined APDMs usage across agencies with varied sizes, regions, and resources
3. What are the advantages and disadvantages of APDMs, as well as the opportunities and barriers for their use?	Synthesized more than 50 references detailing pros, cons, and contextual barriers for APDMs	Captured bills' development in response to barriers (including project cost thresholds, procurement policies, and project types)	Questions on public and private industry perceptions	Identified industry perspective for various agency types
4. What key aspects should be considered in the selection and implementation of APDMs in local transportation agencies?	Identified APDMs selection criteria from literature in general	Captured project selection requirements in bills	Questions on public and private APDMs selection/pursuit criteria and recommendations	Examined internal agency factors (e.g., scale, technical ability) effect on APDMs selection and recommendatio ns

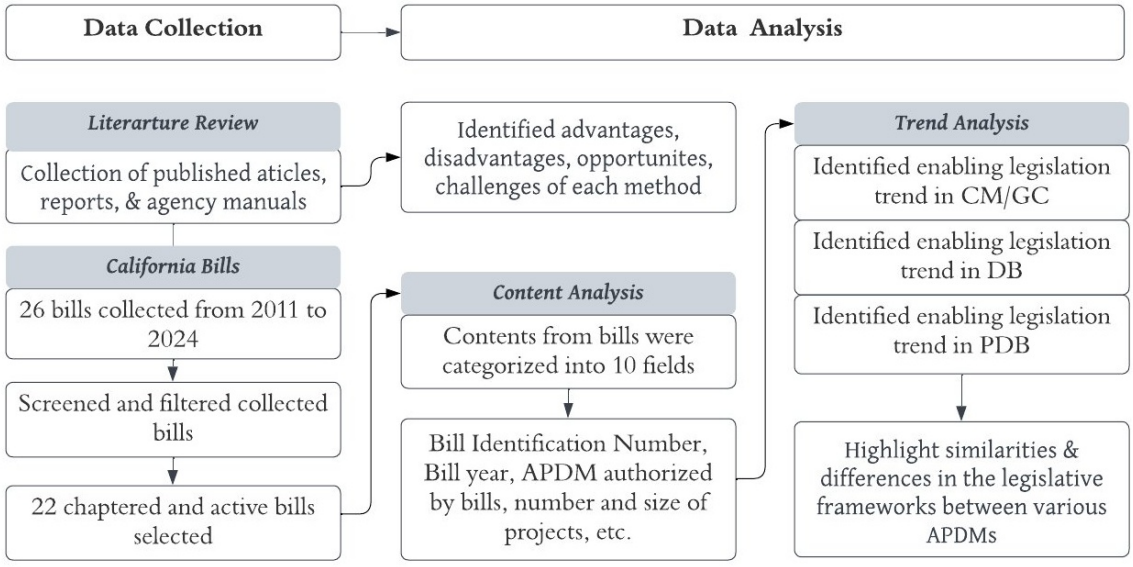
2.2 Content Analysis

The objective of the content analysis was to identify the existing bills for APDMs use, as well as investigate the trends in the issuance of APDM bills in California, including the restrictions and evolvement of the bills. The analysis also aimed to provide insights on how and why such bills evolved. To this end, the content analysis followed a three-step approach as shown in Figure 4.

Step 1 included collecting Assembly Bills (AB) and Senate Bills (SB) related to construction (CM/GC), (DB), and (PDB) in transportation projects using the California Legislative Information website (California Legislative Information, 2025). A search was conducted using the option "Bill Information/Advanced Search." The researchers used the keywords "Construction Manager AND General Contractor," "Design-Build," or "Progressive Design-Build" to identify relevant bills in each session year. Twenty-six (26) bills were collected between 1999 and 2024 associated with the targeted PDMs and focused on transportation projects. Only chaptered and active bills were included in the analysis (26 CM/GC, DB, and PDB bills). Chaptered bills are those that became law (signed by the governor) and are no longer under review. Active bills are those that are still under consideration. Inactive-died bills were excluded from the analysis as they did not advance.

This structured data collection ensured that the study focused on legislation that had undergone full legislative review, whether passed into law or still under debate. Other documents associated with the bills posted on the California Legislative Information website were also collected, such as the most recent and the earliest bills analyses. This provided the research team with a more comprehensive understanding of the legislative historical context, its intent, its progression, and its current status.

Figure 4. Content Analysis Steps



Step 2 entailed the actual content analysis of the bills which aimed at systematically categorizing and comparing the information collected bills. Ten distinct categories were established to systematically organize and analyze information pertaining to the bills, concentrating on the following aspects: (1) bill identification number (e.g., AB 2498), (2) year of the bill, (3) the APDMs sanctioned by the bill, (4) agencies authorized, (5) limitations on the number of projects, (6) restrictions on project size, (7) method of procurement, (8) requirements for in-house design services, (9) rationale for the selection of APDMs, and (10) reporting obligations if APDMs are utilized. The final step—Step 3—was to categorize the bills by APDM(s) (CM/GC, DB, and PDB) and identify specific trends such as adoption of APDMs, project size and scope limitations, and procurement methods selection.

2.3 Survey

Following the content analysis, the research team developed and distributed a survey targeting California's public transportation agencies and private industry stakeholders (such as consultants, contractors, and design firms) to examine their perspectives on the adoption, selection, and challenges of APDMs. This section outlines the survey design, piloting, and validation process.

2.3.1 Survey Design

The survey design was informed by both the literature review and the content analysis. To achieve the research objectives of the study and informed by a literature review, the survey included mostly close ended questions (Likert-scale, ordered, and non-ordered multiple-choice questions) and some open-ended questions to collect both quantitative and qualitative data. The survey was organized into five parts, as follows:

1. Demographic and organizational data, including the respondent's position, years of experience, and agency type.

2. APDM use, including the level of use and future adoption plans for CM/GC, DB, and PDB.

3. APDM selection and procurement procedures, including the factors that influence agency choices, procurement issues, and legal constraints.

4. APDM implementation and challenges, including practitioners' experiences, impediments, and best practices.

5. Effect of policy and regulation on APDMs, specifically how legislation influences APDM adoption and compliance.

The survey's target population was transportation-related public organizations and private companies engaged in project planning, management, and delivery throughout California. Public agencies included transit authorities, county departments of public works, state agencies, and other public entities including members from regional transportation planning groups (refer to Section 4.1 for more details), while private organizations were represented by contractors, consultants, and design firms. This targeted diversity of the groups was to ensure that the perspectives of public agencies of different sizes and scopes of work, as well as private companies, are well represented.

2.3.2 Survey Piloting, Validation, and Dissemination

To ensure the clarity, relevance, and reliability of the survey questions in collecting accurate and meaningful responses, the survey was piloted with prospective respondents, including DOT professionals and the research project advisors. Based on the feedback received, the team revised the survey to remove some of the redundancies in questions improve the logical flow, to help reduce the time taken by respondents to take the survey. Additional response options were also introduced, and the conditional logic was modified. After the survey was revised and finalized, the research team disseminated the survey via Qualtrics. It was sent to a total of 308 participants. Of those contacted, 86 completed the survey, resulting in a response rate of approximately 28%. The final response group reflects a broad coverage of organizational types, functional roles, and geographic regions across the state, as will be detailed in Chapter 4.

2.3.3 Survey Analysis

Descriptive and inferential statistical analyses were conducted to examine underlying trends in agency experience, project delivery practices, and selection criteria associated with APDMs. Descriptive statistics were first used to summarize respondent characteristics—such as agency type, years of experience, and levels of maturity in using CM/GC, DB, and PDB—as well as to analyze responses on project types and procurement and implementation challenges. Frequency tables and mean rankings were generated to identify common patterns and emphasize the most frequently selected features.

To further analyze the statistical relationship and test for statistical significance of the descriptive data presented, further inferential analyses were conducted using SPSS on the data, testing the hypotheses listed in Table 2. Table 2 shows the alignment between the study's research questions, related hypotheses, and the statistical tests used to evaluate them. This structure guided the selection of appropriate statistical tests based on the type of dependent and independent variables and test assumptions.

The tests conducted included the following:

1. **Mann–Whitney U Test.** The Mann–Whitney U test functions as a non-parametric statistical approach which enables researchers to examine ordinal or continuous variable

differences between two independent groups. In contrast to the independent samples *t*-test, this method does not require data normality assumption. The test evaluates the significance of rank differences between values in one group relative to values in another group. Specifically, the test works by converting the data into ranks across both groups and then calculating the mean rank for each group; a statistically significant difference in these mean ranks suggests that the two groups differ in their distribution of the dependent variable. The test serves its purpose when the independent variable contains two categories, and the dependent variable exists as either ordinal or non-normal datum.

2. **Chi-Square Test of Independence.** The chi-Square test of independence helps researchers established if two categorical variables demonstrate statistically significant relationships. The test evaluates whether observed category distributions match the expected patterns when variables are independent. The test applies to nominal data which are measured through frequency counts.

3. **Fisher–Freeman–Halton Exact Test.** This is a non-parametric statistical test used to examine the association between two categorical variables when sample sizes are small or when the assumptions of the chi-square test—particularly the requirement for sufficient expected cell counts—are violated.

4. **Kruskal–Wallis H Test.** This test functions as a non-parametric alternative to one-way ANOVA for comparing three or more independent groups on ordinal or non-normally distributed continuous variables. The test evaluates whether group median ranks show significant differences while not requiring normality assumptions. The method works best with ordinal data and continuous variables that have skewed distributions.

Table 3. Research Questions, Corresponding Statistical Hypotheses, and Statistical Tests

Research Question (RQ)	Related Hypothesis (H)	Independent Variable	Dependent Variable	Statistical Analysis
RQ1. What are the current enabling legislation and policies to implement APDMs in local transportation agencies?	*No direct hypothesis tested; addressed descriptively through survey questions*			Descriptive (Frequencies and Mean)
RQ2. What is the current state of practice of the use of APDMs in CA local transportation agencies?	H_{o1}: Public and private sector organizations have the same distribution of APDM maturity scores.	Public vs. Private (nominal)	APDM overall maturity intensity (continuous)	Mann–Whitney U *1 test*
	H_{o2}: Public and private organizations have the same distribution of future adoption plans for each APDM (CM/GC, DB, PDB).	Public vs. Private (nominal)	Future <APDM> adoption (nominal)	Fisher–Freeman–Halton Exact Test *3 tests for each APDM: CM/GC, DB, and PDB*
	H_{o3}: There is no association between an organization's APDM maturity level and its future adoption plans for that APDM.	Maturity score of <each PDM> (ordinal)	Future <PDM> adoption (nominal)	Fisher–Freeman–Halton Exact Test *4 tests for each PDM: DBB, CM/GC, DB, and PDB*
RQ3. What are the APDMs' advantages and disadvantages, as well as opportunities and barriers for its use?	H_{o4}: Barrier rankings are the same across APDM maturity levels.	Maturity of <each APDM> (ordinal)	Agreement on rank score of barriers (ordinal)	Kruskal Wallis *3 tests for each APDM: CM/GC, DB, and PDB*
RQ4. What key aspects should be considered in the APDMs' selection and implementation?	H_{o5}: Public and private organizations rank APDM selection factors the same way.	Public vs. Private (nominal)	Each individual selection factor rank for each PDM (ordinal)	Mann–Whitney U *18 tests for each APDM: CM/GC, DB, and PDB, and*

Research Question (RQ)	Related Hypothesis (H)	Independent Variable	Dependent Variable	Statistical Analysis *each selection factor*
	H_{o6}: Selection factor rankings are the same across APDM maturity levels.	Maturity score of <each APDM> (scale)	Agreement on rank score of selection factors (ordinal)	Kruskal Wallis *3 tests for each APDM: CM/GC, DB, and PDB*

2.4 Case Study

In addition to the legislative content analysis and statewide survey, case studies were conducted to investigate the practical application of APDMs within various transportation agencies throughout California. The legislative analysis provided a structural comprehension of legal authorizations, and the survey offered a comprehensive overview of agency experiences. The case studies were essential in augmenting them with essential contextual agency insights and their delivery partners within actual policy, institutional, and project settings. The goal was to explore not only the enabling conditions for APDMs use, but also the internal decision-making processes, organizational dynamics, and project-level constraints that shape their implementation. Through these case studies, the research team was able to investigate and determine how factors such as agency size, internal technical capacity, legislative flexibility, funding models, and local governance structures directly influence the adoption and success of APDMs. These in-depth investigations revealed both the opportunities created by APDMs as well as the persistent challenges agencies faced. A case study protocol was developed (see Figure 5 and Appendix B) to offer the team a structured approach for data collection (cases selection criteria, interview questionnaires, interviewees selection, documents to be collected, etc.) and data analysis (thematic analysis).

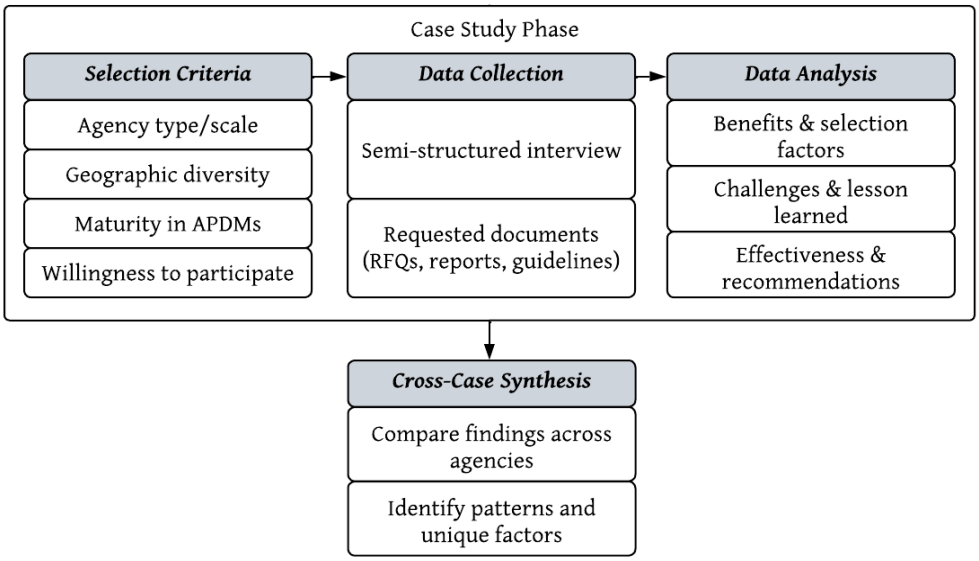
2.4.1 Case Study Selection Criteria

To capture the diversity of APDM implementation across California transportation agencies, the research team selected case study agencies using a structured set of criteria as outlined in the Case Study Protocol (Appendix B). The selection process included the following:

- Diversity in agency type and scale—including state departments, regional transportation planning agencies, county public works departments, and city governments
- Geographic diversity across urban, suburban, and rural contexts
- Maturity in using various APDMs, including those with extensive implementation experience, those piloting or using the methods in a limited number of projects, and

those that had not yet implemented APDMs but indicated a willingness or intent to do so in the future

Figure 5. Case Study Design Framework



The identification of these criteria was initially derived from survey responses and subsequently complemented with the information collected from the literature review and content analysis. The willingness to participate in the case study, which was initially indicated through survey responses and subsequently validated through direct communication with the survey respondent, constituted a significant criterion. This ensured that the selected agencies were open to interviews and further engagement. This process resulted in a diverse and representative sample of agencies, including the California Department of Transportation (Caltrans), the Los Angeles County Metropolitan Transportation Authority (LA Metro), the San Diego Association of Governments (SANDAG), Placer County, Sonoma County, the Fresno County Transportation Authority (FCTA), and the City of Santa Cruz. The selected agencies provided in-depth insights into how governance structure, legislative authority, and internal capacity influenced their selection and implementation of APDMs.

2.4.2 Case Study Data Collection

Each case study was guided by a structured yet flexible data collection protocol that included semi-structured interviews and document review to gain an in-depth understanding of how APDMs are implemented within agencies. Interviews were conducted with public owners, internal cost estimators (ICE), project executives, contractors, designers, and, where applicable, lobbyists or policy advocates. Distinct interview guides were developed for each stakeholder group to ensure relevant and targeted questioning while maintaining a consistent framework across all case studies. The interview questions were grouped thematically to align with the study's core research

objectives and questions (see Appendix B). These themes included the following: (1) interviewee background and agency role, (2) decision-making processes related to selecting APDMs, (3) procurement procedures and regulatory constraints, (4) design and construction phase challenges, (5) effectiveness and performance metrics, and (6) lessons learned and future recommendations for improving APDMs delivery and supporting policy frameworks.

In addition to interview data, project-level and agency-level documents—such as Requests for Qualifications (RFQs), nomination factsheets, procurement guidelines, board reports, and delivery frameworks—were collected when available to triangulate findings and contextualize agency practices.

2.4.3 Case Study Analysis

MAXQDA software was used to thematically analyze the interviews. The software helps analyze qualitative data in an organized fashion that assists in interpreting data patterns. The codes and themes were developed based on the main topics addressed in the case-study interviews. Those topics were: (1) advantages and selection factors, (2) challenges and barriers, (3) effectiveness, and (4) lessons learned and recommendations for each project delivery addressed. The interview questions asked for procedural issues related to the development and implementation of project delivery methods; the answers, once codified according to the previous categories, were summarized and reported in the case study. If contrasting perspectives across stakeholders were found, this was mentioned. A cross-case synthesis was then conducted to identify patterns, unique practices, and structural or legislative factors shaping APDM outcomes. Chapter 5 will present the individual case findings.

The results derived from the literature review, content analysis, survey, and case studies were systematically synthesized and comparatively analyzed to address the project's four research questions, as will be discussed in Chapter 6.

3. Content Analysis of Enabling Legislation

The evolution of California's legislation around project delivery has created new opportunities for innovation, but it also presents a patchwork of constraints and authorizations that differ by agency type and sometimes even a specific project. Transportation agencies should be empowered to employ various Alternative Project Delivery Methods (APDMs), such as construction manager/general contractor (CM/GC), design-build (DB), and progressive design-build (PDB), to enhance the efficiency and cost-effectiveness of infrastructure projects. This authorization is conferred via legislative processes, encompassing a series of bills introduced by different legislators, each targeting specific project delivery methods or scenarios. These processes frequently encounter challenges, including fragmented legislative sponsorship, inconsistent definitions, and procedural inefficiencies, which may hinder the smooth adoption of APDMs. This chapter delves into the findings from the content analysis of the APDM bills retrieved.

According to the Design-Build Institute of America (DBIA, 2021), states may authorize APDMs at the following levels:

1. Fully permitted: APDMs are authorized for all agencies.
2. Widely permitted: APDMs are authorized for multiple agencies.
3. Limited: APDMs are authorized for one or a few agencies.
4. Not authorized: APDMs are not permitted by the state.

It is critical to understand how such laws develop so that public agencies may adopt these APDMs. In California, the process of producing a bill begins when a person or organization persuades a member of the legislature to write it. The member delivers the bill's concept and text to Legislative Counsel, who drafts it into a bill. Once produced, the bill is allocated to the proper policy committee and goes through a series of reviews. If passed, the measure is forwarded to the governor for approval or veto. Once enacted, the measure becomes effective on January 1st of the following year (Senate Publications, 1991). Legislation on APDMs seems to address similar concerns, but they are issued for different reasons and with distinct constraints. The language of a bill can be complex, making it difficult, especially for non-legal experts, to identify (1) the underlying legal reasons that may impede the use of certain APDMs and (2) whether certain types of projects or agencies are not authorized to use certain APDMs.

As a result, it is critical to examine and learn from the growth and limitations of existing legislation to create more cohesive and aligned future bills that react to such changing needs efficiently and on time. The goal was to analyze patterns in the issuing of APDMs bills, including constraints and the evolution of new amended bills, and to give insights into how and why such bills arose. The results can be used to plan future bills in California or other states, specifically in terms of

revisions made and restrictions placed or removed (such as the number of projects, procurement method, cost, type, expiration, and special approvals/reporting required). They can also provide insights into how legislation is hindering/allowing the use of APDMs.

This section presents a summary of the findings derived from the analyzed bills. The analysis is organized into three primary sections corresponding to each APDM: CM/GC, DB, and PDB bills. The conclusion synthesizes and compares the bills. The discussion outlines the different types of agencies in chronological order to illustrate the trends in the evolution of each APDM within agencies as well as in the state of California as a whole. Table 3 further presents a summary of the content analysis performed on the 26 bills, encompassing columns that detail authorized agencies, project cost thresholds, procurement methods, reporting requirements, oversight responsibilities, and legislative outcomes. This section will analyze the findings by categorizing the bills according to their scope, limitations, legislative intent, and overall impact on California's transportation infrastructure.

3.1 Construction Manager/General Contractor (CM/GC)

As seen in Table 3, California enacted 14 bills from 2000 to 2024, permitting various transportation agencies to utilize the CM/GC project delivery method. Certain bills grant authority to individual agencies, while others confer authority to multiple agencies. Furthermore, certain bills were enacted to enhance and build upon existing legislation for different agencies as listed below.

Caltrans

- In 2012, the California Department of Transportation (Caltrans) implemented a pilot program authorized by AB 2498, permitting the use of CM/GC for transportation projects. Caltrans was authorized to execute a maximum of six projects, of which five must exceed a cost of $10 million. A minimum of four projects required design and engineering services to be conducted by Caltrans employees or consultants, with all project inspections mandated to be carried out by Caltrans. A report must be submitted by July 1st annually during the execution of a project utilizing CM/GC and one year following the completion of any such project.

- In 2016, AB 2126 expanded the program four years later by authorizing six additional projects for Caltrans under provisions similar to those specified in AB 2498. A total of 12 projects necessitated a revision, mandating that 10 projects exceed a cost of $10 million, with a minimum of eight projects required to employ Caltrans personnel or consultants for design and engineering services.

- In 2017, AB 115 authorized Caltrans to undertake an additional 12 projects, of which two could be assigned to the County of Riverside. Caltrans employees or consultants were required to execute design and engineering services for a minimum of 16 projects.

- In 2018, SB 1262 eliminated the restriction on the number of CM/GC projects that Caltrans could undertake. The bill removed the project cost threshold requirements and modified the stipulation regarding the use of Caltrans employees or consultants for design and engineering services to apply to two-thirds of the projects.

RTAs

- In 2015, AB 1171 granted RTAs limited authority to utilize CM/GC. The RTAs were permitted to utilize CM/GC exclusively for the design and construction of projects on expressways not included in the state highway system (SHS). The projects were required to be developed in alignment with an expenditure plan that had received voter approval in the preceding year. A report to the RTA's governing body was required upon project completion. RTAs encompassed the following entities:

- Metropolitan Transportation Commission, Tahoe Regional Planning Agency, Placer County Transportation Planning Agency, Transportation Agency of Monterey County, Nevada County Transportation Planning Agency, El Dorado County Transportation Planning Agency, Santa Cruz County Regional Transportation Commission, the consolidated agency in San Diego, and Santa Clara Valley Transportation Authority

- Transportation commissions in Los Angeles County, Orange County, Riverside County, San Bernardino County, and Ventura County

- Other local transportation entities designated as RTAs by statute

- Any joint powers authority (JPA) with the approval of a transportation planning agency or county transportation commission

- In 2016, AB 2374 expanded the authority of the RTAs to encompass two specific bridge projects and ramp projects. The bill also expanded the definition of RTAs to include the County of Placer.

- In 2018, SB 848 authorized the Golden Gate Bridge, Highway and Transportation District to employ CM/GC for the construction, alteration, repair, or improvement of the Golden Gate Bridge.

- In 2019, AB 1475 expanded the authority of RTAs by permitting the use of CM/GC when deemed appropriate, provided the project is not located on the SHS.

Transit Districts, Counties, & Rail Authorities

- In 2012, SB 1549 permitted the San Diego Association of Governments (SANDAG) to employ CM/GC for an unlimited number of public transportation projects, contingent upon written evidence demonstrating that CM/GC would lower costs, accelerate project completion, or offer features unattainable through Design-Bid-Build (DBB). The legislation permitted SANDAG to employ any legally authorized procurement method and mandated the submission of a report to SANDAG's governing board upon project completion. In 2013, AB 797 permitted the Santa Clara County Valley Transportation Authority and the San Mateo County Transit District to employ CM/GC for public transit projects in their jurisdictions, provided that the APDM was determined to be more advantageous than DBB. A progress report to the board of directors was required upon project completion.

- In 2018, SB 502 permitted Metrolink to employ CM/GC for commuter rail projects, excluding interstate passenger rail services, light rail services, or rapid transit services.

- In 2023, AB 427 authorized SANDAG to employ CM/GC for the joint venture project of State Route 11/Otay Mesa East Port of Entry with Mexico.

- In 2024, two bills, SB 1068 and AB 2235, were enacted. SB 1068 permits the Tri-Valley-San Joaquin Valley Regional Rail Authority to employ CM/GC methodology for transit connectivity initiatives. The document outlines the planning, design, and construction of transit connectivity, potentially involving modifications to the SHS for a passenger rail service through the Altamont Pass Corridor. AB 2235 authorizes the City of Long Beach to utilize APDMs (including CM/GC, DB, and PDB) for contracts associated with the terminal development project at the Port of Long Beach.

It is seen from this timeline that initially CM/GC was authorized for Caltrans with significant restrictions due to its experimental nature. AB 2498 restricted Caltrans in terms of project quantity and mandated annual reports to assess the efficacy of the delivery method. Other transportation agencies, including SANDAG, were permitted to utilize CM/GC contingent upon the prior submission of a report demonstrating the advantages of CM/GC. A bill was passed permitting RTAs to utilize CM/GC with restricted authority, following the delegation of authority to multiple agencies. As projects progressed and agencies acquired experience with CM/GC, the limitations for Caltrans and RTAs were progressively reduced. Caltrans and RTAs were ultimately authorized to employ CM/GC for an indefinite number of projects. The progression of these bills in many stated agencies imply satisfactory results from CM/GC and has led to its increased adoption.

3.2 Design-Build (DB)

The history of AB 958 illustrates California's developing strategy regarding APDMs in public transportation. Prior to its implementation, the majority of projects utilized the conventional DBB method, frequently resulting in extended project timelines and budget excesses. Assembly member Jack Scott introduced AB 958 during the 1999–2000 legislative session to address inefficiencies by permitting transit operators to utilize the DB method. On September 18, 2000, Governor Gray Davis enacted legislation that established procurement standards for DB transportation projects and mandated reporting requirements to evaluate its impact. The legislation contained a sunset clause, rendering its provisions void on January 1, 2005, unless renewed. This established a basis for extensive DB expansion, culminating in SB 785 (2015), which standardized DB procurement among various agencies.

The Legislature enacted SB 1130 (2003–2004) to prolong DB authorization for transportation projects until January 1, 2007. It stated that DB rules were applicable solely to transit projects, thereby excluding state highways and municipal roads. The legislation mandated that transit operators utilizing DB submit project information encompassing costs, timelines, and obstacles to the Legislative Analyst's Office by December 1, 2005. SB 1130 extended the repeal date from 2005 to 2007, allowing for additional time for DB implementation while ensuring oversight was preserved. The legislation specified that minor alterations to local roads, which are incidental to transit projects, were not impacted.

The enactment of SBX2-4 in 2009 represented a notable change in California's infrastructure procurement approach, broadening the application of APDMs to include state highways, bridges, and tunnels in addition to transit projects. Implemented in California's Second Extraordinary Legislative Session to expedite infrastructure development, this measure permitted Caltrans and local agencies to utilize DB for a maximum of 15 projects—10 designated for state roads and 5 for local transportation initiatives. SBX2-4 expanded Public-Private Partnerships (PPPs) by eliminating legislative restrictions on these agreements, with the objective of accelerating project completion and promoting private-sector participation. Similar to AB 958, the legislation included a sunset clause effective January 1, 2014. It instituted rigorous oversight, mandating agencies to provide annual reports to the California Transportation Commission (CTC) and the Legislature, thereby ensuring transparency and accountability. Insights gained from SBX2-4 informed the development of SB 785 (2014), which established a permanent and unified authority for debt issuance in state and local transportation projects.

Table 4. APDM Bills Summary

Bill #	Lead Author	Chapter #/ Statutes yr.	APDM	Restrictions/Requirements						
				Agencies with authority	No. of projects	Size ($) of project	Procurement method	Required: Inhouse design services	Required: Justify PDM selection	Required: Reporting
AB 2498	Gordon (A)	752/2012	CM/GC	Caltrans	6	At least 5 projects greater than $10,000,000	Not specified	(4 projects)	Not stated	Yearly when CM/GC projects are underway or completed
SB 1549	Vargas (S)	767/2012	CM/GC	SANDAG	Unlimited	Not specified	Construction services method authorized by law (such as BV)	Not stated		Upon projects completion and posted on website
AB 797	Gordon (A)	32/2013	CM/GC	VTA, SamTrans	Not specified	Not specified	BV	Not stated		Upon projects completion and posted on the website
AB 1171	Linder (A)	413/2015	CM/GC	RTAs (certain express ways not on SHS)	Not specified	Not specified	Negotiated process with the most qualified CM	Not stated	Not stated	Upon projects completion)
AB 2126	Mullin (A)	750/2016	CM/GC	Caltrans	12	At least 10 greater than $10,000,000	Negotiated process with the most qualified CM	(8 out of 10 projects)	Not stated	Yearly when CM/GC projects are underway or completed

Bill #	Lead Author	Chapter #/ Statutes yr.	APDM	Restrictions/Requirements						
				Agencies with authority	No. of projects	Size ($) of project	Procurement method	Required: Inhouse design services	Required: Justify PDM selection	Required: Reporting
AB 2374	Chiu (A)	753/2016	CM/GC	RTAs, County of Placer	2 (bridges not on SHS)	Not specified	Not specified	Not stated	Not stated	Not specified
AB 115	Committee on Budget (A) - Assembly Member Ting (Chair)	20/2017	CM/GC, DB	RCTC, cities, counties	24 CM/GC (2 Caltrans), 6 DB (3 RCTC)	At least 10 projects greater than $10,000,000	Riverside County may use BV (cost + time indicated)	(16 out of 24 projects)	Not stated	Yearly for first 4 CM/GC projects
SB 1262	Beall (S)	465/2018	CM/GC	Caltrans	Unlimited	Greater than $10,000,000	Not specified	(2/3 of projects)		Interim report by July 2021 & final report by July 2025
SB 502	Portantino (S)	602/2018	CM/GC	Metrolink	Not specified	Not specified	Not specified	Not stated	Not stated	Not specified
SB 848	Committee on Budget and Fiscal Review (S)	46/2018	CM/GC	RTAs, GGBHTD	Not specified	Not specified	Not specified	Not stated	Not stated	Not specified
AB 1475	Bauer-Kahan (A)	289/2019	CM/GC	RTAs	Project not on SHS	Greater than $10,000,000	Not specified	Not stated	Not stated	Not specified
AB 427	Alvarez (A)	163/2023	CM/GC	SANDAG (State Route 11/ Otay Mesa East	1	Not specified	Construction services method authorized	Not stated	Not stated	Not specified

Bill #	Lead Author	Chapter #/ Statutes yr.	APDM	Restrictions/Requirements						
				Agencies with authority	No. of projects	Size ($) of project	Procurement method	Required: Inhouse design services	Required: Justify PDM selection	Required: Reporting
				Port of Entry Project)			by law (e.g., BV)			
SB 1068	Eggman (S)	NA/2024	CM/GC	Tri-Valley Authority	Not specified	Not specified	Not specified	Not stated	Not stated	Not specified
AB 2235	Lowenthal (A)	NA/2024	CM/GC, DB, PDB	City of Long Beach	1	Not specified	BV	Not stated	Not stated	Not specified
AB 958	Scott (A)	541/2000	DB	Transit operators (transit districts, municipal operators, transit development boards, and JPAs)	Not specified	Transit projects ≥ $10M; Rail projects ≥ $50M	BV or Low bid	Not stated		Report due Dec. 1, 2005, for projects completed by Nov. 1, 2005
SB 1130	Scott (S)	196/2004	DB	Transit operators	Not specified	Not specified	BV or Low bid	Not stated		Report due Dec. 1, 2005, for projects completed by Nov. 1, 2005
SB X2 4	Cogdill (S)	2/ 2009-10	DB	Caltrans, RTAs, local transportation authorities	Caltrans- 10 state highway; local agency- 5;	$10M min for local projects, no min for state highway projects	BV or Low bid	Not stated		Annual reports to CTC, final report upon completion, CTC submits

Bill #	Lead Author	Chapter #/ Statutes yr.	APDM	Restrictions/Requirements						
				Agencies with authority	No. of projects	Size ($) of project	Procurement method	Required: Inhouse design services	Required: Justify PDM selection	Required: Reporting
					unlimited P3s					annual legislative report."
AB 401	Daly (A)	586/2013	DB	Caltrans, RTAs, VTA, LTAs, joint powers authorities	Up to10 on SHS	Not specified	BV or Low bid	NA	Not stated	Annual starting 2 years post-award until completion
SB 785	Levine (A)	931/2014 (sunsets 1/1/2025)	DB	DGS, CDC, MH, SDUPD, other local agencies	Not specified	Greater than $1,000,000	RFQ then RFP (selection using BV or Low bid)	NA		Not specified
AB 1499	Daly (A)	212/ 2021	DB	Caltrans for state highways, regional agencies for projects on/near state highways	Caltrans-10 state highway; regional agencies-unlimited on/near highways	Not specified	BV or Low bid	Not stated	Not Stated	Report due Jan. 1, 2033,
SB 985	Hueso (S)	422/2022 (sunsets 1/1/2031)	DB	SANDAG (State Highway Route 11 corridor including int'l border	1	Not specified	Not specified	NA		Review toll rates adequacy 2 years after project opening & biennially thereafter

Bill #	Lead Author	Chapter #/ Statutes yr.	APDM	Restrictions/Requirements						
				Agencies with authority	No. of projects	Size ($) of project	Procurement method	Required: Inhouse design services	Required: Justify PDM selection	Required: Reporting
				crossing facilities)						
AB 400	Blanca Rubio (A)	201/2024	DB	Cities, counties, special districts (transit districts, municipal operators, JPAs, CTCs, RTAs)	Not specified	Greater than $10,000,000 (transit projects)	BV or Low bid	NA	Not stated	Compliance with general public contract code reporting requirements is implied
SB 991	Newman (S)	243/2022 (sunsets 1/1/2029)	PDB	Cities, counties, special districts authorized for water related projects	15 (only water related)	Greater than $5,000,000	BV or QBS; establish GMP	NA	Not stated	Report to Legislature by January 1, 2028.
SB 146	Gonzalez (S), Friedman (A)	58/2023	PDB	Caltrans, DWR	Up to 8 for Caltrans; Up to 8 for DWR	Greater than $25,000,000	BV or QBS; GMP for selection	NA	Not stated	Annual report, 2 years post-award to completion
SB 617	Newman (S)	310/2023	PDB	Transit districts, municipal operators,	Up to 10	Greater than $5,000,000	QBS for pre-con selection,	NA	Not stated	Report due January 1, 2028

Bill #	Lead Author	Chapter #/ Statutes yr.	APDM	Restrictions/Requirements						
				Agencies with authority	No. of projects	Size ($) of project	Procurement method	Required: Inhouse design services	Required: Justify PDM selection	Required: Reporting
				consolidated agency, JPAs, RTAs, or local or regional agency			GMP for construction			
SB 706	Caballero (S)	500/2023	PDB	Local agencies, city & county entities, special districts	Up to 10 (water-related projects)	Greater than $5,000,000	QBS for pre-con selection, GMP for construction	NA	Not stated	Report due December 31, 2028

Note. VTA: Santa Clara County Valley Transportation Authority; SamTrans: San Mateo County Transit District; RTA: Regional Transportation Agencies; Caltrans: California Department of Transportation; RCTC: Riverside County Transportation Commission; GGBHTD: Golden Gate Bridge, Highway, and Transportation District; SANDAG: San Diego Association Of Governments; Tri-Valley: Tri-Valley-San Joaquin Valley Regional Rail Authority; LTA: Local transportation authorities; DGS: Department of General Services; CDCR: California Department of Corrections and Rehabilitation; MHD: Marin Healthcare District; SDUPD: San Diego Unified Port District; DWR: Department of Water Resources; JPA: Joint Powers Authority; CTC: County Transportation Commissions; SHS: State Highway System.

AB 401 was enacted by the state in 2013 to enhance the efficiency of transportation project implementation with DB methods. The legislation permits RTAs and Caltrans to utilize DB methods, while explicitly excluding cities, counties, and city-county agencies. AB 401 lacks a defined project cost threshold; however, it limits the use of DB to 10 projects located on or adjacent to state highways. Cooperative Agreements are necessary between RTAs and Caltrans for projects that involve or connect with the SHS.

AB 115 amended Public Contract Code Section 22161 to clarify and regulate the application of the DB method. This amendment highlighted increased flexibility and efficiency by broadening DB authority to encompass a wider array of public works projects overseen by RTAs. The aim was to enhance project management, reduce timeframes, and manage costs, ultimately increasing the overall delivery of infrastructure projects in California. The amendment aimed to expedite project delivery in accordance with the Road Repair and Accountability Act of 2017 (SB 1), incorporating provisions for new projects and enhanced contractual flexibility. AB 401 served as a link between the temporary authorization of SBX2-4 and the long-term consolidation of SB 785, thereby maintaining DB as a viable procurement option for essential transportation infrastructure projects throughout the legislative transition period.

SB 785, enacted as Chapter 931 in the 2013–2014 legislative session, sought to streamline and consolidate the DB procurement process for various state and municipal agencies, as well as reduce project costs and expedite completion. The legislation permitted the Department of General Services, the Department of Corrections and Rehabilitation, and local entities, including cities, counties, special districts, the Marin Healthcare District, and the San Diego Unified Port District, to utilize a unified contract for design and construction. SB 785 aimed to enhance the legal framework by integrating existing DB statutes and eliminating inconsistencies in the statutory language. The Legislature concluded that the existing authorizations were disorganized and necessitated consolidation to create a clear and uniform authorization for DB. Numerous state and municipal agencies supported the law, emphasizing the benefits of DB such as cost efficiency and expedited project completion. The agreement included a sunset clause effective January 1, 2025 and required detailed reporting to promote transparency and accountability. This legislative initiative demonstrated a dedication to improving public service delivery via enhanced infrastructure development.

AB 1499 (2021) extended the DB authority for Caltrans and RTAs from January 1, 2024 to January 1, 2034, while preserving the framework established by SB 785 (2014). Caltrans is restricted to 10 DB projects on the SHS, whereas regional agencies have unrestricted access to DB for projects on or adjacent to state highways. The legislation requires Caltrans to oversee construction inspections, monitor compliance, and enforce safety regulations. Caltrans is required to submit a report to the Legislature by January 1, 2033, detailing cost reductions, efficiency improvements, and procurement effectiveness in comparison to traditional methods. AB 1499 strengthens California's dedication to efficient infrastructure development through the continued use of DB as a primary procurement tool, while also ensuring legislative accountability.

In 2023, AB 400 was enacted to extend the authority of local agencies to utilize DB from January 1, 2025 to January 1, 2031. This measure adopted a comprehensive approach, allowing various local authorities to utilize DB in projects exceeding $1 million, including municipalities, counties, combined city and county organizations, and specialized districts. The definition of a "local agency" is expanded to include a larger number of JPAs tasked with transportation projects. In contrast to AB 401, which restricts the application of DB to specific project categories, AB 400 provides local governments with significant flexibility regarding project types, encompassing public buildings, parks, utilities, and transit and transportation initiatives. Extending the current DB authority is aimed to continue to enhance certainty for counties and local governments in planning, funding, and executing pending and future projects.

SB 985, referred to as the Otay Mesa East Toll Facility Act, received approval in 2021. SANDAG is authorized to construct and manage toll facilities along the State Highway Route 11 corridor and the Otay Mesa East Port of Entry with DB methods. SANDAG is permitted to negotiate agreements regarding tolling operations and toll collection with federal and Mexican governmental entities. SB 985 establishes detailed provisions for financial management, the utilization of toll revenue, and collaboration among governmental entities. Toll revenues must be allocated to project expenses, and biennial toll rate assessments are necessary to ensure adequate resources. In contrast to AB 400 and AB 401, which encompass broader implications, SB 985 is concentrated on a specific border project, thereby securing dedicated attention and resources.

An analysis of these bills reveals significant differences regarding their objectives, scope, and targeted agencies. AB 401 focuses on Caltrans and RTAs, explicitly excluding local entities, and seeks to enhance the efficiency of DB utilization at state and regional levels. In contrast, AB 400 employs a broad and inclusive framework, permitting cities, counties, and special districts to utilize DB for a range of infrastructure projects without imposing significant restrictions. SB 785, passed during the 2013–2014 session, unified existing DB statutes, enabling various state and local agencies to employ design-build for public works projects, thus resolving discrepancies in statutory language. SB 985 specifically addresses a toll facility along the State Highway Route 11 corridor and the Otay Mesa East Port of Entry, ensuring dedicated attention and resources for this initiative. These bills exemplify a legislative framework that integrates specificity and flexibility to address the varied requirements of infrastructure development at state, regional, and local levels, thereby enhancing project performance in response to agency needs.

3.3 Progressive Design-Build (PDB)

PDB is regarded as a relatively recent development in APDMs and is consequently addressed by newer legislation in California. In 2022, SB 991 incorporated the application of PDB in water-related infrastructure projects and initiatives. The bill highlights the adaptability and effectiveness of PDB, which is essential for meeting the urgent demand for innovative approaches in water resource management and infrastructure. It authorized local agencies, including cities, counties, and special districts, to execute PDB on up to 15 projects, each with a budget surpassing

$5 million. The necessity of integrating design and construction phases is underscored by the emphasis on qualifications-based selection (QBS) at the earliest feasible stage.

SB 146 demonstrates California's advancement in improving public service delivery and infrastructure project management by emphasizing efficiency and adaptability via the authorization of PDB. Initially intended to concentrate on conventional public works initiatives, SB 146 was revised to encompass additional local agencies and prolong the PDB authorization until December 31, 2033. Enacted in July 2023, the law permits local agencies to employ PDB for up to eight public works projects per department, with each project valued at over $25 million. This legislation permits municipalities, counties, and specialized districts, such as transit districts and RTAs, to employ PDB for various projects, including highway maintenance and the installation of stormwater pollution control devices, with the exception of activities on state-owned properties. Guidelines for Conflict-of-Interest policies must be established concerning the solicitation of PDB.

In 2023, two additional bills—SB 706 and SB 617—were signed into law to expand the use of PDB to other types of projects and agencies by enhancing the framework established by SB 991. SB 706 adopted a comprehensive strategy by expanding the PDB process beyond water-related projects. SB 706 enables cities, counties, and special districts to engage in PDB for a maximum of 10 projects, each surpassing $5 million. This modification improved the alignment of design and construction phases and allowed local governments to implement innovative infrastructure concepts across multiple domains. SB 617 focused on allowing transit districts, municipal operators, consolidated agencies, joint power authority, RTAs, and local or regional agencies to employ PDB for up to 10 public works projects, each valued at more than $5 million. SB 617 emphasized the prioritization of transit initiatives to enhance project delivery while maintaining construction and design quality. The law integrated multiple transit agencies to effectively tackle the specific challenges related to transit infrastructure projects in improving overall efficiency and dependability of the transit system.

The implementation of these laws reflects a targeted approach to enhance the efficiency of infrastructure projects by allowing for the utilization of PDB across multiple agencies. SB 991 initially conferred upon local governments the authority to efficiently oversee water-related infrastructure projects. SB 706 expanded the applicability of PDB, enabling local governments to utilize it for a range of public works projects, such as roads, bridges, buildings, and parks. SB 706 addressed comprehensive infrastructure development across multiple disciplines. SB 617 is focused on transportation, permitting transit agencies to allocate PDB for a maximum of ten transit projects, each exceeding $5 million.

3.4 Main Findings

APDMs offer advantages in cost, schedule, innovation, and early contractor involvement compared to the DBB method, as outlined in the literature review. Consequently, California transportation agencies are increasingly capitalizing on these opportunities, evidenced by a

significant rise in enabling legislation for APDMs. The content analysis facilitated a comparative examination of legislative trends among CM/GC, DB, and PDB bills, emphasizing the evolution of specific provisions in response to challenges associated with project size, procurement methods, and reporting obligations. The analysis revealed notable commonalities and differences among these APDMs, indicating a distinct legislative shift towards increased flexibility and expanded implementation authority.

The key highlights observed from this analysis include the following:

- Expansion of transportation agencies and projects permitted to execute APDMs
- Fewer restrictions on CM/GC and DB, justified by demonstrated performance in previous projects with multiple agencies
- Significant rise in PDB bills across various categories, enabling diverse agencies such as transit, water, RTAs, counties, cities, and ports
- Greater flexibility in selecting the APDMs in certain agencies when deemed appropriate
- Explicit language permitting the use of QBS and Best-Value (BV) procurement methods when considered suitable
- Increased collaborative agreements among state, regional, and local agencies to engage in various types of APDMs projects, including those on SHSs and international borders
- Increases in the authorized number of projects, which may be unlimited in specific instances
- Adjustments to project cost thresholds, whether lower, higher, or unspecified, to utilize APDMs based on the agency and project types
- Certain bills require the agency's internal design and engineering services for projects, often specifying numerical mandates, to address the agency's structure and requirements
- Bills being proposed and enacted for specific projects that achieve their objectives more effectively through APDMs
- Bills necessitating reporting to either the legislature or the agency board to confirm the accrued advantages of APDMs

California's experience since the early implementation of DB in the 1990s demonstrates that enacted bills have consistently mirrored the performance of these projects, highlighting both successful and unsuccessful aspects, particularly regarding staffing and project size. Agencies should continue to learn from their own and each other's challenges and barriers and propose legislation that addresses these obstacles within the context of their organizational constraints. Collaborative and inclusive legislation would enhance the effectiveness of APDM implementation across the state. Reporting remains a vital component in facilitating decision-making as new bills are introduced, both within the agency and at the legislative level, to enable the assessment of effective and ineffective practices.

4. Survey

As detailed in Chapter 3, the research team conducted a survey to explore how California's transportation agencies are using project delivery methods (PDMs), namely design-bid-build (DBB), construction manager/general contractor (CM/GC), design-build (DB), and progressive design-build (PDB). This chapter presents the survey results, starting with a descriptive summary of the participants' agency demographics, industry maturity levels of various project delivery methods, characteristics, legislative and regulatory barriers, opportunities and barriers, selection factors, procurement methods, and lessons learned to support future policy improvements. This is followed by inferential analysis of the hypothesis tested as detailed in Section 2.3.3.

4.1 Demographics of Respondents and Their Organizations

Agency Types. The survey garnered 86 responses from public (59.3%) and private (40.7%) organizations involved in transportation infrastructure projects. To account for the variability in the type of public organization respondents and its effect on the organization's alternative PDM (APDM) implementation approach, they were further categorized by institutional roles and responsibilities. Agency type was assigned through triangulation of several sources of information, including the following:

- Survey responses submitted by participants describing their agency roles
- Follow-up emails or clarifications requested from survey respondents on their agency roles
- Official agency websites and their definition of the agency roles
- Caltrans documentation, including agency lists and planning maps (Caltrans, 2021a, 2022)
- Professional organization websites

Accordingly, the following agency categories were identified and used for the analysis:

1. *State agencies* represent the California Department of Transportation (Caltrans) and the California Transportation Commission (CTC) as statewide entities, which establish transportation policy while distributing funds and supervising large infrastructure projects throughout California.
2. *Metropolitan Planning Organizations (MPOs)* are established by the federal government as entities which handle regional transportation planning for urbanized areas that reach populations exceeding 50,000, such as the San Diego Association of

Governments (SANDAG) and Southern California Association of Governments (SCAG). For the purposes of this report, the categorization of MPOs was based on their official designation regardless of them performing broader functions of construction delivery, finance, and transit operations.

3. *Regional Transportation Planning Agencies (RTPAs)* operate as state-designated entities which perform transportation planning across rural and less urbanized regions. RTPAs lead the development of Regional Transportation Plans (RTPs) while managing funding programming and maintaining State Transportation Improvement Program (STIP) coordination with Caltrans. These organizations function as the leading planning bodies when MPOs are absent.

4. *County Planning and Management Agencies* refer to transportation planning departments along with administrative oversight units that exist within county structures. These agencies maintain only administrative functions because they do not participate in construction or project delivery operations.

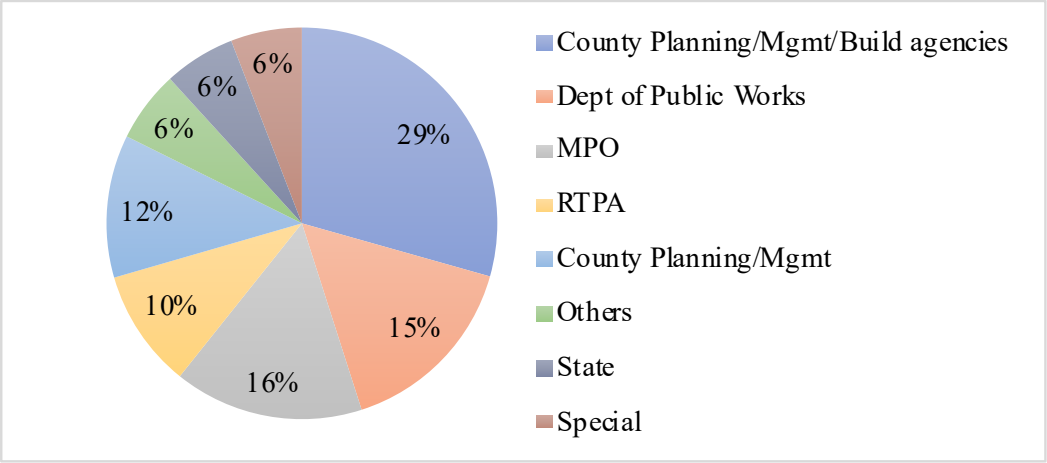
5. *County Planning, Management, and Build Agencies* combine planning and oversight responsibilities with project delivery functions that include engineering design and construction activities. Public works departments and capital programs usually are housed in these agencies.

6. *Special Agencies* are non-standard or hybrid agencies with unique legal mandates or specialized functions. Toll authorities and transit joint powers authorities (JPAs) along with regional entities which do not match planning or public works categories fall into this category. The Bay Area Toll Authority and Stanislaus Regional Transit Authority are examples of special agencies.

Unidentified includes agencies for which role classification could not be confirmed due to incomplete survey responses, limited website information, or lack of follow-up contact information.

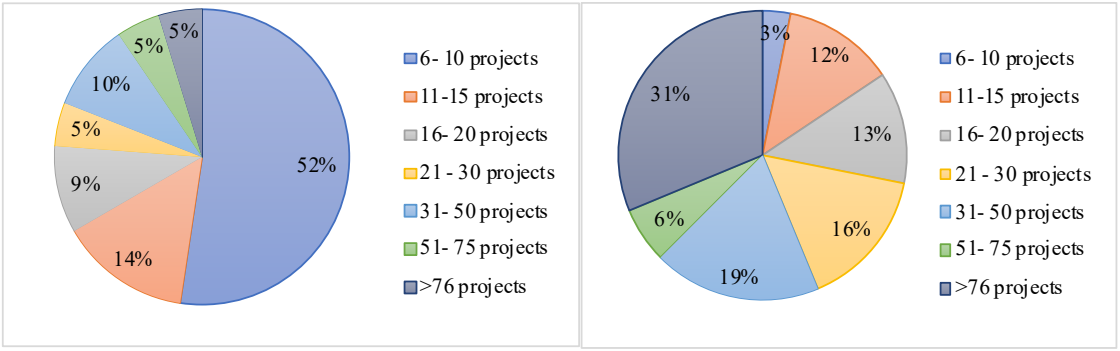
Figure 6 shows the distribution of public organizations respondents (n = 51), which includes County Planning/Management/Build agencies (29.4%), followed by both Departments of Public Works and MPOs (15.7% each), County Planning/ Management entities (11.8%), RTPAs (9.8%), and finally state agencies, special districts, and unidentified agencies (5.9% each). The respondents represented geographic diversity across metropolitan (e.g., Los Angeles Metro, San Diego, Santa Barbara), suburban (e.g., Ventura County, Stanislaus, Sonoma), and rural regions (e.g., San Benito, Mariposa, Sutter, and Calaveras), as well as diversity in agency roles from planning agencies, departments of public works, and transportation operators.

Figure 6. Respondent Demographics Per Public Agency Type



As for the private sector respondents' distribution, of the 33 private sector organizations that responded to this question, the majority—26 respondents (74.3%)—identified as general contractors, four respondents (11.4%) identified as design firms, and the remaining two (5.7%) identified as construction management (CM) firms under the "Other consulting firm" category. Only two respondents (5.7%) did not specify their organization type. This diverse representation of agencies guaranteed views from public-sector owners and private-sector implementers across several delivery roles and geographic locations. Figure 7 also shows the average number of projects the responding public and private agencies have ongoing each year. For the public agencies, most had on average 6 to 10 projects in a given year (52%), while for the private most had >76 projects in a given year (31%).

Figure 7. Average Number of Ongoing Projects Per Year



Public Private

Public Agency Involvement Across Project Phases. As shown in Figure 8, of the 19 public agencies that responded to the question about their agency involvement in construction project stages, all 19 (100%) selected the planning stage to design the project, and 94.7% participated in both the early planning stage to secure funding and the procurement stage to select designers or contractors.

The early planning stage to conduct needs assessments and identify projects and the construction stage to manage the project were each selected by 89.5% of respondents. The operation stage to operate and maintain the completed facility was selected by 73.7% of respondents. The planning stage to issue project-related permits was reported by 68.4% of respondents, and the pre-planning stage to develop and advocate infrastructure-related bills was reported by 63.2% of respondents. The "Other" category was selected by 15.8% of respondents who stated specific and general responsibilities that were not included in the typical project stages presented in the survey question, such as project closeout and project delivery and programming funding into the FTIP. The agencies thus represented those involved in various project stages all the way from initiation to operation.

Figure 8. Public Agency Involvement Across Project Phases

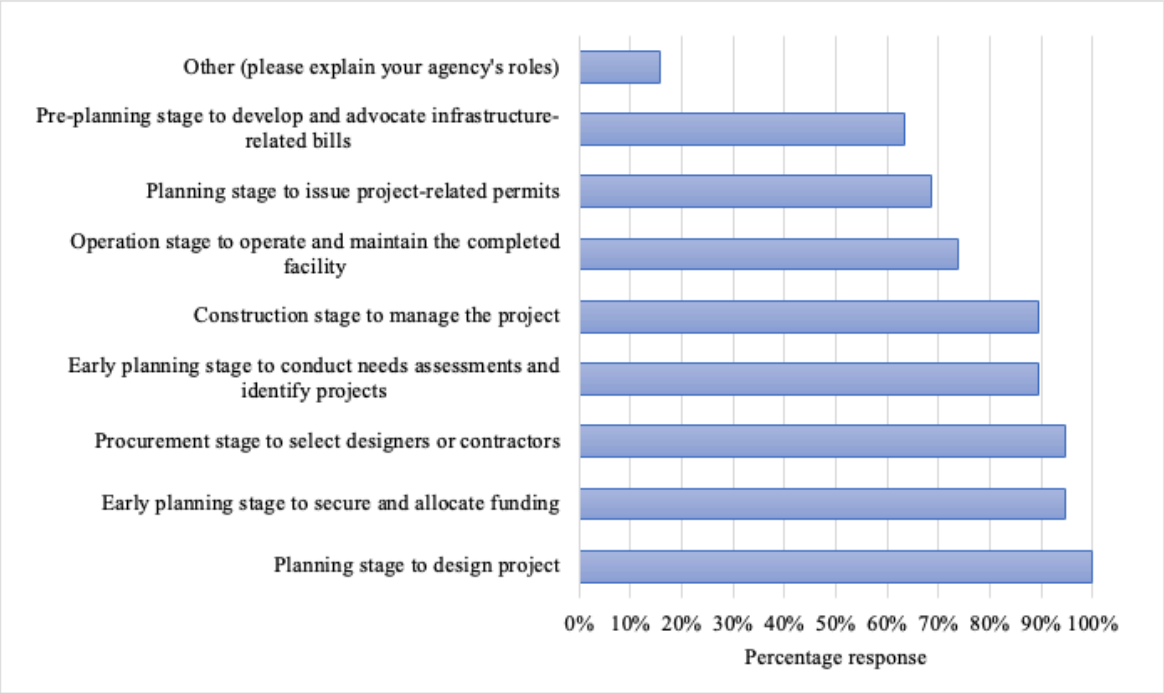
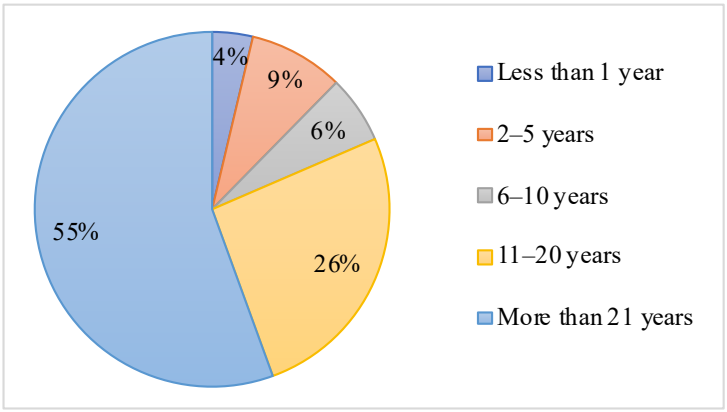


Figure 9. Respondents Overall Experience Level



Respondents' Overall Experience and Roles. As seen in Figure 9, most survey respondents (81%) reported having more than 10 years of experience, 56% of which had more than 20 years of experience. This experience level ensured strong representation from experienced professionals in both the public and private sectors. In terms of the respondents' roles on APDM projects, out of the 48 respondents from the public sector, most respondents were Project Managers (n = 18, 37.5%), followed by Construction Managers (n = 9, 18.8%), Program Managers (n = 6, 12.5%), and Agency Directors of Alternative Delivery (n = 3, 6.2%). The additional roles reported by respondents included Contract Administrators (n = 3, 6.2%), Quality Assurance/Control (n = 1, 2.1%), Procurement Engineer (n = 1, 2.1%) and Legal Advisor (n = 1, 2.1%). Six respondents chose the "Other" category which included Chief Estimator and Pre-Construction Manager, an MPO representative who tracked and supported APDMs projects, DB Manager, Project Engineer, Contractor Executive, and Project Executive. The respondents thus represented various technical, managerial, and executive roles in APDM projects delivery, providing broad perspectives on the utilization of APDMs.

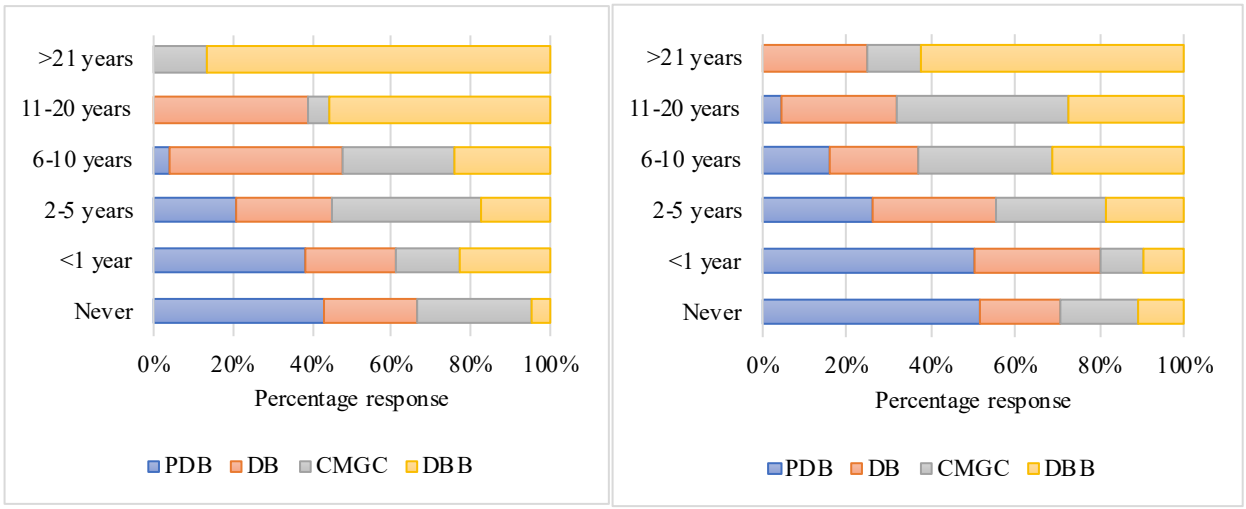
4.2 Alternative Project Delivery Methods Respondents Experience by Sector

In terms of the respondents' experience in PDMs (DBB, CM/GC, DB, and PDB), the public sector respondents (n = 47) reported extensive usage of the (DBB) method, with 40.4% of these respondents having more than 21 years of experience and 21.3% having 11–20 years of experience, 10.6% with 6–10 years, and 8.5% with no experience at all, as shown in Figure 10. As for the private sector respondents (n = 33), 18.2% had more than 21 years, 18.2% had 11–20 years, 18.2% had 6–10 years, 21.2% had 2–5 years, and 9.1% reported no experience.

The CM/GC method exhibited a sharp contrast in terms of recipients experience level. Among public respondents, only 6.4% exceeded 21 years of experience, 23.4% had 2–5 years, and the majority (48.9%) reported no experience with CM/GC. CM/GC though received more usage from private respondents who distributed their experience between 18.2% with 11–20 years, 30.3% with 2–5 years, and 15.2% with no experience at all. As for the respondents' DB experience, 14.9% of public respondents had between 11–20 years of experience, 23.4% had 6–10 years, while 40.4% had no experience. The private respondents displayed wider experience in DB as well, with 18.2% with 11–20 years of experience, 18.2% with 6–10 years, 33.3% with 2–5 years, and 15.2% with no DB experience.

The PDB method was the least used delivery method among all participants and especially among public sector respondents where 74.5% had no experience, 2.1% had 6–10 years, and 6.4% had 2–5 years. Private sector respondents displayed higher familiarity with PDB with 9.1% with 6–10 years of experience, 30.3% with 2–5 years, and 42.4% with no experience. Overall, public agencies demonstrate extensive experience with conventional methods such as DBB, yet their adoption of APDMs is relatively limited, particularly for CM/GC and PDB. However, the private sector respondents demonstrated experience across all four methods.

Figure 10. Respondents' Experience Across Various PDMs



Public Private

4.3 Organizational Maturity Level and Use of Project Delivery Methods

This section presents the survey results of APDM use, including maturity levels of the public and private agencies, types of APDM work, and types of projects. It also presents the reasons reported by some agencies for not using each APDM.

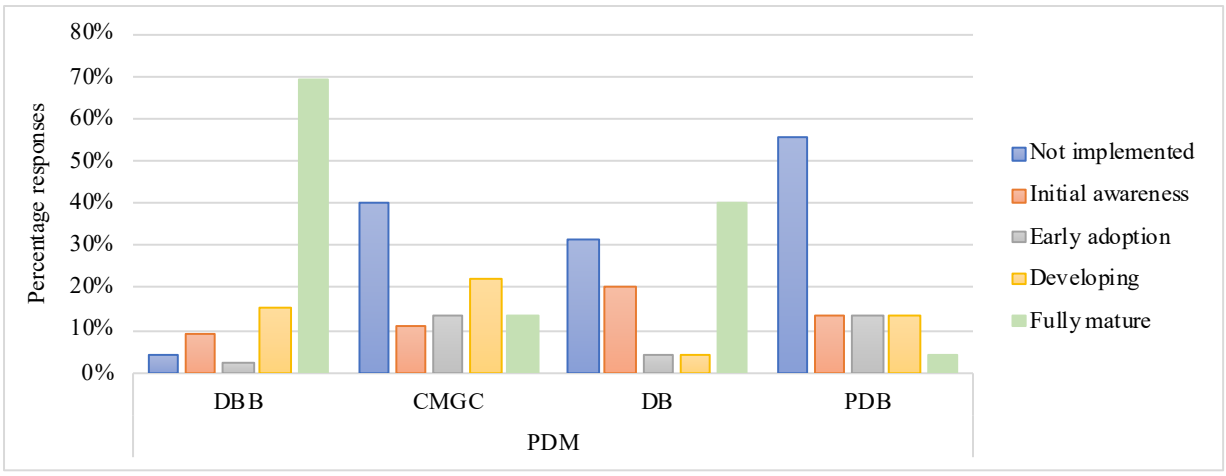
4.3.1 Public Agencies PDM Maturity Level – Overall

Across the 51 public agencies who responded, 45 valid responses were received for the question on the agency's maturity level in PDMs. As shown in Figure 11, DBB was reported as *fully mature* by 31 agencies (68.9% of respondents), seven agencies (15.6%) are in the *developing* stage, one agency (2.2%) is in *early adoption*, four (8.9%) reported *initial awareness*, and two (4.4%) have *not implemented* DBB. CM/GC showed more varied levels of organizational maturity: six agencies (13.3%) are *fully mature*, 10 agencies (22.2%) are *developing*, six (13.3%) are in *early adoption*, five (11.1%) are at initial awareness, and 18 agencies (40.0%) reported that CM/GC is *not implemented*. For DB, 18 agencies (40.0%) reported *fully mature* use, three (6.7%) are *developing*, one agency (2.2%) is in *early adoption*, nine (20.0%) reported *initial awareness*, and 14 (31.1%) reported *it is not implemented*. Finally, PDB was the least mature method reported among agencies: only one agency (2.2%) reported PDB being at *full maturity*, seven (15.6%) being in the *developing* stage, seven being in *initial awareness*, five (11.1%) being in *early adoption*, and most agencies (25 agencies, 55.6%) reported PDB is *not implemented*.

In summary, these results show that DBB is the most established PDM in current use, and while CM/GC is gaining traction in some agencies, a significant number of agencies have not yet adopted it. DB is moderately mature and more advanced than CM/GC among these respondents,

and PDB remains in its early adoption or experimental phase for most public agencies. These results highlight the opportunities for further development and support in implementing APDMs statewide.

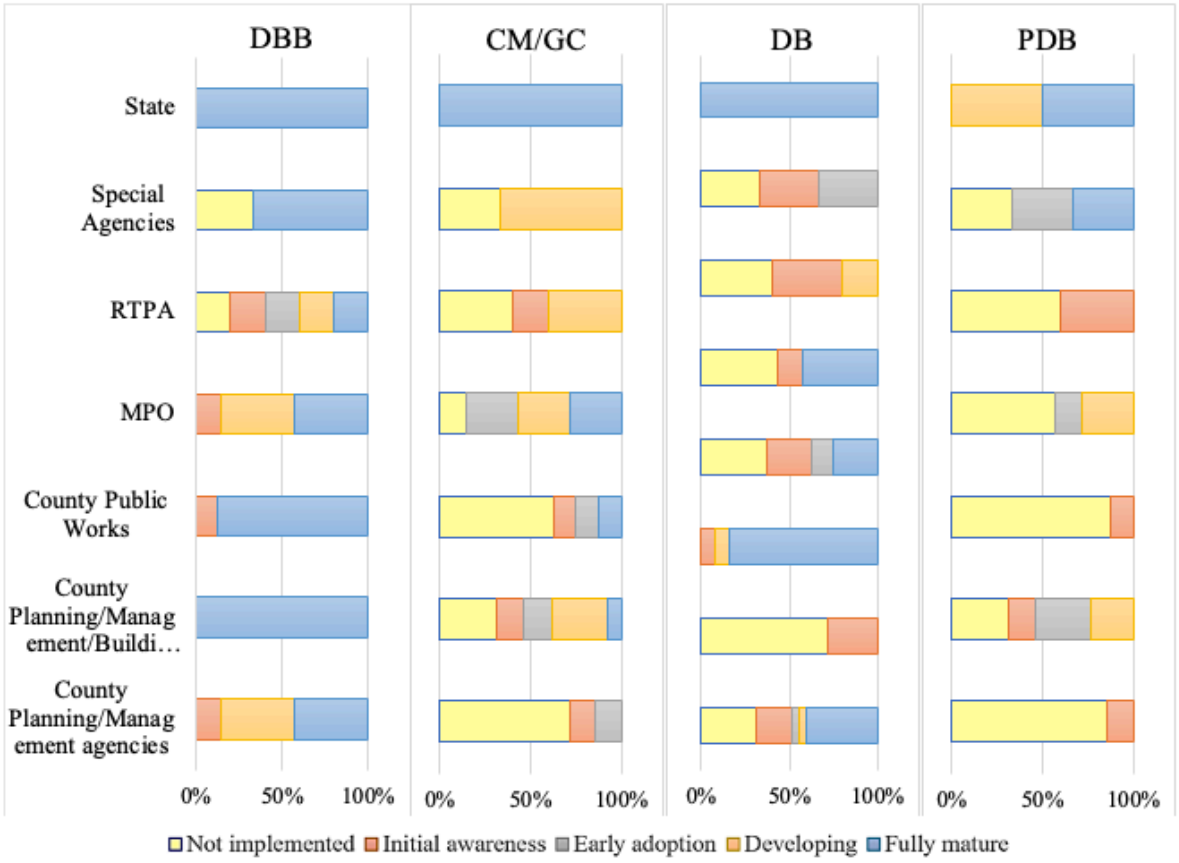
Figure 11. Agency PDM Maturity Levels



4.3.2 Public Agencies PDM Maturity Level by Agency Type

In addition to the overall public agencies' maturity level, it is also important to investigate how the public agency type determines the PDM maturity level and usage. Thus, the public agency responses were further categorized based on the agency types discussed in Section 4.1, as shown in Figure 12.

Figure 12. PDM Maturity Levels Across Different Public Agency Types



State agencies (*n* = 2) show strong maturity in all PDMs, with PDB developing in one of the two state agencies and fully mature in the other agency. **Special agencies** (*n* = 3) show varied implementation. DBB is implemented in two of the agencies and not implemented in the other. CM/GC is developing in two agencies and not implemented in the third one. DB is evenly distributed in terms of implementation between early adoption, initial awareness, and not implemented. Finally, PDB has one agency reporting being fully mature, and the two other agencies in early adoption and not implemented.

RTPAs (*n* = 5) reported all five maturity levels for DBB. CM/GC is fully mature in two, developing in one, and not implemented in two. DB follows an almost similar adoption level, with two not implemented, two in early adoption and one developing. PDB is not implemented by three of the five agencies and is at initial awareness in the remaining two.

For **MPOs** (*n* = 7), DBB is fully mature in three agencies, in development in another three, and in initial awareness in the remaining one. CM/GC is distributed at all maturity levels. DB is not implemented by three agencies, in initial awareness in one, and is fully mature in the remaining three. PDB is not implemented in four agencies, in early adoption in one, and developing in two.

For the **County Public Works**, (*n* = 8), seven reported being fully maturity and one in initial awareness. CM/GC is "not implemented" or "developing" by the majority, with only one being fully mature. DB is also mostly not implemented or in initial awareness and developing, with only two agencies being fully mature. Finally, PDB is not implemented by seven of the eight agencies and is in initial awareness in the remaining one.

For **County Planning/Management** agencies (*n* = 13), DBB is fully mature in all, whereas CM/GC varies across all maturity levels, with only one fully mature and four not implementing it. DB, in contrast, has 11 of the 13 agencies fully implementing it while one developing and another one in initial awareness. None of the agencies were fully mature in PDB; they were mostly between all other levels, with three developing and four in early adoption.

For **County Planning/Management/Building agencies** (*n* = 7), three agencies were fully mature in DBB, three developing, and only in initial awareness. For CM/GC, five of the seven did not implement it, one was in initial awareness, and one in early adoption. For DB, again five of the seven didn't implement it, and two were in the "initial awareness" stage. A similar trend was seen in PDB, but with six of the seven not implementing it and only one in initial awareness.

Across the spectrum of public agencies, PDM maturity levels vary significantly by agency type and delivery method. State agencies demonstrate the most consistent and advanced implementation across all PDMs. Special agencies show a more mixed profile, with DBB still being more commonly adopted and CM/GC in development stages. RTPAs and MPOs reflect a transitional stage, with a widespread distribution across all maturity levels, particularly for APDMs. County Public Works agencies show strong maturity in DBB but limited adoption of other methods. County Planning/Management agencies show full maturity in DBB followed by more development in DB and widespread implementation of CM/GC, though PDB remains largely underdeveloped. Finally, County Planning/Management/Building agencies exhibit the lowest overall maturity, with all APDMs either not implemented or in the earliest stages of awareness. These patterns highlight both progress and persistent gaps in APDM adoption across California's public sector landscape and are also reflective of the roles of these agencies:

1. **State Agencies (Caltrans & CTC)** are statewide entities responsible for setting transportation policy and overseeing large-scale infrastructure projects. They are expected to demonstrate high maturity across all PDMs. Their leadership role in funding distribution and project supervision necessitates advanced capabilities in all delivery methods, including the more complex PDB, which is still developing in one of the two agencies.

2. **MPOs** such as SCAG and SANDAG, are federally mandated to manage transportation planning in urbanized areas. Their moderate to high maturity in DBB and CM/GC and mixed adoption of DB and PDB reflects their role evolving beyond planning into

project delivery and finance. The variation in maturity aligns with the diversity of functions MPOs perform, which may include construction and transit operations in some cases.

3. **RTPAs** serve rural and less urbanized regions and focus primarily on planning and coordination with Caltrans. Their lower maturity in DB and PDB and moderate use of DBB and CM/GC is consistent with their planning-centric mandate and limited direct involvement in project delivery.

4. **County Planning and Management Agencies** are administrative in nature and do not engage in construction. Their full maturity in DBB likely reflects routine administrative oversight of traditional projects, while their limited maturity in CM/GC, DB, and PDB could be reflective of their non-operational role in project execution.

5. **County Planning, Management, and Build Agencies** combine planning with engineering and construction functions. Their strong maturity in DBB and DB and moderate engagement with CM/GC reflect their operational role in delivering capital projects. However, their low adoption of PDB suggests a lag in adopting more progressive delivery methods, possibly due to resource or capacity constraints.

6. **Special Agencies** have unique legal mandates and specialized functions (e.g., tolling, transit), Special Agencies and thus show diverse maturity patterns. Their stronger engagement with CM/GC and DBB may reflect the need for flexible delivery in specialized infrastructure, while limited PDB adoption could be due to the novelty of the method.

4.3.3 Private Agencies PDMs Maturity Level

As seen in Figure 13, private organizations report a high level of maturity in utilizing DBB. Approximately 84% of respondents indicated their firms are fully mature in this approach, demonstrating standardized practices and well-integrated procedures. A small percentage of the private agencies reported being at the developing (3%), early adoption (3%), or initial awareness (3%) stages, and only 6.1% stated that DBB is not utilized.

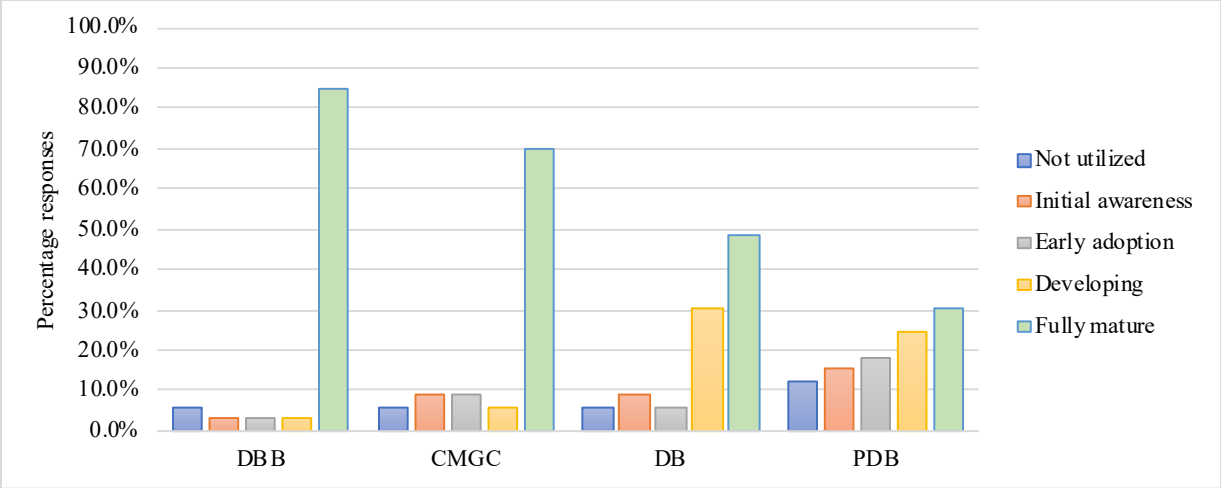
CM/GC also shows broad adoption among private firms, with 69.7% reporting full maturity. However, engagement is slightly more distributed compared to DBB, with 6.1% in the developing stage and 9.1% each in early adoption and initial awareness. Another 6.1% reported not utilizing CM/GC at all, suggesting a mix of maturity levels and ongoing integration efforts within the private sector.

DB maturity levels were more varied. While 48.5% of private organizations reported full maturity and 30.3% reported being in the developing stage, early adoption (6.1%) and initial

awareness (9.1%) levels indicate that many firms are still institutionalizing this approach. Notably, 6.1% reported not utilizing DB, highlighting room for growth.

Similar to public organizations, PDB is the least mature in the private sector. Only 30.3% of respondents considered their use of PDB as fully mature. However, many are on the path to institutionalization, with 24.2% in the developing stage and 18.2% at early adoption. A sizable 15.2% remain at the initial awareness phase, and 12.1% have not yet utilized it. This suggests PDB is still emerging as a delivery strategy in the private sector as well.

Figure 13. PDM Maturity Levels for Private Organizations



4.3.4 APDMs Scope and Project Type

Figure 14 shows that DBB is evenly used across different project scopes (new construction, rehabilitation/ improvements, and repair/maintenance). In contrast, APDMs are mostly used for new construction, with CM/GC and DB being used more than PDB for rehabilitation/improvements and DBB being used more for repairs/maintenance than CM/GC and DB. Figure 15 shows a more detailed analysis into APDM use by agency type. DBB stands as the leading delivery approach for almost all agencies. DB is used by mostly all agencies for new construction projects. State and County Planning/Management/Building agencies show an atypical pattern in that they employ a relatively high number of DB methods across all project scopes, including rehabilitation and maintenance, which deviates from the general trends observed among other agencies. Special Districts, MPOs, and County Planning/Management/Building departments use of PDB is limited to new construction.

Figure 14. Project Scope Per PDM

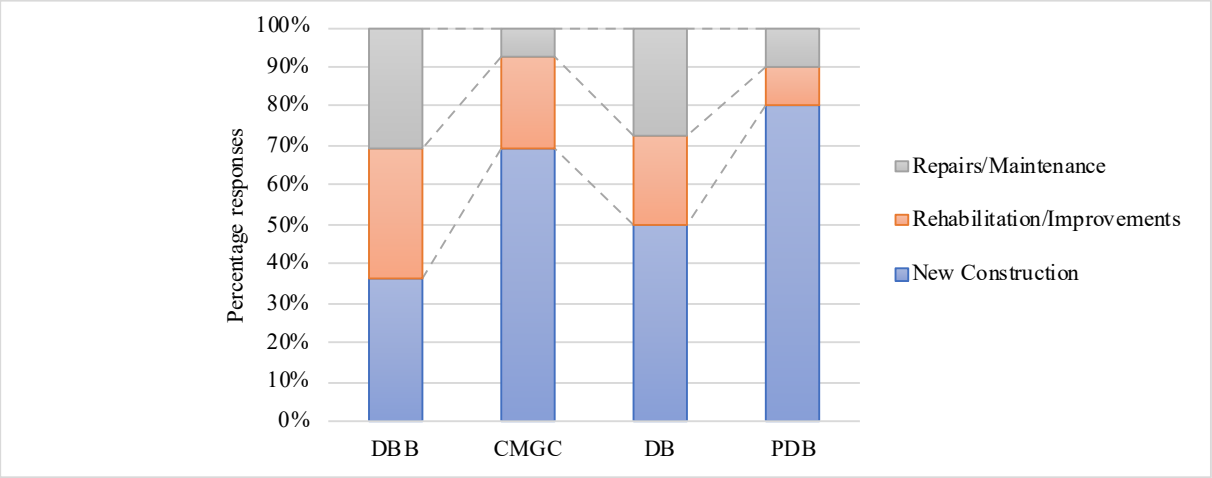
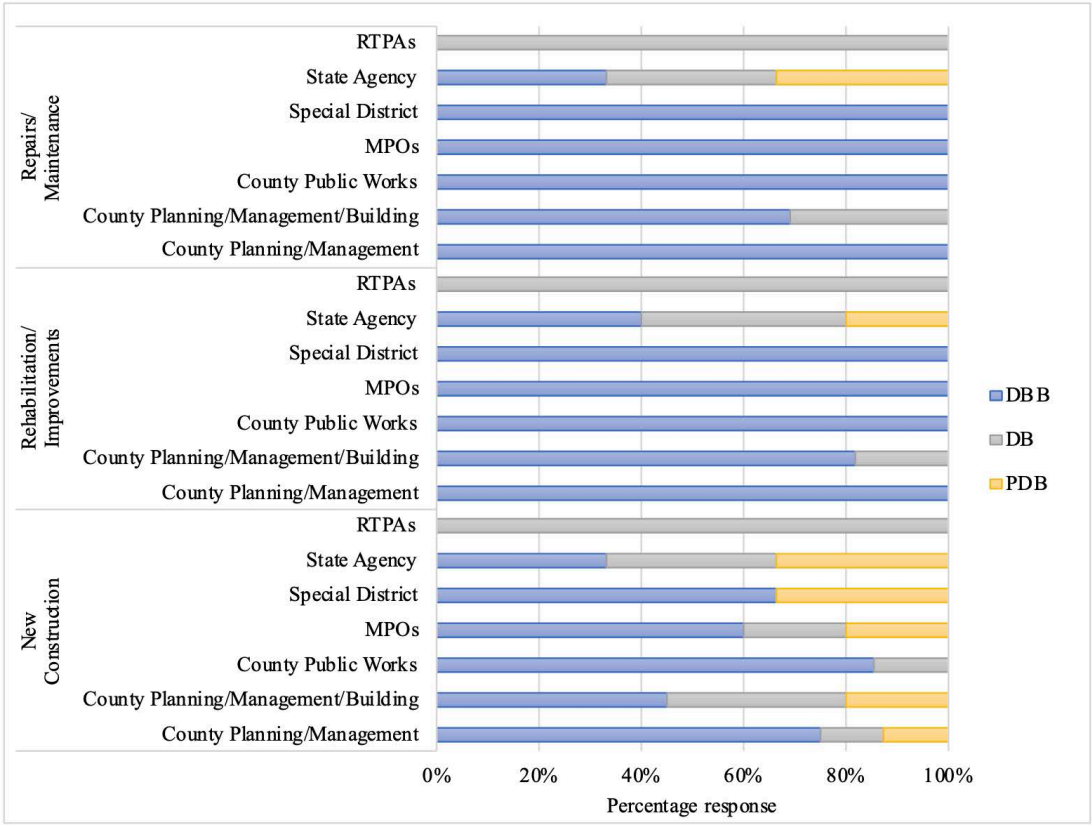
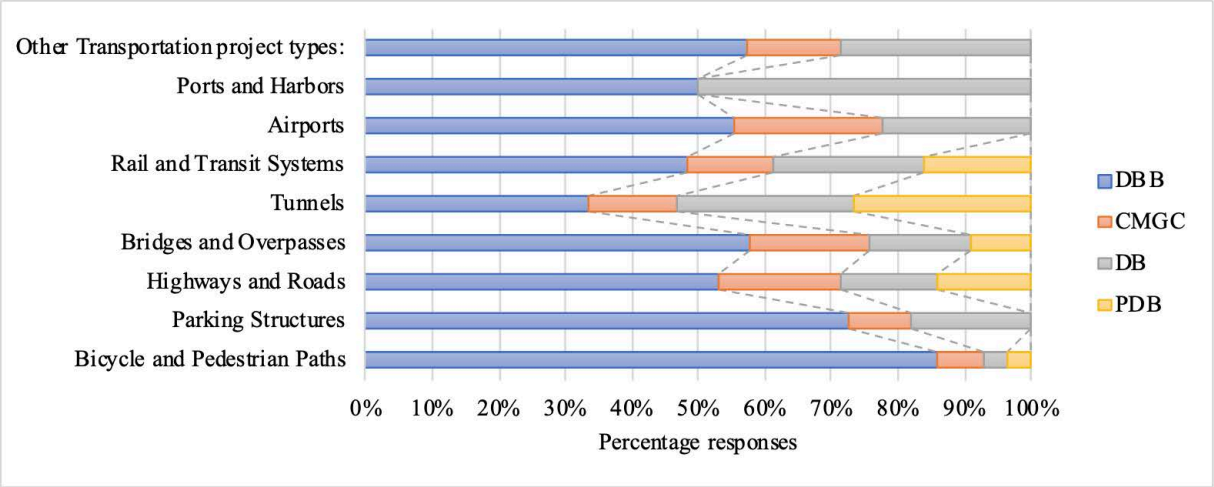


Figure 15. Project Scope Per PDM Per Agency Type



As for the project types, Figure 16 shows that DBB continues to be the most widely used PDM across all project types compared to APDMs. It is seen mostly used in traditional, simpler projects (e.g., roads, paths). CM/GC is preferred for complex, high-risk projects (e.g., airports and bridges), while DB is widely used in integrated, large-scale projects (e.g., rail, airports). PDB is the least used across all types, except for tunnels, possibly due to its newer adoption.

Figure 16. Project Type Per PDM



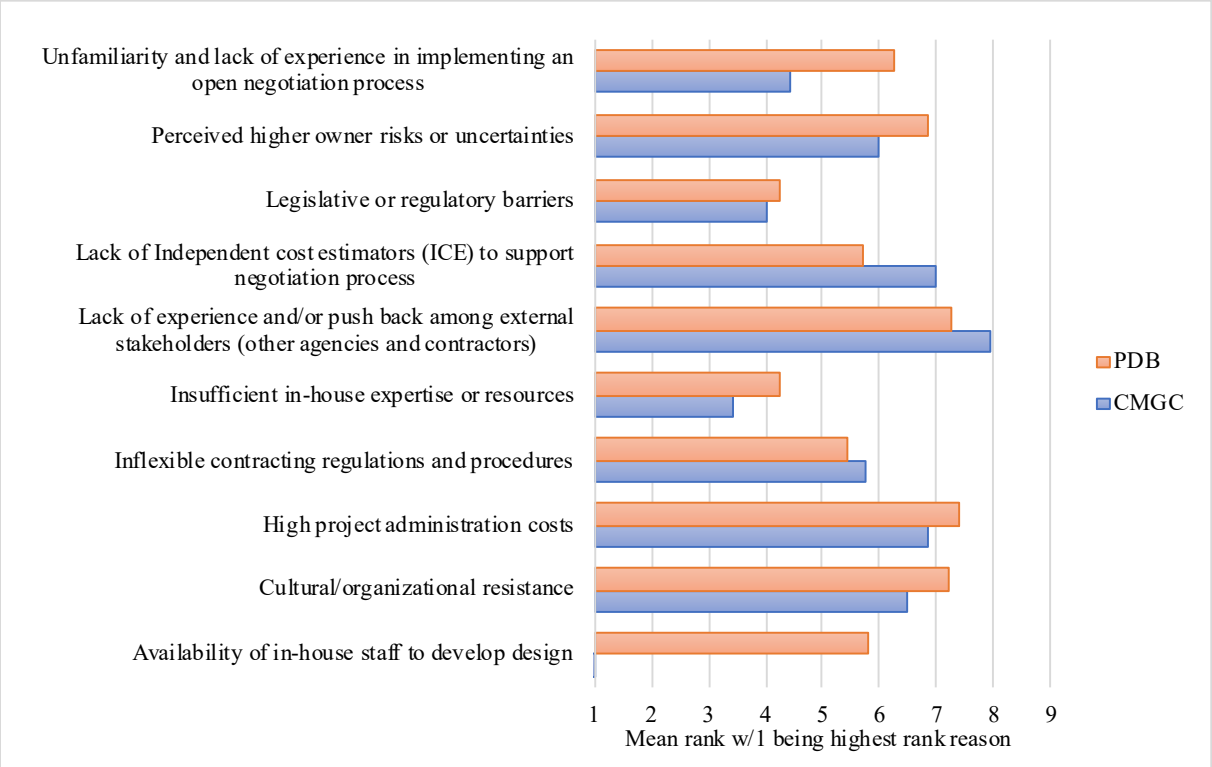
4.3.5 Reasons for not using APDMs

When public agencies and private indicated that they were not using a certain APDM, they were prompted to select from a list of reasons why they were not using it.

Public Agencies. As shown in Figure 17, for both CM/GC and PDB, the top ranked reasons for not using them were insufficient in-house expertise or resources (*M* Rank = 3.41 and 4.26, respectively) and legislative or regulatory barriers (*M* Rank = 4.00 and 4.26, respectively). Unfamiliarity and lack of experience to implement open negotiation process was also ranked higher for CM/GC (*M* Rank = 4.41). The least ranked reason also for both was lack of experience or pushback from external stakeholders (*M* Rank = 7.04 and 7.26, respectively).

Private Agencies. Out of all the private organizations that responded to the survey, four companies reported not utilizing PDB, and only one of those four companies responded to this question. The reasons they selected for not using it were primarily because of unfamiliarity and lack of experience in implementing an open negotiation process and lack of in-house expertise. None of the two companies that reported not using CM/GC responded to this question.

Figure 17. Reasons Ranked by Agencies for Not Using APDMs



4.4 Legal Authority and Enabling Legislation

Agencies were asked to identify the laws enabling their use of the three APDMs. Most agencies either did not respond or cited general references, with only a few naming specific legislation. For DB, out of 51 agencies, 11 (12.2%) cited AB 401, often mentioned alongside Public Contract Code Section 22160. Other citations included references to county boards, the Public Contract Code, Public Utilities Code Section 130242, and Caltrans authority. For CM/GC, 12 (13.3% of respondents) mentioned Caltrans partnership laws, AB 1475, AB 2498, AB 427, AB 2375, Board of Supervisors, Public Contract Code, and Public Utilities Code Section 130242. For PDB, eight agencies (8.9%) mentioned bills, including SB 617, SB 146, and SB 706, along with the Public Contract Code, Public Utilities Code Section 130242, and county-level authority.

In terms of public-intergovernmental agreements, agency responses showed different patterns regarding agreement structures and agency participation levels. A total of 24 agencies provided responses to this question, with 15 agencies confirming their participation in such agreements, seven agencies not being involved in such agreements, and two reporting being unsure of their involvement. The agencies that entered into such agreements most often used Cooperative Agreements (n = 8) to define specific responsibilities and resource commitments between agencies, followed by Memoranda of Understanding (MOUs) (n = 4) which are generally non-binding yet clarify roles and expectations for collaboration. Also, JPAs (n = 2) were stated to establish a legal entity or framework facilitating the joint exercise of authority. Agencies reported entering into

these agreements for several reasons, including coordinating construction responsibilities, extending project coverage across jurisdictions, defining funding arrangements, and clarifying operational roles when projects involve state agencies (such as Caltrans), cities, counties, or multiple regional stakeholders. For example, some respondents noted using MOUs to set construction protocols, while others described Cooperative Agreements for managing shared jurisdiction over infrastructure or formalizing funding roles in freeway development.

4.5 APDMs Characteristics and Procurement Barriers

This section addresses the respondents' answers to the 5-point Likert scale questions (1 = *strongly disagree,* 5 = *strongly agree*) about both characteristics and barriers statements for implementation of the various APDMs. Respondents whose agencies did not implement an APDM were opted out of these questions to ensure that data is solely collected from agencies with respective APDM experiences.

4.5.1 APDM Characteristics

Public Agencies. As seen in Figure 18, the CM/GC question respondents' (n = 14) two most highly reported characteristics included *enhances project collaboration* and *offers owner input to design* (M = 4.29). The lowest reported statements were *provides effective off-ramp* (M = 3.64) and *reduces owner preparation effort* (M = 3.21). For DB (n =18), the highest reported characteristics were *accelerates project completion* (M = 3.55) and *enhances project collaboration* (M = 3.33). The lowest reported opportunities for DB were *reduces owner preparation effort* (M = 2.88) and *improves project quality* (M = 2.89). Finally, for PDB (n = 9), the highest rated statements were PDB *enhances project collaboration* (M = 4.33) and *allows owner's input* (M = 4.22). While the lowest rated statements were *allows effective off-ramp option* (M = 3.22) and *moves most of the project risks to the contractors* (M = 3.10).

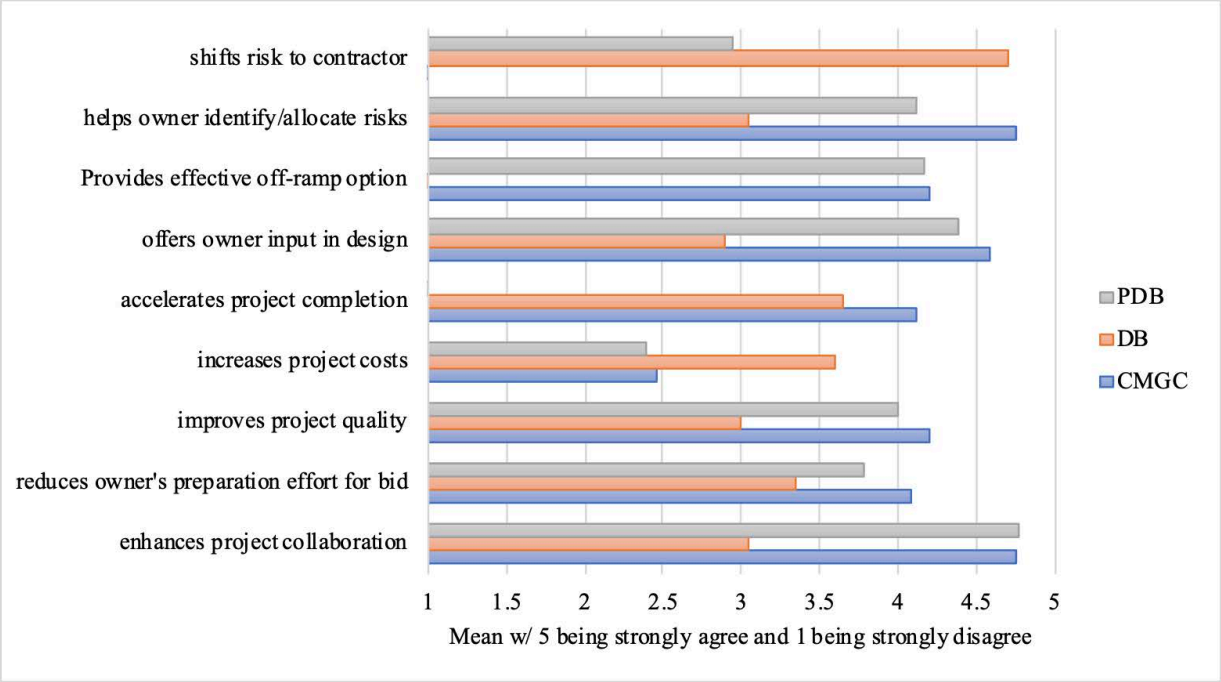
Overall, *collaboration* was consistently rated highly across all PDMs, especially for CM/GC and PDB. Owner input is more valued for CM/GC and PDB than DB. *Reducing owner preparation effort* is the lowest-rated characteristic across all methods. PDB appears to be the most favorably viewed overall in terms owner involvement.

Figure 18. Public Sector Perspectives on APDM Characteristics

Private Agencies. For the private entities who responded to the CM/GC, DB, and PDB characteristics questions (n = 24, n = 20, and n = 18, respectively), as seen in Figure 19, the highest rated characteristics for CM/GC were *enhances project collaboration* and *helps identify/allocate risks* (M = 4.75). The lowest rated statement was *increase project cost* (M = 2.45). For DB, the top-rated characteristic statements were *shift risk to contractor* (M = 4.7) and *accelerates project completion* (M = 3.65). The lowest rated was *improves project quality* (M = 3.05) and *offers owner's input into design* (M = 3.00). For PDB, the highest rated characteristics were *enhances project collaboration* (M = 4.78) followed by *offers owner's input into design* (M = 4.39). The lowest rated characteristics were *increases project costs* (M = 2.39) and *shifts risks to contractors* (M = 2.95).

Risk was not as highly rated by public agencies compared to private agencies. In CM/GC, *allocating risk* was highly rated by contractors, while *shifting risk to contractors* was the highest rated in DB and the lowest for PDB, showing contractors' preference for CM/GC and PDB in terms of risk allocation. *Owner input* is valued more in CM/GC and PDB than in DB. Cost concerns are not prominent for any method, with all scoring low on "*increases project cost*." Comparing public and private organizations perspectives, public entities were more critical of DB's impact on quality and owner involvement, while private entities did not highlight cost concerns as strongly. Both groups rated *collaboration* highly in PDB and CM/GC.

Figure 19. Private Sector Perspectives on APDM Characteristics



4.5.2 Barriers

Public Agencies. As shown in Figure 20, for the public agencies who responded to the CM/GC barriers questions (n = 15), the two highly reported barriers were *complexity of the process* and *lack of in-house expertise* (M = 3.99), followed by *legislative or regulatory constraints* (M = 3.84). The lowest reported barrier for CM/GC implementation was *lack of local contractor buy-in* (M = 3.07). For DB, the highest reported barriers were *complexity of the process* (M = 3.76), followed by *higher perceived cost* (M = 3.67). The lowest reported barrier for DB implementation was *compliance with the National Environmental Policy Act* (NEPA; M = 2.76). Finally, for PDB, the highest reported barrier was *lack of in-house expertise* (M = 3.89), followed by *complexity of the process* and *higher perceived cost* (M = 3.56). The lowest reported barrier for PDB was *compliance with NEPA* (M = 2.44).

It is evident that *complexity* emerges as one of the most reported barriers for all APDMs, with *legislative and regulatory constraints* being reported as barriers for relatively newer APDMs like PDB. These results are in aggregate; thus, a deeper dive into organizational types and their unique requirements and roles might reveal barriers that are also related to internal organizational readiness and external regulatory requirements.

Private Agencies. As shown in Figure 21, for the private agencies who responded to the CM/GC, DB, **and** PDB barriers questions (n = 24), the highest barrier for all three APDMs was *legislative or regulatory constraints* (Ms = 3.79, 3.57, and 3.75, respectively). This was followed by *high perceived cost* for CM/GC and DB (Ms = 3.70 and 3.57, respectively) and *complexity of the process*

of PDB. The lowest reported barrier for CM/GC and PDB implementation was *compliance with NEPA* (*M*s = 2.66 and 2.75, respectively), while for DB, it was *lack of in-house expertise and experience* (*M* = 3.05). For PDB, the highest reported barrier was *legislative and regulatory constraints* (*M* = 3.75). This was followed by *complexity of the process* and *higher perceived cost* (*M* = 3.24).

Figure 20: Public Sector Perspective on Barriers that Hinder APDMs Implementation

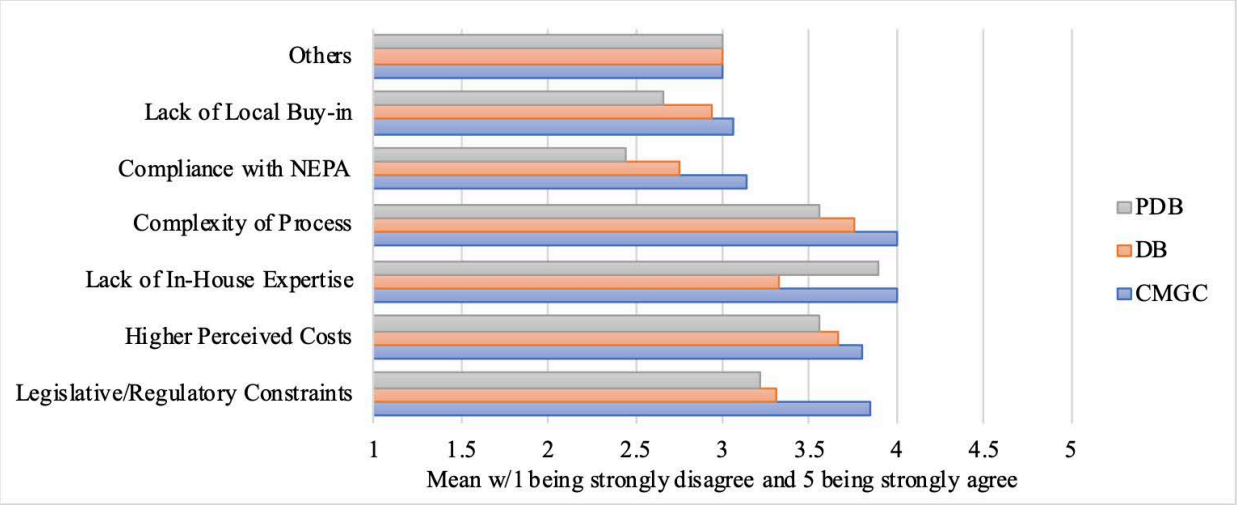
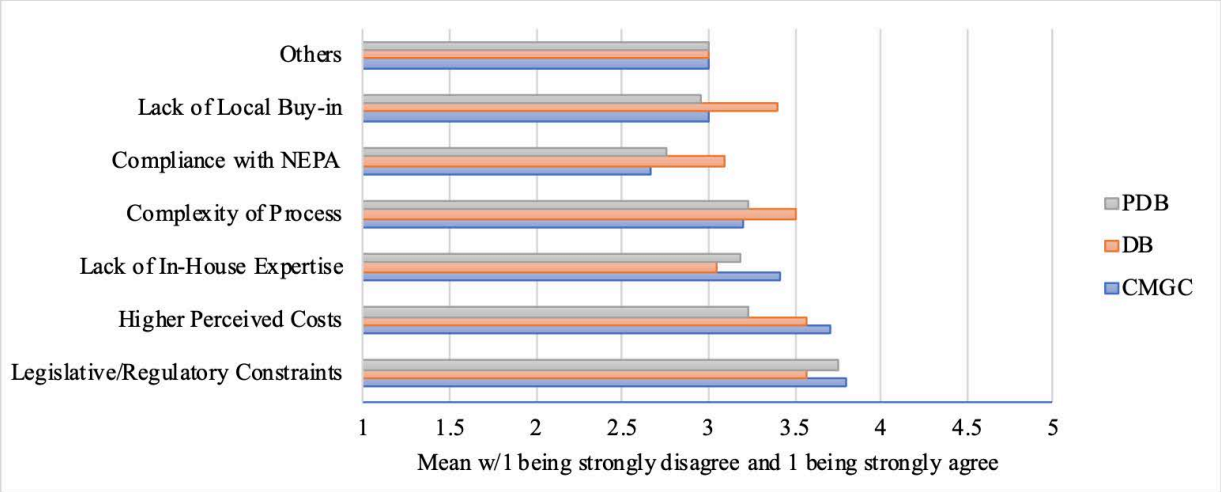


Figure 21. Private Sector Perspectives on Barriers that Hinder APDM Implementation



Comparing the public and private organizations shows the that public agencies view CM/GC as more complex with lack of in-house experience, while private entities felt CM/GC face more regulatory hurdles. Public agencies felt less prepared than private ones, especially for CM/GC and PDB. They perceived higher barriers overall for CM/GC. Both public and private agencies agreed on the higher costs perceived and higher perceived costs for CM/GC. NEPA compliance and local contractor buy-in were not seen as a major barrier overall.

4.6 APDMs Selection Factors

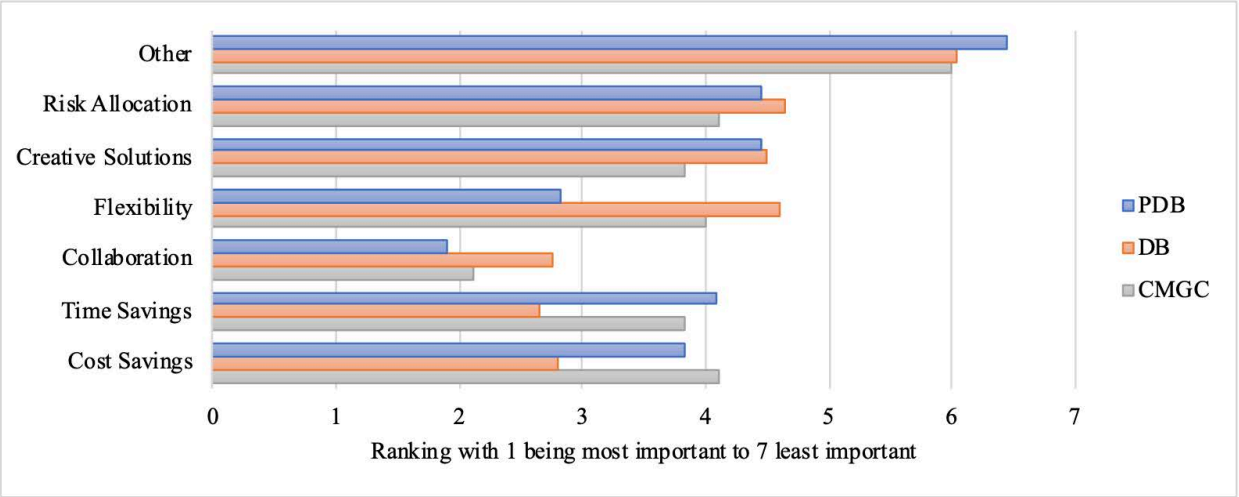
This section addresses the selection factors that drive public agencies to use APDMs and private agencies to pursue these APDM projects. Respondents were asked to rank factors influencing their decision to select/pursue the various APDMs, with 1 indicating the most important and 7 the least important.

4.6.1 Public Sector Decision to Select APDMs

For **CM/GC**, as shown in Figure 22, the highest ranked factor was *collaboration between the owner, contractor, designer, and other stakeholders* (*M* rank = 2.12). *Time savings* and *fostering creative solutions* were the next highest-ranked factors (*M* rank = 3.82). The least ranked were *cost savings* and *appropriate risk allocation* (*M* ranks = 4.12). The "Other" category had the lowest overall ranking (*M* rank = 6.00), but three respondents provided specific insights, including the ability to use the same contractor in multiple segments to streamline coordination and the value of cost and schedule certainty. For DB, *time savings* was ranked as the most important factor (*M* rank = 2.65), followed by *collaboration* (*M* Rank = 2.75). *Risk allocation* was considered the least important (*M* rank = 4.65), followed by *flexibility* (*M* Rank = 4.60). For PDB, similar to CM/GC, *collaboration* was the highest ranked (*M* rank = 1.91), followed by *flexibility,* unlike DB. The least important was *risk allocation* and *creative solutions* (*M* Rank = 4.45).

Across all APDMs, collaboration between stakeholders was consistently viewed as a critical driver for APDMs selection. PDB is appreciated for its flexibility, while DB is seen as more rigid and favored for its time savings. Although collaboration consistently ranks as a top factor across all APDMs, agency-specific priorities vary. County Planning/Management and State agencies placed greater emphasis on *cost savings* (*M* Ranks = 1.5) and *time savings* (*M* Rank = 2.5 and 3.5, respectively) in DB. MPOs focused on *time* (*M* Rank = 1.0) and cost savings (*M* Rank = 2.0) but rated *flexibility* lowest (*M* Rank = 7.0). In contrast, Special Districts prioritized *creative solutions* (*M* Rank = 2.0) and *flexibility* (*M* Rank = 3.0) in PDB, while placing less importance on *cost* (*M* Rank = 5.0) and *time savings* (*M* Rank = 6.0).

Figure 22. Public Agency Rankings of APDM Selection Factors



4.6.2 Private Sector Decision to pursue APDMs

As for factors influencing private organizations' decision to pursue CM/GC, Figure 23 shows that the highest ranked factor by the respondents (n = 25) was *collaboration among stakeholders* (M Rank = 1.84), followed by *appropriate risk allocation* (M Rank = 2.16). *Time savings* was rated as least important (M Rank = 5.00). These results suggest companies prioritize collaboration and risk-sharing over time efficiency when considering CM/GC projects. As for DB (n = 25), the survey participants ranked *cost savings* (M Rank= 3.32) as the most important factor, followed by *collaboration* (M Rank = 3.44). *Flexibility* (M Rank = 4.04) was ranked as the least important factor. For PDB (n = 23), *stakeholder collaboration* was again ranked as the most significant factor (M Rank = 1.87) while *appropriate risk allocation* received the second highest rating (M Rank = 2.43). *Time savings* received the lowest ranking (M Rank= 5.13).

Figure 23. Private Agency Rankings of APDM Selection Factors

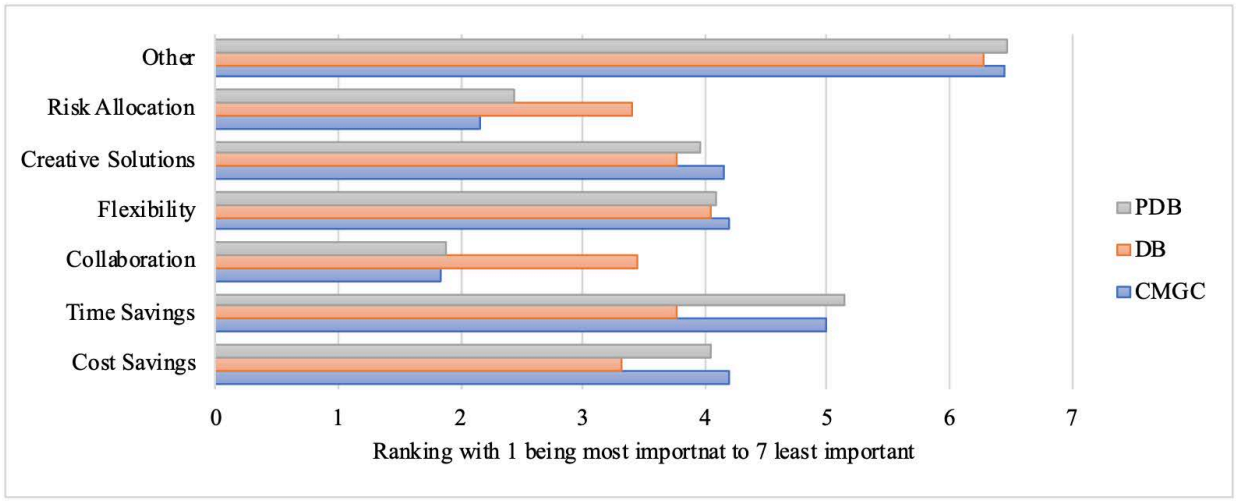
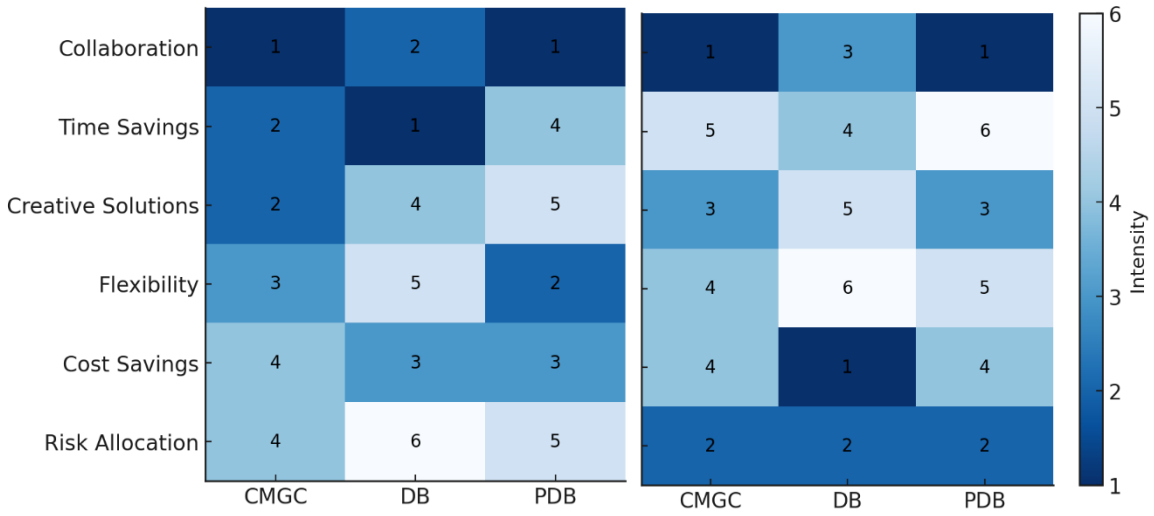


Figure 24 is a heatmap of the selection factors for both public and private sectors, with darker blue being the most important for each APDMs. While *collaboration* emerges as one of the most, if not the most important selection/pursuit factors for both public and private sectors, both sectors' opinions on DB are not aligned, with *risk allocation* showing mixed views. PDB, being one of the newest methods, seems to have also varied perspectives.

Figure 24. Heatmap Showing Ranking of Public Agencies APDM Selection Factors and Private Agencies Decisions to Pursue Projects Factors



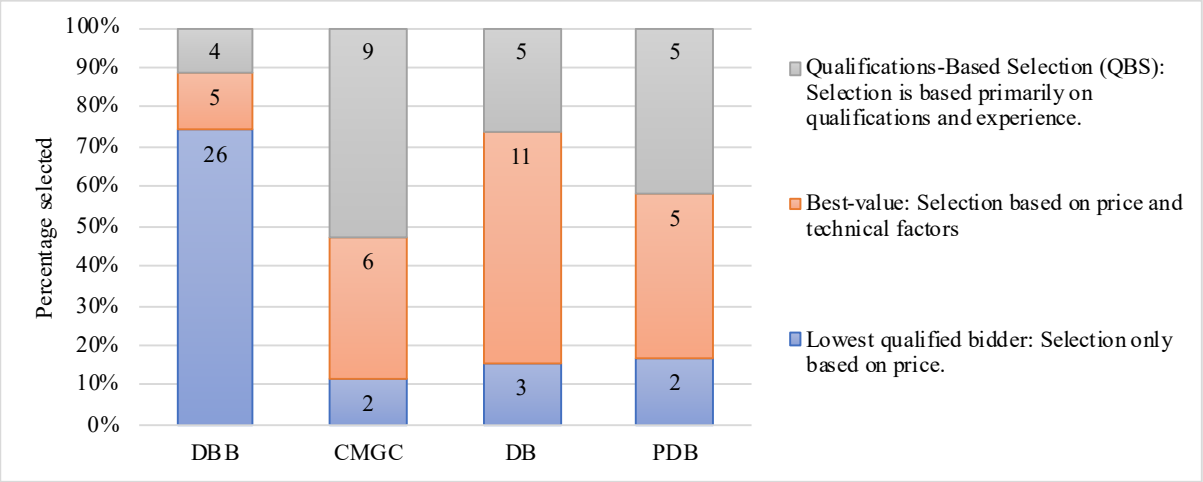
4.7 Procurement Methods

This section discusses the various aspects of APDM projects procurement, including selection methods utilized, procurement challenges, effect of legislation on procurement, and recommendations for improvements.

4.7.1 Procurement Selection Strategies

Respondents were asked to select the procurement methods used in the various PDMs they employ. As shown in Figure 25, out of the 35 responses for DBB, the most selected response was *lowest bidder* (n = 26). For CM/GC, out of 17 responses, the most selected response was *QBS* (n = 9), followed by the *Best-Value (BV) method* (n = 6), and *low-bidder* (n = 2). For DB, out of 19 responses, BV was the most selected (n = 11), followed by QBS (n = 5) and *low bidder* (n = 3). For PDB, out of 12 responses, *QBS* and *BV* were used equally (ns = 5). All of these responses came from the different types of agencies—county, local, and special agencies—highlighting that more progressive procurement methods (QBS and BV) are tightly coupled with APDMs that emphasize qualifications.

Figure 25. Procurement Selection Method by PDM

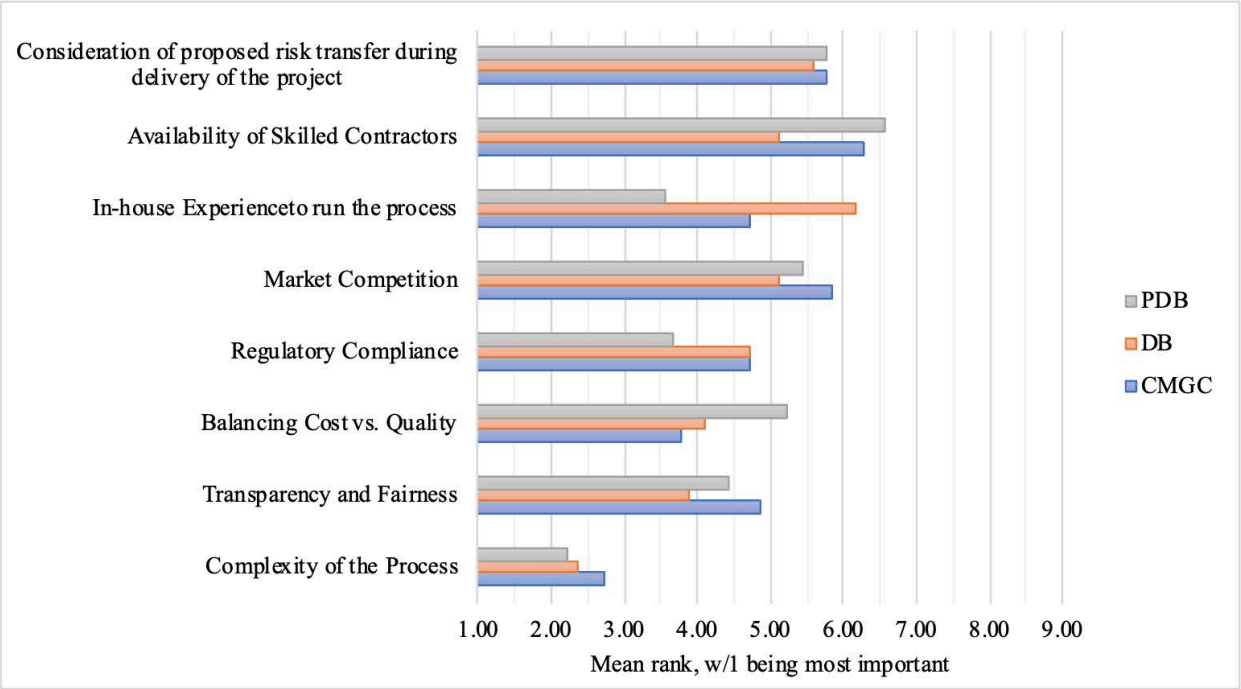


4.7.2 Procurement Challenges

The survey investigated the major obstacles organizations encounter during APDM project procurement through respondent rankings of their challenges, with 1 being the most significant and 8 being the least.

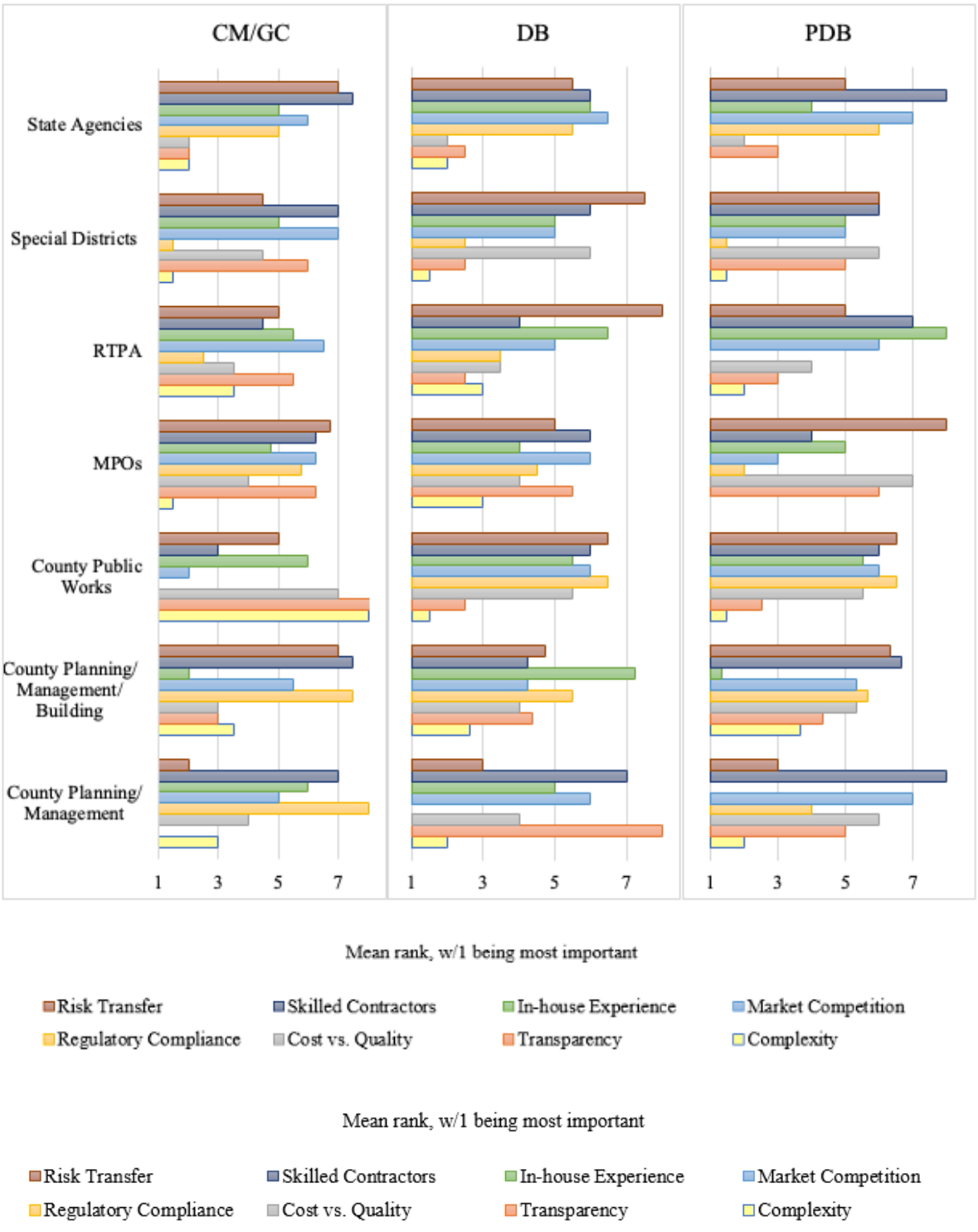
Public. As shown in Figure 26, the top challenge reported by the 14 public agency respondents for all three APDMs (CM/GC, DB, and PDB) was *complexity of the process* (*M* Rank = 2.71, 2.37, and 2.22, respectively). For CM/GC, the next highest top challenge reported was *cost vs. quality* (*M* Rank = 3.79). The least ranked challenge was *skilled contractors* (*M* Rank = 6.29). As for DB, the next highest challenge after complexity was *transparency* (*M* Rank = 3.89). The least significant challenge reported was *in-house experience* (*M* Rank = 6.16). As for PDB, the next highest challenges were *in-house experience* (*M* Rank = 3.56). The lowest ranked challenge was *the availability of skilled contractors* (*M* Rank = 6.56). Overall, the complexity of the process emerged as the highest procurement challenge in all PDMs. The lowest procurement challenge for CM/GC and DB was the in-house experience and for PDB it was the availability of skilled contractors.

Figure 26. APDM Challenge Rankings from the Public Sector



Agency Types. A deeper dive in the procurement challenges based on agency types showed different patterns, as shown in Figure 27. MPOs (*n* = 4), Special Districts (*n* = 2), and State Agencies (*n* = 2) all ranked *complexity* as their top challenge in CM/GC, DB, and PDB (*M* Rank = 1.5, 1.5, and 2, respectively). For CM/GC, the County Planning/Management agency that responded to this question ranked *transparency and fairness* as their top challenge (*M* Rank = 1.0). In addition, the County Public Works (*n* = 1), RTPAs (*n* = 2), and Special Districts (*n* = 2) ranked *regulatory compliance* as their top challenge (*M* Rank = 1, 2.5, and 1.5, respectively), and the County Planning/Management/ Building (*n* = 2) ranked *in-house experience* as their top challenge (*M* Rank = 2). This indicates that agencies experience different challenges based on their own constraints whether organizational or regulatory. For DB, all agencies except the County Planning/Management (*n* = 1) and the RTPA (*n* = 2) agreed with *complexity* being the top challenge. For PDB, top ranked challenges also varied based on the agency type. The MPO (*n* = 1), Special Districts (*n* = 2), and State Agencies (*n* = 1) were again in agreement (similar to CM/GC), with the top challenge being *complexity* (*M* Rank = 1, 1.5, and 1, respectively), while the County Planning/Management (*n* = 1) and the County Planning/Management/Building (*n* = 3) entities reported *in-house experience* as the top ranked challenge (*M* Rank = 1 and 1.33, respectively). The RTPA (*n* = 1) reported *regulatory compliance* as their top challenge (*M* Rank = 1).

Figure 27. APDM Procurement Challenges Across Different Public Agency Types

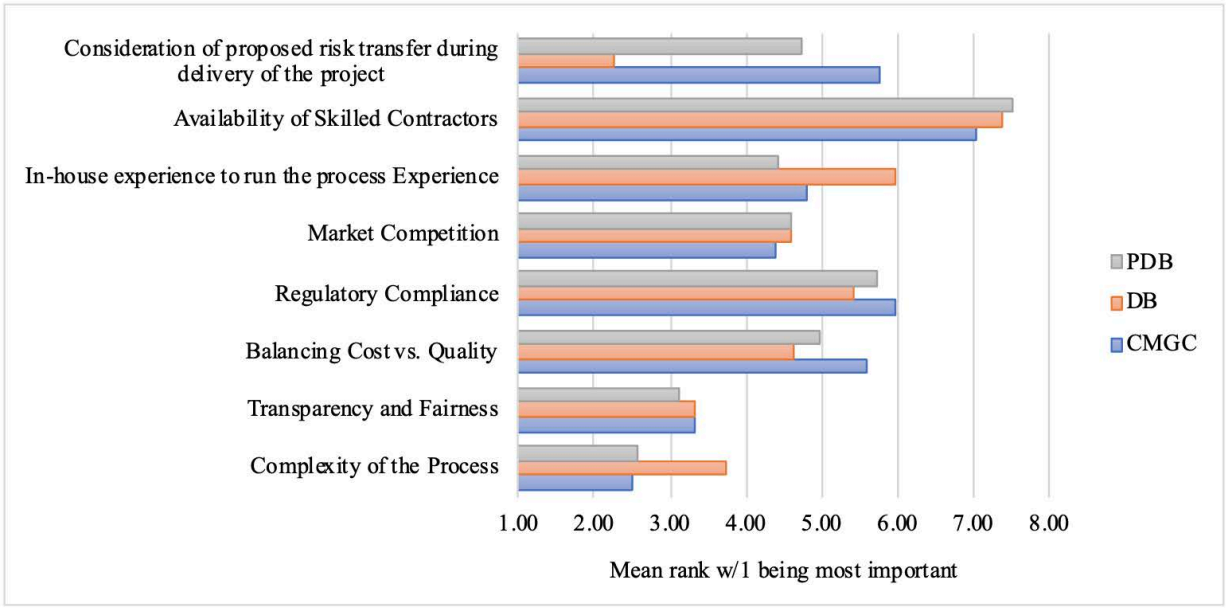


Mean rank, w/1 being most important
Risk Transfer
Skilled Contractors
In-house Experience
Market Competition
Regulatory Compliance
Cost vs. Quality
Transparency
Complexity

Private. As shown in Figure 28, *complexity* came as the main challenge in the procurement process for both CM/GC and PDB (*M* Rank = 2.55 and 3.33, respectively), while consideration of *proposed risk transfer during delivery of the project* (*M* Rank = 2.27) was the highest for DB. The second major challenge for all APDMs (CM/GC, DB, and PDB) was *transparency and fairness* (*M* Rank = 3.33, 3.32, and 3.13, respectively). For all APDMs, the least significant challenge was the *availability of skilled contractors* (*M* Rank = 7.04, 7.36, and 7.52, respectively).

Comparing the public and private sectors, the complexity of the procurement process continues to stem as the highest ranked challenge in most cases, except for the private sector for DB where risk transfer is ranked the most challenging. However, secondary concerns vary for the private and public sector; the second highest challenge is transparency for the private sector as well as for DB in the public sector. For CM/GC in the public sector, the highest challenge was the balance between cost and quality, and for PDB, it was in-house experience. The least ranked for all cases was the availability of skilled contractors, with the only exception of in-house experience to run the process for DB for public agencies. This was the opposite of PDB's highest ranked challenge and could be attributed to PDB being one of the newest PDMs.

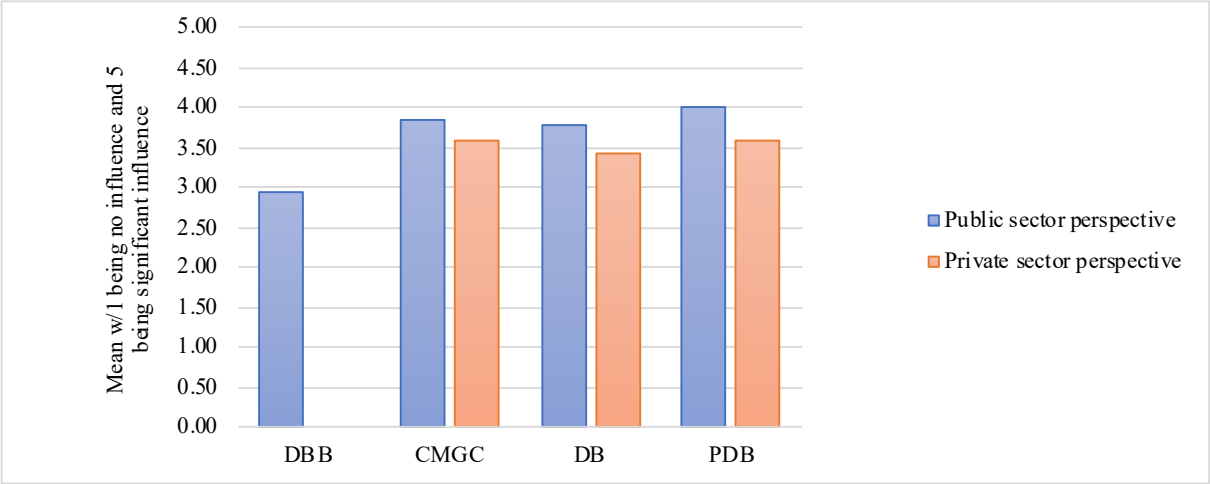
Figure 28: APDM Procurement Challenges Across Different Private Organizations



4.7.3 Influence of Legislative/Regulatory Factors on the Procurement Process

In terms of the influence of legislative and regulatory factors in the implementation of APDMs overall as well as in the procurement process, the public sector reported higher influence for APDMs procurement, in general, compared to the traditional method, DBB. The highest legislative influence on APDM implementation was reported on PDB and CM/GC and less on DB (Figure 29).

Figure 29. Comparison of Public and Private Sector Perspectives on the Legislative Influence of Delivery Methods



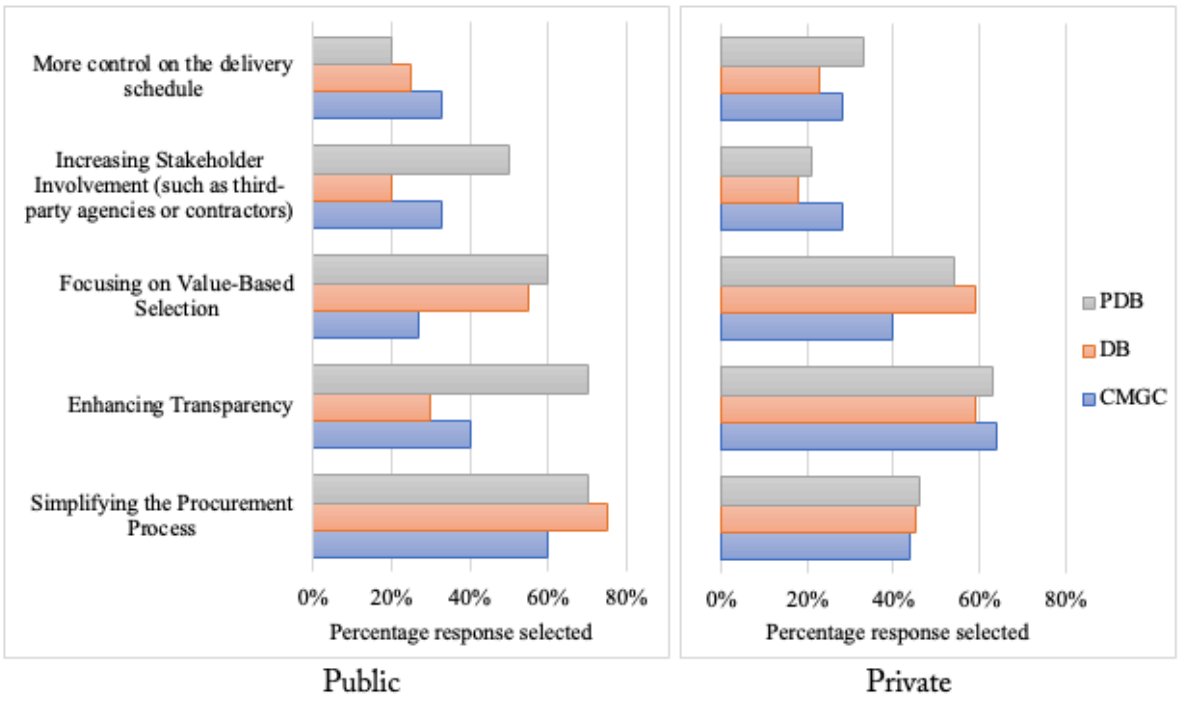
4.7.4 Recommendations for Procurement Improvement

Respondents were asked to select all applicable improvement recommendations for APDMs procurement for each of the APDMs.

Public Agencies. Among the five identified improvement areas shown in Figure 30, CM/GC's most selected improvement areas focused on *simplifying the process* (40%), followed *by stakeholder involvement* (25%). DB improvement recommendations focused more on *simplifying the process* (60%) and *value-based selection* (35%), and they focused less on *stakeholder involvement* (15%) and *transparency* (20%). PDB's most frequently selected areas included *simplifying the procurement process* (65%), *increasing stakeholder involvement* (60%), and enhancing *transparency* (55%). These results suggest that public agencies see the greatest need for procurement process simplification for all three APDMs—aligning with the barrier of complexity mentioned earlier—and value-based selection was emphasized specifically in DB and PDB.

Private Agencies. As shown in Figure 30, the private sector did not select *simplifying the process* as frequently as the public sector. The highest selected overall was *enhancing transparency*, with CM/GC at 64%, DB at 59%, and PDB at 63%. For DB and PDB, *value-based selection* was also emphasized (59% and 54% respectively). These findings suggest that private entities see the greatest need for procurement process improvements in transperancy and value-based selection, whereas public agencies mostly focused on simplying the procurement process but also emphasized value-based like the private sector.

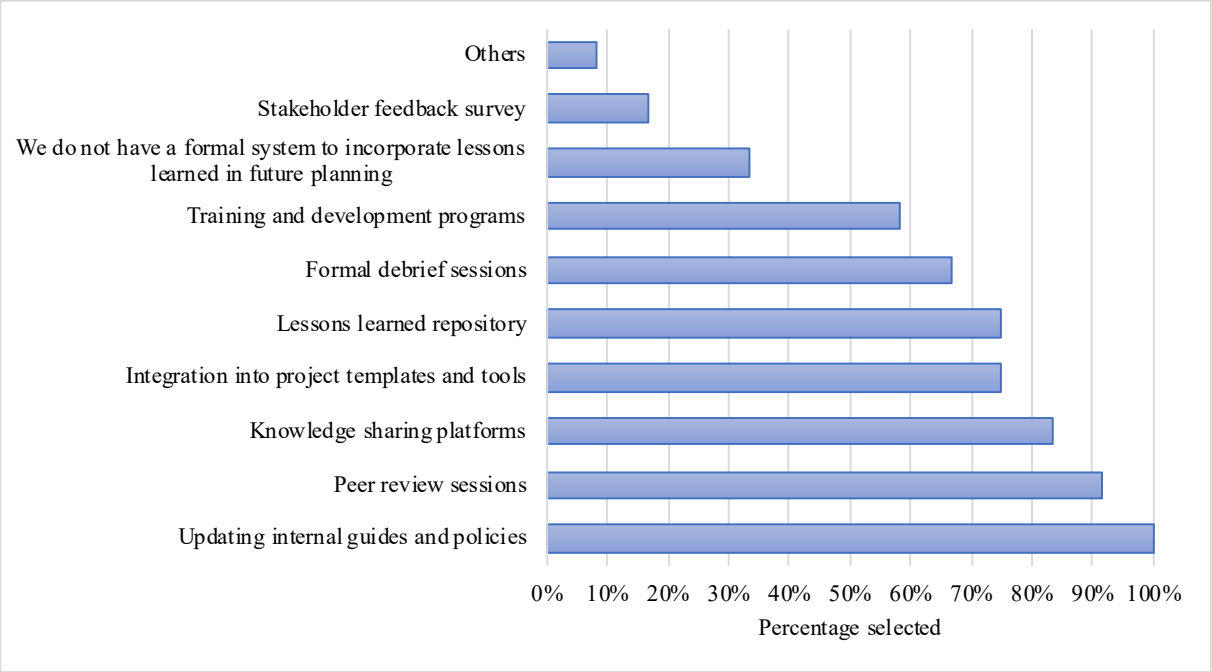
Figure 30. APDM Procurement Improvement Recommendations for the Public and Private Sector



4.8 Lessons Learned and Overall Recommendations for Improvement

As shown in Figure 31, the survey findings show that public agencies use various methods to implement lessons learned from past APDMs projects, with *updating internal guides and policies* being the most popular choice among all respondents to this question (n = 12). This was followed by *peer review sessions* (91.7%), *knowledge sharing platforms* (83.3%), and *project templates and tools integration lessons learned repositories* (75.0%) as other frequently used methods. The least used method is *stakeholder feedback survey* (16.7%). This reinforces the previously mentioned recommendation for improvement of involving more stakeholders.

Figure 31. Methods Used by Agencies to Incorporate APDMs and Lessons Learned



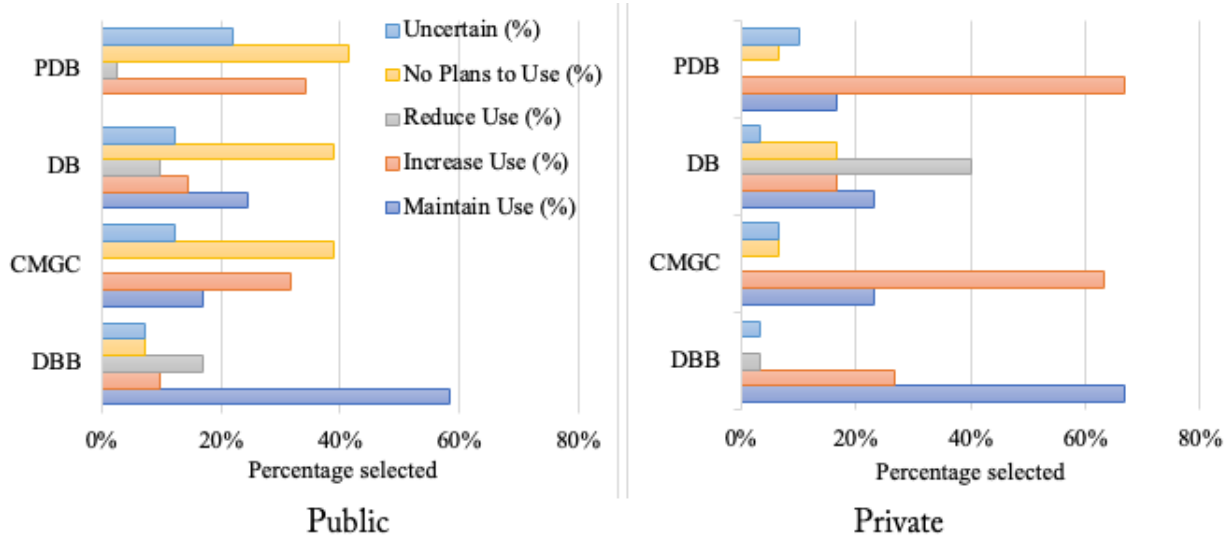
The open-ended question further addressed recommendations for best practices in planning, selecting, procuring, and implementing the APDMs the agency uses, especially as pertains to legislation. For CM/GC, respondents stated statements such as that the method should receive expanded legislative authority to enable wider application while maintaining that project selection should not rely only on cost factors. The evaluation of CM/GC projects should focus on total value delivery because this method excels at complex projects that need innovative solutions from contractor-designer collaboration. As for DB recommendations, responses included removing superfluous regulatory obstacles while educating local agencies about APDMs and establishing a transparent scoring system for selection. The procurement process needed better clarification on roles of oversight staff and quality verification personnel. The comments about PDB stated that this method remains new to the market and suggest that legislative authorities should expand to support more project types, especially innovative and non-traditional projects.

4.9 Future Use and Implementation Plans

Public Agencies. Out of 51 public agencies surveyed, 41 agencies (80.4%) responded to the question regarding their future plans for using APDMs. Among these agencies, DBB remained the most widely used method. As shown in Figure 32, a majority of respondents (58.5%) indicated plans to *maintain current use* of DBB. Other respondents indicated plans to *reduce* its use (17.1%) or *increase* use (9.8%), or they reported having *no plans to use it* or having *uncertainty* about use (7.3% each). For CM/GC, 31.7% plan to *increase* use, while 17.1% plan to *maintain* current use and about 12.2%were *unsure*. Notably, 39.0% reported *no plans to use* the method, and *no respondents* indicated intent to *reduce* usage of CM/GC. DB showed diverse interest, with 39.0% reporting *no plans to*

use it, 24.4% intending to *maintain* current usage levels, 14.6% intending to *increase* use, 9.8% intending to *reduce* use, and 12.2% expressed *uncertainty* regarding use. PDB, while less established, shows increasing interest. Despite 41.5% indicating *no plans to use* PDB, 34.1% plan to *increase* use. A smaller proportion reported *uncertainty* (22.0%) or intent to *reduce* use (2.4%). No respondents indicated they intend to *maintain* current use of PDB, which could be attributed to PDB being a new method.

Figure 32. Plans for Future Use of APDMs from Public Agencies and Private Organizations



A deeper dive into agency preferences for APDMs revealed notable variation across agency types. Among County Planning/Management Agencies (n = 7), DBB remains the dominant method, with 71.4% *continuing its use* and 14.3% citing internal procedures guiding delivery selection. CM/GC received minimal support, with 71.4% reporting *no future use* and 28.6% expressing *possible increases*. Similarly, DB showed limited engagement, with 71.4% indicating no future use and only 14.3% *planning to increase usage*. PDB adoption was also low, with 85.7% reporting no plans to use it and just 14.3% *indicating future interest*. These agencies appear risk-averse, favoring traditional methods over newer APDMs. In contrast, County Planning/Management/Building Agencies (n = 13) demonstrated significantly more openness to APDMs. While 100% of agencies affirmed continued DBB use, CM/GC stood out, with 46.2% *planning to increase* use and 23.1% remaining undecided. DB showed moderate uptake, with 38.5% *planning to maintain current* levels, 23.1% to *reduce*, and 7.7% to *increase usage*. PDB demonstrated the highest growth outlook, with 58.3% reporting plans to *increase use* and only 8.3% *planning to reduce*, suggesting an overall progressive stance toward alternative delivery models.

County Public Works Agencies (n = 8) showed continued reliance on DBB, particularly for transportation projects. CM/GC showed limited acceptance, with 62.5% reporting *no future use*, 25% *planning to maintain*, and 12.5% *planning to increase use*. DB usage expectations were mixed—50% reported *no plans to use* it, while 25% expected *continued or increased use*. PDB also faced

hesitancy: 50% reported *no plans to use it*, 25% planned *to increase use*, and 25% were *undecided*. These agencies appear to maintain a traditional foundation while cautiously exploring alternatives.

Among MPOs (n = 5), DBB remains central, with 100% indicating *continued use*, though only 20% explicitly planned to *maintain it*. CM/GC showed mixed outlooks, with 40% planning to *maintain use*, 20% planning *to increase*, and 20% *reporting no plans*. DB had low anticipated use, with 60% reporting *no future plans*, 20% planning to *maintain use*, and 20% *uncertain*. PDB received a similarly cautious response: 40% *do not plan to use it*, 20% *plan to increase use*, and 40% remain *undecided*. MPOs thus reflect moderate openness to APDMs, though DBB remains the base.

Private. As for future use and implementation plans for different APDMs, as also shown in Figure 32, the majority of private agency respondents (66.7%) reported that they will *maintain* their existing DBB project pursuit levels, while 26.7% plan to *increase* their efforts. The CM/GC delivery method demonstrates the most promising growth potential, with 63.3% of respondents planning to *increase its use*, 23.3% intending to *maintain* their current level of involvement, and only 6.7% having *no plans to pursue this method*. The DB delivery method shows a conservative approach, with 56.7% of respondents planning to *decrease or abstain from involvement* and only 16.7% intending to *increase* their use—indicating possible challenges with this approach. The PDB method demonstrates the strongest growth outlook, with 66.7% of respondents planning to *increase* their use and 16.7% intending to *maintain* their current level of involvement, confirming its status as a developing delivery strategy. Among the APDMs, CM/GC and PDB receive the most positive outlooks for future development, while DB faces the highest level of uncertainty.

Comparing both private and public, private entities are more proactive in expanding the use of CM/GC and PDB. Public agencies are more conservative, with a significant portion still undecided or not planning to adopt some of these APDMs. DBB remains the most stable method across both sectors. The private sector shows strong growth interest in CM/GC, while the public sector is more cautious. DB is the most contested method. Public agencies are split, with 39% having no plans to use it and only 14.6% planning to increase use. In contrast, private entities are more skeptical: 56.7% plan to reduce usage or avoid it. For PDB, the private sector shows the strongest growth interest (66.7% plan to increase use), while the public sector is across the board, with 41.5% having no plans to use it and 34.1% planning to increase its use.

4.10 Inferential Analysis

Further inferential analyses were conducted to evaluate the statistical significance and relationships between the various variables of the study as detailed in Section 2.3.3 and Table 2. This section details the results of these tests.

4.10.1 Public vs. Private and Overall APDM Maturity

H_{o1}: Public and private sector organizations have the same distribution of APDM maturity scores.

To evaluate the APDM maturity level of the agency, a composite variable (*maturityintensecombin*) was created in SPSS through the summation of four maturity-related questions which corresponded to DBB, CM/GC, DB, and PDB. The maturity levels had numerical values starting from 0 (not implemented) up to 4 (fully mature) resulting in a possible composite score ranging from 0 (no maturity across all methods) to 16 (fully mature across all methods). The selection of an appropriate statistical test required initial assessment of the composite variable's normality through skewness analysis, kurtosis examination, and visual inspection of histograms and Q–Q plots. The data did not satisfy the assumptions of normality. Given the non-normal data and $n = 78$ participants, a non-parametric test was used to compare public and private organizations. A Mann–Whitney U test was conducted to examine differences in APDM maturity between the public ($n = 45$) and private sector ($n = 33$). The results showed a statistically significant difference in the median scores, as follows:

$U = 519.000$, $Z = -2.273$, $p = 0.023$ (two-tailed).

The maturity intensity mean rank for the private sector (M rank = 46.27) was higher than the public sector (M rank = 34.53), indicating significantly higher APDM maturity for the private sector.

4.10.2 Public vs. Private and Future APDM Adoption Plans

H_{o2}: Public and private organizations have the same distribution of future adoption plans for each APDM (CM/GC, DB, PDB).

To examine whether public and private sector agencies in their future plans for adopting each APDM (CM/GC, DB, and PDB), the Fisher-Freeman-Halton Exact Test was conducted. Due to violations of the Chi-square test assumptions—specifically, 60% of cells with expected counts less than 5—the exact test was deemed more appropriate. As shown in Table 4, the results were all statistically significant ($p < 0.001$). These findings provide evidence of statistically significant differences between public and private sector agencies in their planned adoption of APDMs.

Table 5. Results of Fisher Exact Tests for Hypotheses 2 for 3 APDMs

H_{o2}: There is no significant association between sector type and plans for future use of:	***p*-value**	**Interpretation**
CM/GC	$p = 0.003$*	Significant association; reject H_0
DB	$p = 0.020$*	Significant association; reject H_0
PDB	$p < 0.001$*	Highly significant; reject H_0.

Note. The significance threshold used was $\alpha = 0.05$ for all tests.

4.10.3 Organization's Maturity Level and Future Adoption Plans

H_{o3}: There is no association between an organization's APDM maturity level and its future adoption plans for that APDM.

To examine the relationship between organization's maturity level and their future plans for adopting each APDM (CM/GC, DB, and PDB), the Fisher-Freeman-Halton Exact Test was conducted. As shown in Table 5, no statistically significant association was found for DBB and CM/GC, whereas significant associations were observed for DB and PDB. This pattern may reflect the industry's limited preference to use DB in the future based on their previous experiences, and that PDB is relatively a new method, with sparse adoption among the agencies.

Table 6. Results of Fisher Exact Tests for Hypotheses 3 for All PDMs

H_{o3}: There is no significant association between organization maturity and plans for future use of:	***p*-value**	**Interpretation**
DBB	$p = .054$	Marginally not significant, fail reject
CM/GC	$p = 0.492$	Not significant, fail to reject H_0
DB	$p < 0.009$	Significant association; reject H_0
PDB	$p < .001^*$	Highly significant; reject H_0.

Note. The significance threshold used was $\alpha = 0.05$ for all tests.

4.10.4 Agency Maturity Level and Barriers Ranking

H_{o4}: Barrier rankings are the same across APDM maturity levels.

To test these hypotheses, the non-parametric Kruskal–Wallis H test was used to compare ordinal barriers data (ranking scores from 1 to 7, with 1 = most important) across the different APDM maturity categories (not implemented, initial awareness, early adoption, developing, and fully mature). Each barrier was tested independently to assess whether its importance ranking was significantly different based on APDM maturity.

As seen in Table 6, the Kruskal–Wallis test results indicate that most of the barriers had statistically significant differences in their importance rankings across agencies across CM/GC, DB, and PDB's differing maturity levels. In most cases, the *p*-values exceeded the significance threshold (ps > 0.05), indicating insufficient evidence to reject the null hypothesis. However, only the *complexity of process* barrier in DB showed a statistically significant difference ($p = 0.046$), suggesting variation in perceptions based on agency experience, with less mature agencies perceived the process as more complex, as reflected by their higher mean ranks. For example, agencies at the "not implemented" stage had a mean rank of 11.3, compared to 5.4 for "fully mature" agencies. This implies that organizations, regardless of how mature they are in their APDM implementation, tend to experience mostly the same barriers.

Table 7. Results of Kruskal Wallis Tests for Hypothesis 4

Barrier	*p*-value		
	CM/GC	***DB***	**PDB**
Legislative/Regulatory Constraints	0.557	0.482	0.346
Higher Perceived Costs	0.623	0.437	0.999
Lack of In-House Expertise	0.939	0.109	0.625
Complexity of Process	0.805	**0.046***	0.295
Compliance with NEPA	0.817	0.457	0.189
Lack of Buy-In from Local Contracting Community	0.817	0.305	0.184

Note. The significance threshold used was $\alpha = 0.05$ for all tests.

4.10.5 Public Versus Private Sector and Selection Factor Ranking

H_{o5}: Public and private organizations rank APDM selection factors the same way.

Mann–Whitney U tests were used to compare public and private organizations selection factor rankings in each of the three APDMs. As shown in Table 7, the test results indicate that time savings was the only factor with statistically significant difference between the public and private sector. All other cases' *p*-values were greater than 0.05, providing insufficient evidence to conclude that rankings differed. This implies that both public and private organizations tend to not rank the selection factors similarly, with the exception of time savings, which was ranked higher by the private sector across all APDMs:

- CM/GC. The results revealed a statistically significant difference between the two groups, U = 110.5, Z = -2.689, p = 0.007, with a mean rank of 25.58 for private versus 15.50 for public agencies.

- DB. The results showed a statistically significant difference between the two groups, U = 146.5, Z = -2.412, p = 0.016, with a mean rank of 27.14 for private versus 17.83 for public agencies.

- PDB. The results showed a statistically significant difference between the groups, U = 65.0, Z = -2.340, p = 0.019, with a mean rank of 20.17 for private versus 11.91 for public agencies.

Table 8. Results of Mann Whitney Tests for Hypothesis 5

Selection factor	*p*-value		
	CM/GC	*DB*	PDB
Cost Savings	0.917	0.269	0.721
Time Savings	0.007*	0.016*	0.019*
Collaboration with stakeholders	0.558	0.127	0.766
Flexibility in project changes	0.742	0.264	0.050
Fosters creative solutions	0.459	0.146	0.327
Appropriate risk allocation to parties	0.514	0.502	0.970

Note. The significance threshold used was α = 0.05 for all tests.

4.10.6 Agency Maturity Level and Selection Factor Ranking

H_{o6}: Selection factor rankings are the same across APDM maturity levels.

To test these hypotheses, the non-parametric Kruskal–Wallis H test was used to compare ordinal data (ranking scores from 1 to 7, where 1 = most important) across the five maturity categories (not implemented, initial awareness, early adoption, developing, and fully mature). The groups are independent, and normality is not assumed. Each factor was tested independently to assess whether its importance ranking varied significantly by each APDM maturity category.

The Kruskal–Wallis test results show that none of the decision-making factors had statistically significant differences in their importance rankings across agencies across differing CM/GC, DB, and PDB maturity levels. In all cases, the *p*-values were greater than 0.05, indicating insufficient evidence to conclude that rankings differed by maturity level. This implies that organizations, regardless of how mature they are in their APDM implementation, tend to value the same key factors—such as cost savings, collaboration, and flexibility—when deciding whether to pursue the APDMs.

Table 9. Results of Kruskal Wallis Tests for Hypotheses 6

Selection Factor	*p*-value		
	CM/GC	*DB*	PDB
Cost Savings	0.743	0.557	0.885
Time Savings	0.846	0.330	0.547
Collaboration with stakeholders	0.546	0.538	0.206
Flexibility in project changes	0.267	0.060	0.339
Fosters creative solutions	0.561	0.229	0.992
Appropriate risk allocation to parties	0.566	0.856	0.220

Note. The significance threshold used was α = 0.05 for all tests.

Table 9 provides a summary of all the inferential tests conducted, decision made, and implications. While several APDM-specific associations were observed, these analyses are exploratory since multiplicity was not adjusted for. Findings should be interpreted with caution.

Table 10. Summary of Inferential Test Results

Hypothesis (H)	Statistical Analysis	Decision	Implications
H_{o1}: Public and private sector organizations have the same distribution of APDM maturity scores.	Mann–Whitney U	Reject H_{o1}	Private organizations had higher APDM maturity scores compared to public organizations
H_{o2}: Public and private organizations have the same distribution of future adoption plans for each APDM (CM/GC, DB, PDB).	Fisher–Freeman–Halton Exact Test	Reject H_{o2} for all APDMs	Private organizations plan greater adoption of all APDMs compared to public agencies
H_{o3}: There is no association between an organization's APDM maturity level and its future adoption plans for that APDM.	Fisher–Freeman–Halton Exact Test	Fail to reject H_{o3} for DBB and CM/GC Reject H_{o3} for DB and PDB	There is a significant association between DB and PDB maturity and future adoption plans
H_{o4}: Barrier rankings are the same across APDM maturity levels.	Kruskal Wallis	Fail to reject H_{o4} for all barriers <u>except</u> complexity of the process in DB	Organizations regardless of APDM maturity level, tend to experience the same barriers for all APDMs, except complexity of process in DB
H_{o5}: Public and private organizations rank APDM selection factors the same way.	Mann–Whitney U	Fail to reject H_{o5} for all factors <u>except</u> time savings in all three APDMs	Private and public organizations tend to agree on the ranking of the APDMs selection factors, with the exception of private organizations ranking time savings more important in all three APDMs
H_{o6}: Selection factor rankings are the same across APDM maturity levels.	Kruskal Wallis	Fail to reject H_{o6} for all three APDMs	Agencies tend to agree on the ranking of the APDMs selection factors regardless of their maturity level

4.11 Survey's Main Findings

This section summarizes and synthesizes the findings from the 86 respondents, including the public (59.3%) and private (40.7%) organizations involved in transportation infrastructure projects. Both the public and private sector were represented by different types of organizations (state, special, MPOs, RTPAs, contractors, consultants, etc.) who were involved at various project stages, ranging from initiation to operations and maintenance. The respondents represented various technical, managerial, and executive roles in APDM project delivery. This ensured the responses received represented the organizations' variability and its effect on APDMs implementation, as well as provided broad perspectives on APDMs utilization. The following section highlights the key takeaways from the survey on these various aspects.

APDMs Current State of Practice.

1. Public agencies demonstrate extensive experience and **maturity levels** with conventional methods like DBB, yet their adoption of APDMs is still largely in the early stages or has not been implemented widely.

2. DBB is the most established PDM in current use; while CM/GC is gaining traction in some agencies, a significant share has not yet adopted it. DB is moderately mature and more advanced than CM/GC among these respondents, and PDB remains in its early adoption or experimental phase for most public agencies.

3. Private companies appear to be further along in adopting and maturing their processes across various delivery methods and demonstrated relatively higher experience across all four methods. These differences were statistically significant.

4. Upon a deeper dive into the spectrum of public agencies, PDM maturity levels vary significantly by agency type and delivery method. State agencies demonstrate the most consistent and advanced implementation across all PDMs. Special agencies show a more mixed profile, with DBB still being more commonly adopted and CM/GC still being in development. RTPAs and MPOs reflect a transitional stage, with a widespread distribution across all maturity levels, particularly for APDMs. County Public Works agencies show strong maturity in DBB but limited adoption of other methods. County Planning/Management agencies are fully mature in DBB, are developing in DB, and have widespread implementation of CM/GC, but PDB remains largely underdeveloped. Finally, County Planning/Management/Building agencies exhibit the lowest overall maturity, with all APDMs either not implemented or in the earliest stages of awareness. These patterns highlight both progress and persistent gaps in PDM adoption across California's public sector landscape.

5. For **project types**, DBB continues to be the most widely used PDM across all project types compared to APDMs. It is mostly used in traditional and simple projects (e.g., roads, paths). CM/GC is preferred for complex, high-risk projects (e.g., airports and bridges), while DB is widely used in integrated, large-scale projects (e.g., rail, airports). PDB is the least used across all types, except for tunnels, possibly due to its newer adoption.

6. For **procurement selection methods**, more progressive procurement methods (QBS and BV) are tightly coupled with APDMs (CM/GC, DB, and PDB) that emphasize qualifications.

7. A key feature for implementing APDMs for some agencies was the development of intergovernmental agreements for various reasons, such as coordinating construction responsibilities, extending project coverage across jurisdictions, defining funding arrangements, and clarifying operational roles when projects involve state agencies (such as Caltrans), cities, counties, or multiple regional stakeholders.

APDMs Future Implementation Plans.

1. Comparing both private and public entities, private entities are more proactive in expanding the use of CM/GC and PDB. Public agencies are more conservative, with a significant portion still undecided or not planning to adopt some APDMs. These differences were statistically significant.

2. DBB remains the most stable method across both sectors.

3. DB is the most contested method: public agencies are split, with most having no plans to use it and some planning to increase use, whereas private entities are more skeptical, with the majority planning to reduce use or avoid it.

4. For PDB, the private sector shows the strongest growth interest (66.7% plan to increase use), whereas public sector is more cautious, with 41.5% having no plans to use it and 34.1% planning to increase use.

5. Further statistical investigation of the relationship between maturity level and future adoption plan indicated statistically significant associations between DB and PDB maturity and agencies' future adoption plans.

These results highlight the opportunities for further development and support in implementing APDMs statewide in different types of public agencies and on different projects, leveraging the private sector experience in these APDMs. It also highlights the strong interest of the private sector in CM/GC and PDB, rather than DB.

APDMs Advantages and Opportunities.

1. Overall, collaboration was consistently rated as a favorable **characteristic** across all PDMs by the public and private sector, especially in CM/GC and PDB.

2. PDB appears to be the most favorably viewed method overall in terms of collaboration and owner involvement.

3. For public sector, owner input is more valued in CM/GC and PDB than in DB. Reducing owner preparation effort is the lowest-rated characteristic across all methods.

4. Public entities were more critical of DB's impact on quality and owner involvement, while private entities did not highlight cost concerns as strongly.

APDMs Barriers and Challenges.

1. Complexity emerged as one of the most reported barriers across all APDMs, with legislative and regulatory constraints being reported for relatively newer APDMs like PDB.

2. Public agencies perceive higher barriers overall, especially for CM/GC.

3. Public agencies see CM/GC as most constrained, while private entities feel PDB faces more regulatory hurdles.

4. Public agencies perceive more complexity than private agencies, especially for CM/GC. Both perceived higher costs for CM/GC.

5. NEPA compliance and local contractor buy-in were not seen as a major barrier overall.

6. A deeper dive into organizational types and their unique requirements and roles might also reveal barriers related to internal organizational readiness and external regulatory requirements.

7. In terms of procurement challenges, the complexity of the procurement process continues to stem as the highest ranked challenge in most cases, except for the private sector for DB, where risk transfer is ranked the most challenging. This may explain why the private sector reported reducing their use of DB in the future.

8. Secondary concerns varied for the private and public sector. The second highest-ranked challenge was transparency for the private sector as well as for DB in the public sector. For CM/GC in the public sector, the second highest challenge was the balance between cost and quality, and for PDB it was in-house experience to run the process.

9. The least ranked for all cases was the availability of skilled contractors, with the only exception being the in-house experience to run the process for DB for public agencies. This was the opposite of how it was ranked for PDB. This could be attributed to PDB again being the newest PDM that requires more process education.

10. A deeper dive in the procurement challenges based on agency types showed different patterns. For example, even though most agencies (MPOs, Special Districts, and State Agencies) agreed that complexity was the highest ranked challenge, some (County Public Works, RTPAs, and Special Districts) ranked "regulatory compliance" as their top challenge, and others (County Planning/Management/Building) selected "in-house experience." This indicates that agencies experience different challenges based on their own constraints, whether organizational or regulatory.

11. The influence of legislative and regulatory factors on the APDMs implementation overall as well as the procurement process was reported to be higher in general by the public sector than the private sector. Higher influence was reported for APDM (PDB and CM/GC, then DB) procurement compared to DBB.

12. Further statistical testing of the differences in perception of barriers based on APDM maturity level indicated that organizations, regardless of their APDM maturity level, tend to experience the same barriers for all APDMs, except complexity of process in DB.

APDMs Selection Factors or Reasons Not to Select

1. Collaboration is the highest ranked selection factor for all APDMs for the public sector. Following collaboration, creative solutions were the second highest ranked reason for CM/GC selection, flexibility for PDB selection, and time savings for DB.

2. As for the private sector, collaboration was the highest ranked for both CM/GC and PDB but not DB. Cost savings were ranked highest for DB. Risk allocation was the second highest ranked for CM/GC and PDB.

3. For both CM/GC and PDB, the top ranked reasons for not using them were insufficient in-house expertise or resources and legislative or regulatory barriers. Unfamiliarly and lack of experience in implementing open negotiation process was also ranked higher for CM/GC.

4. The least ranked reason for both CM/GC and PDB was lack of experience or pushback from external stakeholders.

5. For private agencies and PDB, similar to the public sector, lack of in-house expertise, and unfamiliarity and lack of experience in implementing an open negotiation process were ranked highest.

6. Statistically, private and public organizations tended to agree on the ranking of the APDM selection factors, with the exception of private organizations ranking time savings higher than public organizations across all 3 APDMs. Agencies tended to agree on the ranking of the APDMs selection factors regardless of their maturity level.

5. Case Studies

The primary focus of this chapter is to provide in-depth case studies of transportation agencies across various levels of government, highlighting their experiences with Alternative Project Delivery Methods (APDMs), namely Construction Manager/General Contractor (CM/GC), Design-Build (DB), and Progressive Design-Build (PDB). As seen in Table 10, the agencies encompassed state, regional, county, and city levels, providing a diverse range of perspectives on the application of these methods in various governance structures. At the state level, agencies such as the California Department of Transportation (Caltrans) oversee large-scale projects, while regional bodies such as Metropolitan Planning Organizations (MPOs) and transit operators manage multi-jurisdictional projects. County and city agencies, on the other hand, handle more localized infrastructure projects, often with unique challenges and opportunities.

This diverse range of agencies provides valuable lessons on how APDMs are adapted and executed depending on the specific needs, resources, and legislative environments of each agency and their roles. This chapter is structured to guide the reader through a series of individual case studies, with each section dedicated to one agency. These case studies delve into agency backgrounds, the roles of 22 interviewees, and detailed discussions of their perspectives on each APDM's advantages, selection criteria, challenges, effectiveness, and recommendations. The full case study protocol is included in Appendix B, providing a comprehensive framework for understanding the data collection and analysis. Additionally, this section concludes with a summary of all the case studies offering a concise overview of the key takeaways and practical implications of APDMs in the context of transportation infrastructure.

Table 11. List of Case Studies and Interviews Conducted

Case study	Agency	APDM used	Parties interviewed	No. of interviews	Type of project
1	Caltrans	CM/GC, DB, PDB	Agency, Contractor	8	Several
2	La-Metro	CM/GC, DB, PDB	Agency	3	Several
3	SANDAG	CM/GC	Agency, Contractor	2	Several
4	Santa Barbara Association of Governments	CM/GC	Agency	1	Highway corridor
5	Placer County Department Public Works	CM/GC	Agency, Contractor, Independent Cost Estimator	3	Bridge
6	Sonoma County Department Public Works	CM/GC	Agency, Design Consultant, Contractor	3	Airport
7	Fresno County Transportation Commission	Not using but willing to use	Agency	1	-
8	City of Santa Cruz	CM/GC	Contractor	1	Culvert replacement

5.1 Case Study 1. California Department of Transportation (Caltrans)

This case study includes the following sections: (1) Agency Background, (2) Interviewees Background, (3) Construction Manager/General Construction, (4) Design-Build, and (5) Progressive Design-Build. Each APDM section covers the following aspects: advantages and selection factors, challenges and barriers, effectiveness, and recommendations.

5.1.1 Agency Background

Caltrans is the state's leading transportation agency responsible for the planning, construction, operation, and maintenance of more than 50,000 miles of highway and freeway lanes across California (Caltrans, 2025). The agency also collaborates closely with regional and local transportation partners to deliver complex infrastructure projects and advance transportation innovation across the state. Caltrans operates through 12 districts and administers large capital investments as part of its mission to improve mobility and connectivity. The agency's strategic direction, outlined in its 2024–2028 Strategic Plan, emphasizes innovation, stewardship, and efficiency—principles that are directly reflected in its increasing use of APDMs such as CM/GC, DB, and PDB (Caltrans, 2024).

APDM legislation. Caltrans has served as a legislative pilot agency for APDMs, beginning with CM/GC under Assembly Bill (AB) 2498 in 2012, which authorized six projects under strict cost and staffing conditions. Through AB 2126 (2016), AB 115 (2017), and SB 1262 (2018), this authority was progressively increased until project caps and cost thresholds were eliminated, granting the agency complete and unrestricted use of CM/GC. Caltrans's implementation of DB followed a similar legislative trajectory, beginning with SBX2-4 (2009) and continuing through AB 401 and SB 785, which standardized DB procedures. In 2021, AB 1499 extended Caltrans's DB authority through 2034, though it remains subject to a 10-project cap on the state highway system (SHS). Despite this limitation, DB is now a fully institutionalized method supported by internal procurement protocols and performance reporting.

Most recently, SB 146 (2023) gave Caltrans new authorization to use PDB. This legislation permits Caltrans to deliver up to eight PDB projects, each valued at over $25 million, using a qualifications-based, collaborative procurement model. The law prescribes a two-phase process in which a design-builder is selected based on qualifications and early project involvement, followed by a negotiated price once a guaranteed maximum price (GMP) is established. This marks a significant evolution in Caltrans' APDM portfolio, expanding the agency's flexibility and aligning with its broader goals to improve project outcomes through early contractor collaboration and risk management.

Institutionally, Caltrans advances its APDM implementation through comprehensive internal resources, including the Alternative Procurement Guide and the CM/GC Procedures Manual (Caltrans, 2008, 2021b). These documents provide structured guidance to help project managers assess when and how to apply alternative delivery methods based on factors such as project complexity, risk profile, and schedule constraints. Caltrans' evolving use of APDMs reflects the dynamic relationship between enabling legislation, organizational readiness, and innovation in project delivery. With CM/GC now fully authorized, DB moderately constrained but operationally mature, and PDB newly authorized, Caltrans is well-positioned to remain at the forefront of alternative delivery in California. The agency's experience serves as a valuable case study in how legislative reforms, combined with institutional capacity building, can enable more efficient, adaptable, and performance-driven infrastructure development at the state level.

5.1.2. Background of Interviewees

The research team interviewed eight (8) professionals involved in the implementation of CM/GC, DB, and PDB, including four (4) serving in Caltrans positions and four (4) representing private construction firms (see Table 11). Caltrans interviewees included the Chief of the Office of Innovative Design & Delivery, who has 27 years of experience and has led statewide efforts to implement and legislate APDMs; a CM/GC project manager with over 20 years at Caltrans and who played a key role in managing corridor projects such as the Santa Barbara U.S. 101 CM/GC initiative; a DB project manager with 33 years of Caltrans experience who oversaw one of District

3's major DB projects; and a design manager with 19 years of service and direct involvement in CM/GC procurement, constructability reviews, and design oversight.

On the construction side, interviewees included a Senior Project Manager with over 36 years of experience in construction industry who has overseen multiple CM/GC and PDB projects over 12 years; a Project Executive with 44 years in the industry and leadership over $700 million in CM/GC projects; an Area Manager with two decades of experience spanning DB, CM/GC, and PDB and roles in technical reviews and preconstruction coordination; and a Project Manager who is involved in DB projects. Collectively, the interviewees brought extensive experience in delivering complex transportation projects and provided valuable insights into the application and evolution of alternative project delivery methods. Detailed interviewee backgrounds are provided in Appendix C.

Table 12. Caltrans Interviewee Roles and Respective PDM Experience

Interviewee Role	Title	**PDM Experience**		
		CM/GC	**DB**	**PDB**
Owner (Caltrans)	Chief of Alternative Delivery	x	x	x
	Project Level Executive	x	-	-
	Design Lead	x	-	-
	District Project Manager		x	-
Construction Firm	Senior Project Manager	x	x	x
	Project Executive	-	x	-
	Area Manager	x	-	-
	Project Manager	-	x	-

5.1.3 Construction Manager/General Contractor (CM/GC)

Procurement of CM/GC projects. As per the interviewees, in Caltrans projects, the procurement of CM/GC projects involves a one-phase selection using a Request for Qualification (RFQ). The qualification-based approach aims to identify contractors capable of collaborating effectively in the CM/GC process. The primary evaluation criteria include past experience, identification of key personnel, and the proposed approach to making changes. This qualification-based selection (QBS) process involves two components: a written proposal and an interview. The proposal consists of a statement of qualifications, where the company responds to the criteria outlined in the RFQ. It includes the experiences of both the company and the proposed team members, demonstrates an understanding of the project and its associated risks and opportunities, and presents innovative ideas to improve it. The evaluation uses a weighted matrix, with 65–70% of the weight based on the Statement of Qualifications (SOQ) and the remaining portion allocated to the interview. There are no restrictions on how the weights are assigned. The contract terms are largely determined by Caltrans' legal team.

The interview can take different approaches; for example, the agency might present real-time problem-solving scenarios to prospective teams. Contractors are given a short period—typically about eight minutes—to discuss, strategize, and present solutions as a team. Another approach could include a 45- to 60-minute interview, including a presentation followed by questions and answers by the panel members. The presentation—usually around 15 minutes—can be either open-ended or focused on specific questions provided by the owner, such as Caltrans. These questions often relate to project understanding, risks, and opportunities, and they help the panel score responses more consistently. The interview component helps Caltrans assess how well the team collaborates, communicates, and reaches solutions under pressure. Such interactive evaluations have become a crucial factor in selection, as they allow the agency to observe firsthand how prospective teams function together.

The agency prioritizes contractors with CM/GC experience, relevant expertise in the specific challenges of the project, a track record of minimizing claims, history of providing innovations to previous project designs, and risk management strategies. Staffing for the procurement process includes senior-level personnel or higher, ideally an office chief who has significant experience in administering contracts or developing design contracts. This ensures a thorough assessment but requires additional time and effort compared to traditional design-bid-build projects. From the constructor's perspective, private companies usually decide whether to submit a proposal for a CM/GC project based on three primary factors: familiarity with the project scope, established relationships with the owner, and internal capacity to complete the project.

The implementation of CM/GC requires trust and collaboration between Caltrans and the CM/GC contractor. Trust is a fundamental element. When trust is present, teams can focus on solving problems instead of defending positions. However, it must be built and maintained. In some cases, Caltrans have implemented regular team partnering sessions, bringing together internal staff, consultants, and local agencies. These meetings helped foster collaboration, improve communication, and align stakeholders on project goals. Maintaining continuity in staffing from design through construction was highlighted by Caltrans personnel as a key factor in minimizing disruptions.

Caltrans frequently partners with local entities under cooperative or interagency agreements to deliver CM/GC projects. Notable examples include the North Coast Corridor with the San Diego Association of Governments (SANDAG) and the Santa Barbara Highway 101 project with the Santa Barbara County Association of Governments (SBCAG). These partnerships arise from the need to pool expertise and resources to manage complex projects effectively, leveraging Caltrans' authority and experience in large-scale transportation initiatives. This collaboration has proven to be an effective solution for funding and resource limitations. Partnerships allow agencies to pool resources, share responsibilities, and expedite project delivery when individual resources are insufficient. Strengthening these cooperative efforts can further improve project outcomes.

5.1.3.1 Advantages and Selection Factors

CM/GC advantages. Based on the agency interviewees' experience, CM/GC's advantages include the following:

- *Early contractor* involvement during preconstruction helps identify and mitigate risks, providing clarity in constructability issues, staging, permitting and regulatory processes. This might imply higher costs upfront in the design phase. However, the overall project's cost might be reduced due to a decreased likelihood of change orders and claims in the construction stage as well as a more efficient project delivery that would minimize delays. The collaborative nature of CM/GC reduces surprises and disputes during construction, making the process more predictable. In other words, one of the CM/GC advantages is the ability to minimize unforeseen change orders, disputes, and delays, which could offset the apparent cost difference in the long run. Construction teams also report that CM/GC contracts are easier to administer because risks and assumptions are pre-negotiated.

- *Project phasing* is key in CM/GC as it enables the agency to break the project into manageable phases, such as early work packages, which help address funding challenges and align construction with available resources. Examples provided include phasing billion-dollar corridor initiatives where full funding may not be available upfront.

- *Schedule adherence* is another advantage; for example, all the CM/GC projects developed by Caltrans District 5 either stayed on schedule or were completed ahead of the originally outlined timeline. In terms of budget management, these projects have consistently had contingency funds remaining at the end or had enough to cover all necessary expenses. Additionally, CM/GC has contributed to efficiency gains by allowing risks to be identified and addressed early, enabling some contingencies included in the contract to be retired before or during construction. This proactive risk management has led to cost savings and improved overall process efficiency.

- *Environmental and permitting management*-. CM/GC can play a crucial role in navigating environmental and permitting processes. Having the contractor involved early allows for clearer communication with permitting agencies, ensuring an accurate understanding of project commitments and reducing potential delays.

- *Owner's resources support* CM/GC helps supplement Caltrans' internal resources by bringing in additional expertise, enhancing the project's efficiency and execution. In addition, the inspection support costs for the agency are typically reduced because of the improved clarity and preparation achieved during preconstruction.

From the construction firm's standpoint, CM/GC has also several advantages. Quality is clearly defined in project specifications, and early discussions with the owner help prevent disputes. The contractor representative interviewed indicated that by collaborating in real time with the owner in the same location and earlier in the design, it is possible to ensure full alignment of expectations on scope, costs, schedule, and risk management. The iterative and feedback-driven process of CM/GC helps to identify potential problems, such as site conditions, traffic management, easements, and construction phasing, and resolve them before breaking ground. Further, construction firms agreed with Caltrans's personnel that CM/GC fosters better stakeholder engagement, ensuring smoother coordination with regulatory agencies, local governments, and affected communities. By emphasizing collaboration over rigid contractual structures, CM/GC improves cost control, reduces disputes, and enhances overall project success rates.

CM/GC selection factors. For Caltrans, CM/GC selection factors relate to the conditions stipulated by California Statutes. This is, it needs to meet the legislative requirement of a minimum of $10 million in construction capital. Generally, CM/GC is often chosen for transportation projects with high complexity and significant risk-sharing potential. The selection process begins with district teams, along with their office chiefs and deputies, nominating projects they believe would benefit from contractor input during the design phase. These projects are typically large and sufficiently complex to warrant early contractor involvement. The headquarters committee receives the nomination and provides final approval on whether to use the method or not. There is not a formalized nomination process, which means the decision often relies on a case-by-case assessment rather than strictly defined criteria.

From the perspective of Caltrans district managers, projects over $50 million—ideally $100 million—with significant construction complexities such as staging difficulties or complex structures are more likely to be considered. For example, in the Santa Barbara 101 corridor project, CM/GC was chosen due to overlapping project schedules, multiple funding sources, and the need for coordinated construction across segments. Traditional low-bid contracting would have resulted in multiple contractors working in the same corridor, creating conflicts and inefficiencies. CM/GC allowed a single contractor to streamline coordination and resource allocation.

5.1.3.2 Challenges and Barriers

Caltrans personnel reported challenges related to the design and construction stage as well as some related to legislation. As for the design phase changes, the interviewees highlighted the following:

- *Balancing contractor-proposed innovations with Caltrans's existing standards and best practices*. It was noted that while the contractor might suggest cost-saving measures, some of these conflicted with standard agency procedures and required thorough internal evaluation.

- *Managing early work packages*, ensuring they are broken out effectively without introducing flaws or dependency issues.

- *Shifting the owner's mindset to share information with the contractor*. The open-book estimate requires the contractor to reveal their estimation methods, which they may be reluctant to do, especially when asked to price jobs without all associated risks defined.

- *Finding difficulty for the design team to fully understand the contractor's perspective*, especially during negotiations over risks and constructability. This disconnect can lead to inefficiencies and delays in aligning project goals.

- *Finding budget limitations also played a role*, sometimes prompting discussions on reducing project scope to align with available funding.

- *Involving contractors* are later in the design process due to lack of approval or evolving project complexity. Design project teams may not fully understand the complexities of a project until later design phases (e.g., nearing 90% design). At this point, teams may decide to involve a contractor to address issues they cannot resolve on their own, limiting the potential benefits of early collaboration

- *Staffing demands*. CM/GC requires additional collaboration and input from both the contractor and design team, which demands extra resources and a thorough understanding of the process. Experienced personnel are crucial for understanding how jobs are priced, as CM/GC requires a different approach from standard design and build processes. This can strain staffing levels. Without proper buy-in and resource allocation, districts may struggle to implement CM/GC effectively.

In the construction phase, a major challenge noted was the transition within the contractor's team from pre-construction to construction. Some of the contractor's personnel who were deeply involved in pre-construction planning and decision-making were not the same individuals managing the project during construction. This led to knowledge gaps, requiring additional coordination to ensure that the rationale behind earlier decisions was properly communicated and upheld. At times, disagreements arose between the contractor's construction team and Caltrans staff regarding previously agreed-upon project details. Further, change orders are common during the construction phase, leading to questions about whether the owner or contractor should bear the associated risks and how the initial assumptions made during pricing affect the final cost.

Legislative requirements were mentioned as a challenge, noting that while there is unlimited project authority for CM/GC under current law, the method lacks flexibility compared to PDB, as it cannot transition into a DB model. In other words, in CM/GC, the design needs to be completed to start construction, while in PDB, the owner and the designer can work together until a certain point where the contract transitions to a traditional design-build and design and

construction can be conducted simultaneously. Further, it was mentioned that the approval process of CM/GC might take a long time, resulting in adopting CM/GC late in the project's timeline, which diminishes the APDM advantage.

Construction firms highlighted the following challenges:

- *Lack of experienced personnel on the owner's side*. The collaborative nature of CM/GC represents a cultural shift from traditional delivery methods and takes time for teams to adapt. Challenges include communication barriers, siloed disciplines—especially in design—and hesitation to fully engage with the contractor.

- *Early and active contractor involvement in the design process*. While some CM/GC contractors passively review plans upon request, it is important for the contractor to be an integrated member of the project team from the beginning to provide timely input. Delayed engagement can result in inefficient design choices, as exemplified by a case where a bridge was designed for a floodplain using cast-in-place methods rather than a more appropriate precast solution.

- *Time it takes for public agencies to deliver design*. Internal structures, such as siloed design disciplines and disconnected management hierarchies, contribute to inefficiencies. For example, Caltrans' design managers and project managers often lack aligned authority, creating delays and limiting responsiveness. The effectiveness of collaboration with the owner varies. Some project managers fully embrace the contractor's involvement, while others restrict information and engagement, limiting the team's overall performance. Successful collaboration requires trust, which can accelerate problem-solving and improve outcomes. However, achieving this cultural shift takes time and buy-in from leadership at all levels.

- *Pricing perception*. Unlike traditional Design Bid Build (DBB), where a competitive low bid establishes a clear cost baseline, CM/GC uses negotiated pricing, which can lead to concerns about whether the best price is being achieved. Since there is no direct competitive bidding at the construction stage, owners sometimes worry that they are not getting the lowest possible price. To address this, independent cost estimators and market analysis tools are used to verify that the negotiated price remains fair and market driven. Following structured pricing processes ensures transparency while still leveraging the benefits of early contractor involvement.

Slow right-of-way certification processes, utilities and funding issues. Agreements with utilities, railroads, and municipalities can be time-consuming, and budget shortfalls can stall projects. When funding gaps arise, some project managers are reluctant to escalate the issue, delaying resolution and compounding the problem. Extended pre-construction periods also affect contractor profitability, as reimbursement covers only expenses without the benefit of construction

markup. Projects intended for construction within one to two years can be delayed to three or four, leading to internal frustration and influencing future pursuit decisions.

5.1.3.3 Effectiveness

All interviewees agreed that it is difficult to measure the effectiveness of CM/GC as compared with the traditional DBB because there is no direct comparison (we cannot build the same project twice, each time with a different method). Caltrans personnel indicated that without early contractor involvement, it is impossible to know how many issues would have arisen during construction, how many change orders would have been necessary, or how much additional cost and delay might have resulted from working with a contractor who lacked pre-construction knowledge. However, effectiveness can be measured based on the success of completed projects that have:

- Minimized impacts on the public
- Protected environmental resources
- Maintained or saved budget and schedule
- Achieved safety goals
- Introduced innovation

From the construction firms' point of view, the effectiveness of CM/GC depends significantly on collaboration, staffing, and mutual trust between contractor and owner. When collaboration is embraced and communication flows freely, projects advance more efficiently and with greater satisfaction for all parties. Projects where the contractor is fully integrated into the design team tend to see better outcomes in terms of time, cost, quality and innovation. However, when the process becomes overly bureaucratic or leadership lacks the necessary collaborative mindset, the project suffers delays and inefficiencies. Trust and transparency are repeatedly emphasized as critical factors in CM/GC's effectiveness. It was also mentioned that the effectiveness is not only about timelines or initial costs—it is also about how well a delivery model aligns with project realities. CM/GC and PDB offer deeper insights and risk mitigation, even if their outcomes may appear costly upfront. Their collaborative nature ultimately leads to more sustainable and predictable project performance.

5.1.3.4. Recommendations

The following recommendations for developing future projects using CM/GC were provided by Caltrans personnel:

- *Early involvement*. Engaging the contractor as early as possible maximizes the opportunity for innovation and constructability improvements. Delayed involvement limits the contractor's ability to influence the project effectively.

- *Recognize that strong collaboration*, partnership and trust building are essential for developing innovative solutions and advancing the project successfully. Regular quarterly partnering meetings at the beginning of the project helped establishing collaboration, and even as the frequency and participation decreased over time, the strong foundation of teamwork remained beneficial.

- *Foster open information*-sharing between the owner and contractor.

- *Innovation approach*. Staff must understand and invite innovation and be able to think outside the box.

- *Resource allocation*. Organizations should dedicate full design teams to CM/GC projects rather than spreading their efforts across multiple contracts to ensure the necessary focus and collaboration. Professionals with adequate qualifications and a mindset should be part of these teams.

- *Use of task teams*. Forming small task groups composed of both contractor and design team members can efficiently resolve specific issues. For example, a group of four people can focus on solving a specific problem while the rest of the team continues working on other tasks. This approach prevents delays, promotes collaboration, and ensures multiple issues are addressed simultaneously without requiring the involvement of the entire team.

- *Understanding cost differences and leveraging Independent Cost Estimators (ICEs*). In some cases, the disparity between traditional low-bid estimates and CM/GC contractor pricing was surprising. However, the ICE team played a critical role in validating contractor estimates, identifying discrepancies, and providing leverage in negotiations. This process ultimately built confidence in cost assessments and ensured fair pricing.

Construction firms interviewed recommended:

- *Owners' team qualifications*. The owner should be just as selective in assembling their internal teams as they expect contractors to be. The personnel assigned to CM/GC projects must be collaborative and suited to the delivery method. Not every person is fit for a collaborative environment, and poor fitness can hinder project progress.

- *Adopt a project-first mentality and prioritize transparency*. Always focus on what is best for the project. Being transparent builds trust, which in turn accelerates problem-solving. Trust is a foundation of effective CM/GC execution.

- *Delays in addressing project risks*—especially budget shortfalls—can cause long-term setbacks. Project teams should surface and resolve "bad news" early, rather than allowing problems to fester. This is particularly critical when additional funding is required, as prolonged avoidance only complicates project delivery.

- *Establish efficient project management processes*. Collaborate with the owner to set up effective and efficient processes for communication, collaboration, and reporting. This includes holding regular status meetings with clear agendas, defined action items, and consistent follow-up—standard practice in construction but often lacking in pre-construction phases. Further, project management processes on the owner side should be strengthened, with a focus on clear, active oversight—moving beyond simple budget tracking. Effective management includes regular check-ins, documentation of responsibilities, and timely issue resolution.

- *Keeping a log* of innovations, risk mitigations, and best practices allows for continuous improvement in future projects.

Recommendations related to legislation touched upon:

- *Rigidity of current fiscal programming requirement*s. Fiscal programming requirements mandate detailed project plans, budgets, and spending allocations years in advance, creating challenges for agencies when addressing complex or evolving project needs. This rigidity limits flexibility, particularly in cases where unforeseen challenges arise late in the design or construction process. For example, some projects might benefit from breaking the overall work into smaller phases—such as starting construction on critical components early—but the current system requires full project scope and cost clarity well in advance, leaving little room for adjustments.

- *Importance of documenting CM/GC successes.* The importance of documenting CM/GC successes was emphasized to justify its use. Improved measurement of benefits, such as cost savings, schedule adherence, and risk mitigation, would help agencies determine when CM/GC is the most appropriate delivery method. While CM/GC is valuable for complex projects, traditional low-bid methods remain suitable for simpler projects when internal expertise is sufficient.

5.1.4 Design-Build (DB)

DB is subject to stringent federal and state legislative requirements. The approval of a DB project requires final approval from the California Transportation Commission (CTC), which plays a key role in endorsing the design-build method in a specific project. The legislative framework for using design-build was established under AB 401, which initially limited the number of DB projects but was later reauthorized to expand its application. DB projects are subject to annual reporting to the senate, providing regular updates and performance assessments, unlike the less frequent reporting for CM/GC.

Procurement of DB projects. The procurement phase uses both an RFQ and a Request for Proposal (RFP). The RFP outlines the proposal details, including the Alternative Technical Proposal (ATP), which focuses on innovative solutions proposed for the project. The evaluation also includes a price component that is split into design and construction phases. DB follows a "best value" approach, with 25–30% of the evaluation weight based on the SOQ and 70% allocated to the pricing component. There are no restrictions on assigning weights. For example, in the case of the US-50 Design-Build project, the selection process was based on this best value approach, combining price and technical evaluation. The lump sum proposal price accounted for approximately 85% of the total score, while the remaining 15% was based on the technical score, which assessed factors such as the qualifications and experience of key personnel, project management approach, and construction methodology. Three bidders competed for the contract, and one was awarded the project as the best value bidder. A key procurement requirement was meeting the Disadvantaged Business Enterprise (DBE) goal of 16%. This posed a challenge in identifying DBE subcontractors capable of handling large-scale work, such as electrical packages worth tens of millions of dollars. The DBE requirement stemmed from the project's federal funding, making it a mandatory component of the contract.

In the development of Caltrans DB projects, partnership arises when legislative mandates or shared interests align. While less common compared to CM/GC or PDB collaborations, DB projects occasionally involve local agencies when specific expertise or resource-sharing is necessary. For example, Caltrans may support local agencies with technical or regulatory challenges, ensuring the project aligns with federal and state requirements.

5.1.4.1 DB Advantages and Selection Factors

- *DB advantages*. From the representatives interviewed perspective, the following key advantages for DB were mentioned:

- *Expediting project delivery*. The DB method is effective in expediting project delivery, allowing construction to start earlier than with traditional DBB. This enabled initial work, like sound wall construction, to address community concerns quickly. This is, unlike traditional design-bid-build, which requires full design approval before bidding,

design-build allows for concurrent design and construction, significantly reducing project timelines. For example, for the US-50 project ($400 million), the decision to use DB was influenced by many factors, with the primary driver being the need to expedite the project timeline, as design-build allowed construction to begin sooner than the traditional bid-build method, which would have required Caltrans staff to complete the full design before construction could start.

- *Design Staffing Constraints*. From the agency's point of view, in the event of a shortage of in-house designers, the DB method could address this critical resource constraint and ensure that progress could be made without overburdening internal staff.

- *Defined risk and upfront fund availability*. This delivery method is ideal for projects where full upfront funding is available, and risks are well-defined. In these cases, federal regulations require that a DB contract cannot be awarded until the project has been approved and an environmental document has been achieved, which is at least 30% of the design to be completed.

DB Selection Factors. DB is ideal for projects where full upfront funding is available, and risks are well-defined. From the contractor standpoint, the decision to pursue DB projects primarily depends on risk assessment. The key factor is the level of design risk, including potential "design creep" and the transfer of responsibilities between parties. Since DB contracts, especially lump sum agreements, involve significant risk, the company carefully evaluates whether the project's risk profile aligns with its capabilities. Logistics and pre-existing relationships with the owner also play a crucial role. Some companies prefer to pursue design-build projects in regions where they already have an established presence, resources, and personnel. Contractors also mentioned that a notable difference between DBB and DB is the level of competition. Traditional DBB projects often attract 13 to 14 competitors, whereas DB projects typically have only three to four bidders due to the higher risk involved. Given these factors, the choice between delivery methods depends on the specific project's priorities and a contractor's risk tolerance at the time of bidding.

5.1.4.2 Challenges and barriers

- *Requirements specifications*. Agencies must be thorough in specifying all requirements, including right-of-way information, and addressing potential differing site conditions (DSCs) to prevent gaps in the contract. Caltrans follows a three-part specification structure: legal specifications, project-specific details, and any changes to standard specifications. Properly defining these elements reduces the likelihood of claims during the construction phase. Since both design and construction are based on these specifications, vague or incomplete details can lead to the contractor delivering a minimal design.

- *Design reviews*. During the design phase, one of the primary challenges was ensuring that Caltrans staff were fully dedicated to reviewing the design submissions in a timely manner. Balancing their other responsibilities with the requirements of the project sometimes created delays.

- *Learning curve* for design consultants who are unfamiliar with Caltrans standards. Many consultants, while skilled engineers, came from other states and were not well-versed in Caltrans-specific requirements. To address this, Caltrans conducted educational and collaborative efforts to align all stakeholders with expectations.

The contractors' perspective regarding challenges included:

- *Expectations misalignment*. A major challenge in traditional DB projects is the misalignment of expectations between owners and contractors. Owners often assume that their RFPs and project documents clearly define scope and objectives, but since a fixed price is required before design completion, gaps in understanding frequently arise. Such confusion leads to conflicts, change orders, and inefficiencies. It was mentioned that this method leads to unbalanced risk allocation.

- *Speed over planning prioritization*. In construction, CM/GC and PDB projects experience fewer issues because of thorough preconstruction planning. Since the contractor is actively involved in the design phase, potential problems such as site conditions, traffic management, easements, and construction phasing are identified and resolved before breaking ground. Traditional DB projects, however, often prioritize speed over planning, leading to unexpected design errors, incomplete project details, and unforeseen site conditions, which can cause delays and cost overruns.

- *Inability to grasp all the risks involved in the project during the procurement phase* due to the high volume of information and the limited time provided. Contractors might propose design changes (via Alternative Technical Concepts) during procurement to stand out from competitors. In some cases, they realize later why the original design was structured that way and did not need modification. These backtracking moments lead to increased costs and delays.

- *The construction phase reinforces this dichotomy*. CM/GC and PDB benefit from a jointly developed risk register that pre-defines responsibilities. As a construction firm representative highlighted, "Everybody's on the same page…and if it occurs, then there's a mechanism to be paid for it." This collaborative risk-sharing contrasts sharply with DB, where, "we generally don't have a mechanism to go back to the owner and say, this is a change condition."

Design submittals in aggressive schedules. During the design phase of the Santa Barbara 101 corridor project, the biggest challenge was adhering to an aggressive schedule while ensuring timely design submittals. The project required over 300 design submittals for Caltrans's approval, making coordination critical. To expedite the process, the team implemented "over-the-shoulder" reviews, where designers and Caltrans representatives addressed issues in real time instead of waiting for formal responses.

5.1.4.3 Effectiveness

The effectiveness of DB projects is evaluated based on the project accelerated timeline, the extent of innovation introduced, and how successfully those innovations are implemented. Contractors indicated that they measure the effectiveness of DB projects through key performance metrics, including schedule adherence (monthly schedule updates), cost tracking (internal cost projections vs. actuals), and quality control (monthly reports assessing defects and resolutions).

5.1.4.4 Recommendations

Several recommendations were identified to improve the use of DB projects:

- *Clear project specifications and ensure dedicated staff*. The agency highlighted the importance of clear and detailed project specifications to avoid misinterpretation and ensure dedicated staff for design reviews and oversight.

- *Risk allocation.* Clearly defining risk allocation in contract language is essential to prevent disputes between owners and contractors, as there is often a misconception that design-build eliminates change orders entirely

- *Right of Way.* Right-of-way acquisitions should be completed before the project starts to avoid construction delays.

- *Permits*. Securing necessary permits before project commencement is crucial, especially when dealing with third parties such as railroads, as permit delays can significantly impact the schedule.

- *Detail data in design stage*. Lessons learned from the design phase emphasized the importance of detailed initial data (e.g., geotechnical information, topography, soil conditions) to ensure a smoother design process and prevent scope growth.

- *Collaboration*. Recognize that strong collaboration and effective partnership is essential for developing innovative solutions and advancing the project successfully.

- *Personnel qualifications and mindset*. Team members must understand the collaborative nature of DB and need to embrace innovation by being able to think outside the box.

- *Training*. The need for consistent training was emphasized to address knowledge gaps for both Caltrans staff and external consultants unfamiliar with Caltrans standards.

Hiring Quality Validation (QV) inspectors directly through Caltrans, as now allowed by updated legislation, was identified as a critical improvement to reduce conflicts of interest and align quality standards.

Specifically, from the contractor's perspective:

- *More focus on early constructability reviews* would help prevent delays caused by unforeseen field conditions. Balancing design accuracy with schedule constraints is crucial to maintaining project timelines in a design-build environment.

- *Integrated project offices* have the potential to significantly improve coordination.

- *Maintaining institutional knowledge* through regular use of DB methods would improve outcomes.

- *Regarding legislative recommendations*, contractors mentioned that there is growing support for PDB over traditional lump-sum DB, since in PDB, contractors are selected based on qualifications, and pricing is negotiated as the design develops, reducing contractor risk. Several major general contractors favor this model over lump sum design-build due to its lower financial uncertainty. Shifting towards PDB could encourage more bidders and improve overall project execution.

5.1.5 Progressive Design-Build (PDB)

PDB is relatively new to Caltrans, with only the first contract recently procured. PDB allows for flexibility during the design phase and enables transitioning the project to a DB model once 60% of the design is completed. The limited project slots (8 projects by SB146) and recent legislative introduction signals that the method is still gaining adoption and operational experience. SB146 authorizes Caltrans and the Department of Water Resources (DWR) to use PDB, reflecting the joint efforts of these agencies to address large-scale multifaceted public works projects. These partnerships are driven by the need for shared resources and expertise, leveraging Caltrans's authority to manage risks and align projects with legislative and funding constraints. Collaborative efforts may also involve local transportation authorities to tackle design and funding complexities.

Procurement of PDB projects. The procurement process is a one-phase selection using RFQ, focusing on past experience, key personnel, and the proposed approach to changes. A key difference in PDB is the consideration of the number of hours needed to complete the design. SB146 mandates the use of "best value" criteria, combining qualifications and price. Originally intended to prioritize "most value," adjustments during negotiations with the senator and labor

unions, influenced by labor laws, led to the "best value" approach. The proposal must include a fee for the design effort, a fee for the construction effort, and the proposed design hours, contributing to the best value assessment. Pricing accounts for 10–15% of the total evaluation, with the remainder based on the SOQ and interview. There are no restrictions on weight assignments.

Owners assess whether the contractor's experience aligns with the project scope and evaluate their depth of understanding regarding project requirements. Additionally, they look for teams that can establish a strong working relationship, as collaboration is essential for project success in CM/GC and PDB. In the interview process, owners present real-time problem-solving scenarios to prospective teams. Contractors are given a short period—typically about eight minutes—to discuss, strategize, and present solutions as a team. This exercise helps owners assess how well the team collaborates, communicates, and reaches solutions under pressure. Such interactive evaluations have become a crucial factor in selection, as they allow owners to observe firsthand how prospective teams function together.

5.1.5.1 PDB Advantages and Selection Factors

PDB selection factors. This method is particularly suitable for large-scale projects with phased funding or where collaborative design development is necessary to address risks and uncertainties. Unlike DB, PDB allows for phased progression, but this requires skilled personnel familiar with managing evolving designs and coordinating risk. As mentioned above, PDB is governed by SB146, which limits the use of this delivery method to eight project slots with a minimum total cost each of $25 million. Thus, this restriction requires careful selection of projects that align with the method's strengths and legislative allowances.

From the contractor standpoint, interviewees mentioned that they pursue PDB based on three primary factors: (1) familiarity with the project scope, (2) established relationships with the client, and (3) internal capacity to do the project. They also mentioned that their companies tend to prefer CM/GC and PDB over traditional DB due to the opportunity to work closely with the owner and designer throughout the design process, fostering alignment on project scope, risk, cost, and schedule.

PDB advantages. The agency and contractors found the following to be key advantages of PDB:

- Contractor engagement and collaboration. Engaging contractors during the design phase leads to better alignment with the project scope, allowing continuous adjustments, risk identification, and scope refinement throughout the design and construction process; this helps to reduce disputes and cost overruns. Further, this collaboration allows proactive engagement with regulatory agencies, streamlining approval processes and ensuring that input from all relevant parties, including local governments and regulatory bodies, is considered. By emphasizing collaboration over rigid contractual

structures, PDB improves cost control, reduces disputes, and enhances overall project success rates.

- Early transparent and feedback-driven process. Quality is clearly defined in project specifications, and early discussions between owner and contractor help prevent disputes. The transparent and feedback-driven process in PDB allows for adjustments before construction, ensuring better cost control, fewer delays, and higher-quality results compared to DBB and traditional DB. A major challenge in traditional DB projects is the misalignment of expectations between owners and contractors. Owners often assume that their RFPs and project documents clearly define scope and objectives, but since a fixed price is required before design completion, gaps in understanding frequently arise. Such confusion leads to conflicts, change orders, and inefficiencies. PDB mitigates these issues by fostering early collaboration, allowing the contractor, designer, and owner to work together from the outset and ensure full alignment on scope, cost, schedule, and risk management.

- Fewer issues in construction because of thorough preconstruction planning. Since the contractor is actively involved in the design phase, potential problems such as site conditions, traffic management, easements, and construction phasing are identified and resolved before breaking ground. Traditional DB projects, however, often prioritize speed over planning, leading to unexpected design errors, incomplete project details, and unforeseen site conditions, which can cause delays and cost overruns.

- Contractors highlighted that the most powerful asset of CM/GC and PDB is the institutional knowledge built over the pre-construction phase that later impacts the ability to complete the project successfully.

5.1.5.2 Challenges and Barriers

PDB is new to Caltrans, with only the first contract recently procured. However, as per the interviewees, it is expected to face similar challenges as the CM/GC method. This includes determining the appropriate timing to transition the design-builder from design to construction or to finalize negotiations for the second phase. The negotiation process is complex and requires skilled personnel who understand the entire delivery process to guide the contractor effectively. Finding qualified engineers to support this negotiation phase remains a significant challenge, as there is a limited pool of experts familiar with this delivery method. Thus, staffing constraints include the need for personnel experienced in managing evolving designs and coordinating risk during the progressive design phase. Pricing perception is another challenge in PDB. Unlike traditional DBB, where a competitive low bid establishes a clear cost baseline, PDB uses negotiated pricing, which can lead to concerns about whether the best price is being achieved. Since there is no direct competitive bidding at the construction stage, owners sometimes worry that they are not getting the lowest possible price.

5.1.5.3 Effectiveness

Since PDB is new to Caltrans, with only the first project procured, there is currently no data available to assess its effectiveness.

5.1.5.4 Recommendations

Recommendations include keeping a log of innovations, risk mitigations, and best practices that allow for continuous improvement in future projects. It was also suggested to expand the use of CM/GC and PDB in public infrastructure projects. It was encouraged to launch pilot programs and further investigate the benefits of CM/GC and PDB to improve project outcomes on a national scale. ICE and market analysis tools should be further developed and used to verify that the negotiated price remains fair and market driven. Following structured pricing processes ensures transparency while still leveraging the benefits of early contractor involvement.

5.2 Case Study 2. Los Angeles County Metropolitan Transportation Authority (LA Metro)

The LA Metro case study includes the following sections: (1) Agency Background, (2) Interviewees Background, (3) CM/GC, (4) DB, and (5) PDB. Each section covers the following aspects for each PDM: advantages and selection factors, challenges and barriers, effectiveness, and recommendations.

5.2.1 Agency Background

The LA Metro was established in 1993 through the merger of the Los Angeles County Transportation Commission (LACTC) and the Southern California Rapid Transit District (SCRTD). As a result of this consolidation, LA Metro operates under a unified statutory structure that retains all legal authorities previously granted to its predecessor entities (California Public Utilities Code, 1993). This framework provides LA Metro with a uniquely broad set of powers compared to many other transportation agencies in California. LA Metro is a County Transportation Commission for Los Angeles County and serves as transportation planner and coordinator, designer, builder, and operator for one of the country's largest, most populous counties (Higgins, 2020). It operates within the jurisdiction of the Southern California Association of Governments (SCAG), the designated MPO for the region, and collaborates with SCAG by contributing data, priorities, and funding strategies for regional transportation plans (SCAG, 2025). LA Metro is also a self-help agency, administering sales tax Measure M to fund transportation infrastructure (Higgins, 2020). In this capacity, it delivers and manages a diverse portfolio of projects—from traffic signal upgrades and corridor enhancements to megaprojects exceeding $20 billion, such as the Westside Purple Line Extension. Additionally, the agency collaborates with regional partners—including Metrolink, the City of Los Angeles, and other municipalities—and allocates more than $2 billion annually through grant programs and joint

projects. For regionally significant and multi-jurisdictional projects, LA Metro often acts through Joint Power Authorities (JPAs) to coordinate with multiple stakeholders.

APDM legislation. LA Metro's core legislative authority for APDMs is rooted in Public Utilities Code Section 130242, which enables the agency to combine multiple phases of project delivery, such as design, construction, and maintenance, into a single contract. This provision originally supported DB but now extends to PDB, CM/GC, and Public-Private Partnerships (PPPs/P3s). As a result, LA Metro is not bound by project-specific statutory constraints that limit many other California agencies. Amendments to this statute have occurred over time to improve alignment with APDMs principles, such as removing low-bid requirements in favor of qualifications-based (QBS) and best-value (BV) selection. Additionally, LA Metro has expanded its authority to include the Operations and Maintenance (O&M) component in contracts, allowing the agency to act without seeking new legislation. However, due to an agreement with the Amalgamated Transit Union (ATU), any project with an O&M component must be approved by Metro's full board through a two-thirds majority vote on a project-by-project basis. While this governance structure enables Metro to move efficiently without the need for further legislative intervention, it can still introduce challenges, such as delays when internal constraints and labor agreements conflict with project timelines. For example, in a progressive design-build-operate-maintain (PDBOM) contract for bus charging infrastructure, LA Metro must return to the board for O&M approval if the cost estimate exceeds set thresholds, with the option to "off-ramp" the contract and procure the O&M scope separately.

LA Metro classifies DB and DBB as traditional delivery methods, while CM/GC and PDB are considered alternative approaches. All four methods are supported by internal procedures that guide method selection based on a structured evaluation process. Once a project reaches the preliminary engineering phase, the project manager and department chiefs assess delivery method options using formal checklists and scoring criteria. This evaluation considers factors such as design complexity, risk profile, schedule constraints, innovation requirements, and funding structure. The results are reviewed by LA Metro's Program Management Department, which convenes a workshop with senior stakeholders to finalize the selection. Final authority lies with the Program Management Department Chief.

Following delivery method selection, LA Metro uses standardized procurement templates and follows a best-value selection process, with technical qualifications weighted more heavily than cost (typically in an 80/20 ratio). Procurement documents include clear scopes of services, constructability review expectations, and project administration requirements. As of writing, the agency is developing a procurement phase guidance manual to further formalize these procedures across all APDMs types. Procurement decisions are subject to internal governance review by the Chief Financial Officer (CFO), Deputy Chief Executive Officer (CEO), and LA Metro's Board of Directors. Importantly, LA Metro's statutory framework enables the agency to hire based on qualifications and best value rather than cost alone, improving flexibility in managing complex and high-risk projects.

Through its integrated statutory authority, internal procedures, and governance structure, LA Metro has established itself as one of the most institutionally mature agencies in California for alternative delivery. Its long-standing use of APDMs, combined with a programmatic rather than project-by-project legislative model, allows the agency to respond quickly to changing project needs, stakeholder input, and delivery constraints. LA Metro provides a model of how legal flexibility and internal capacity can be combined to embed alternative delivery methods across an agency's full capital program.

5.2.2 Background of the Interviewees

The research team interviewed two (2) professionals involved in the implementation of CM/GC, DB, and PDB, and one (1) involved in the legislative process to enable the use of APDMs. These professionals included the Senior Director of Special Projects in the Office of the CEO, who brings over 20 years of experience in the public transportation sector and has played a central role in advancing LA Metro's use of CM/GC, PDB, and DB across a diverse portfolio of capital projects; and an Executive Officer overseeing Metro's Alternative Delivery Programs, who has led the development of internal procedures for APDMs procurement and project delivery, including refining Metro's best-value selection process and standardizing evaluation criteria for high-risk, high-value projects. The third interviewee, the Executive Officer for Government Relations, has been deeply engaged in legislative strategy and coordination. Details on the interviewees' backgrounds can be found in Appendix C.

5.2.3 Construction Manager/General Contractor (CM/GC)

LA-Metro is relatively new in the use of CM/GC.

5.2.3.1 CM/GC Advantages and Selection Factors

CM/GC allows design progression under separate contracts for the designer and contractor facilitating collaborative risk mitigation, which benefits the agency. This provides greater control and off-ramping options if the GMP negotiations fail. CM/GC enables QBS, ensuring competent teams while maintaining owner control over design. In QBS, the focus is on the firm's expertise rather than cost, as early-stage cost estimates are often imprecise. When LA Metro manages the design and requires the contractor's input for constructability and pricing feedback, they often use CM/GC.

5.2.3.2 Challenges and Barriers

LA Metro highlighted three main challenges:

- Managing two contracts and ensuring effective collaboration between designers and contractors presents staffing and oversight challenges.

- Training staff who are new to alternative delivery, since LA Metro's contracts differ significantly from traditional formats. To address this, LA Metro has developed a comprehensive training program and a contract crosswalk to one project at a time. LA Metro is also undertaking agency-wide change management efforts to support its broader shift toward APDMs.

- LA Metro's limited internal familiarity with the procurement processes associated with CM/GC extends across program management, engineering, and contracting teams, requiring additional training and adaptation. While legislative constraints are not a known barrier, expertise gaps in procurement procedures for APDMs pose a challenge. To address this, LA Metro continues to refine its processes while actively managing its first PDB and several CM/GC projects.

Legal and staffing limitations remain significant hurdles. LA Metro depends on external legal counsel for PDB and CM/GC projects due to limited internal expertise. Establishing procurement frameworks and contract documents requires substantial legal effort. The agency has been addressing staffing constraints by hiring and training personnel in APDMs, aiming for a more robust and self-sufficient team in the future.

5.2.3.3 Effectiveness

LA Metro's Alternate Delivery Team tracks the effectiveness of CM/GC projects internally, but no external entity formally evaluates their performance. The agency continues to assess and refine its approaches, learning from ongoing projects to improve efficiency and outcomes.

5.2.3.4 Recommendations

CM/GC provides a unique opportunity for early risk identification and mitigation, which should be maximized; thus, early and continuous cost estimating is essential. Additionally, managing separate contracts for designers and contractors requires sufficient internal resources. It is also critical to ensure that the designer and contractor collaborate effectively, as poor coordination can hinder project success. Although alternative delivery was adopted in part to align risk with contractor capacity, some teams continued to treat these contracts like DBB, leading to adversarial relationships. In response, LA Metro now conducts early partnering sessions to establish project goals, working agreements, and a shared "project-first" mindset from the outset.

5.2.4 Design Build (DB)

DB contracts are awarded based on a BV selection process that considers both cost and technical qualifications; however, sometimes low bid is used.

5.2.4.1 DB Advantages and Selection Factors

DB is recognized for faster project completion compared to DBB, with successes such as the I-15 project in Las Vegas, which was delivered on time and within budget.

5.2.4.2 Challenges and Barriers

LA Metro identified the following challenges:

- DB faces significant risks due to its reliance on early-stage design (typically 15–30%). Uncertainties in third-party stakeholder coordination, especially in rail projects requiring utility relocations, pose a major risk. Unlike highway projects, where utilities can often remain in place and be accessed later, rail projects require complete relocation since utility companies cannot easily access their infrastructure once tracks are installed. This adds complexity, involving agencies such as the Los Angeles Department of Water and Power (LADWP), water and sewage departments, and multiple third-party stakeholders. Contractors are increasingly unwilling to assume these risks, particularly for large-scale projects exceeding billions of dollars. Consequently, claims and change orders are common during construction, making flawless procurement documents and robust design reviews crucial.

- Aggressive pricing strategies. In some cases, mainly if a DB project has been procured on a low-bid basis, the project can face aggressive pricing strategies and contractor-designer conflicts, often leading to budget overruns, schedule delays, and disputes over risk allocation. Contractors, under pressure to submit competitive bids, sometimes rely on legal loopholes to recover costs, creating contentious negotiations during execution. This pressure is also transferred to designers, who are often selected based on price rather than quality.

The *cultural differences between contractors and engineers*—with contractors focusing on rapid execution and engineers prioritizing precision—can lead to significant friction.

5.4.2.3 Effectiveness

DB is recognized for faster project completion compared to DBB, with successes such as the I-15 project in Las Vegas, which was delivered on time and within budget. There are also examples of unsuccessful projects, where the reasons leading to these results should be analyzed on a case-by-case basis. LA Metro's Alternate Delivery Team tracks the effectiveness of these methods internally, but no external entity formally evaluates their performance. The agency continues to assess and refine its approaches, learning from ongoing projects to improve efficiency and outcomes.

5.4.2.4 Recommendations

LA Metro interviewees provided two main recommendations for successful DB use:

- Ensuring *well-prepared procurement documents and early risk identification* is crucial. It is essential to clearly define which risks are transferred to the contractor and which remain with the owner to prevent disputes and ensure fairness.

- *Leverage genuine collaboration*. Although APDMs were adopted in part to align risk with contractor capacity, some teams continued to treat these contracts like DBB, leading to adversarial relationships. In response, LA Metro suggests conducting early partnering sessions to establish project goals, working agreements, and a shared "project-first" mindset from the outset.

5.2.5 Progressive Design-Build (PDB)

LA Metro is relatively new in the use of PDB. PDB uses a QBS approach, where the focus is on the firm's expertise rather than cost, as early-stage cost estimates are often imprecise.

5.2.5.1 PDB Advantages and Selection Factors

PDB is preferred for larger, schedule-sensitive projects—particularly those tied to milestone events such as the 2028 Olympics—because it allows the contractor to manage design and accelerate timelines.

5.2.5.2 Challenges and Barriers

LA Metro identified challenges and barriers related to:

- Lack of knowledge about APDMs: Similarly to DB, one of the primary challenges lies in training staff who are new to alternative delivery, since LA Metro's contracts differ significantly from traditional formats. Limited internal familiarity with these procurement processes extends across program management, engineering, and contracting teams, requiring additional training and adaptation. To address this, LA Metro has developed a comprehensive training program and a contract crosswalk to one project at a time. LA Metro is also undertaking agency-wide change management efforts to support its broader shift toward alternative delivery methods. Further, while legislative constraints are not a known barrier, expertise gaps in procurement procedures for APDMs pose a challenge. To address this, LA Metro continues to refine its processes while actively managing its first PDB.

- Legal and staffing limitations. Also, similarly to DB, LA Metro depends on external legal counsel for PDB and CM/GC projects due to limited internal expertise.

Establishing procurement frameworks and contract documents requires substantial legal effort. The agency has been addressing staffing constraints by hiring and training personnel in alternative delivery methods, aiming for a more robust and self-sufficient team in the future.

Lack of cost certainty until later in the process: PDB emphasizes early collaboration but poses challenges in cost certainty. The absence of a GMP upfront increases the risk of budget overruns and off-ramping complications if pricing disagreements arise late in design. While sufficient schedule flexibility can mitigate these risks, it may contradict the collaborative intent of PDB.

5.2.5.3 Effectiveness

LA Metro is still in the early stages of evaluating PDB effectiveness, with its first PDB project currently underway as of writing (2025). However, in general, the agency tracks the effectiveness of these methods internally, but no external entity formally evaluates their performance. The agency continues to assess and refine its approaches, learning from ongoing projects to improve efficiency and outcomes.

5.2.5.4 Recommendation

LA Metro recommends the following:

- *Frequent cost estimate updates are necessary during early design phases*. If early projections indicate that the GMP will exceed budget, agencies should engage in early discussions and decide whether to proceed, off-ramp, or modify the project scope before significant resources are committed. Delaying such decisions can result in major project challenges later.

- *Leverage genuine collaboration.* Although alternative delivery was adopted in part to align risk with contractor capacity, some teams continued to treat these contracts like DBB, leading to adversarial relationships. In response, LA Metro suggests conducting early partnering sessions to establish project goals, working agreements, and a shared "project-first" mindset from the outset.

5.3 Case Study 3. San Diego Association of Governments (SANDAG)

The case study includes the following sections: (1) Agency Background, (2) Interviewees Background, and (3) CM/GC. The CM/GC section covers the following aspects: advantages and selection factors, challenges and barriers, effectiveness, and recommendations.

5.3.1 Agency Background

The SANDAG is a multi-functional regional agency that serves as the MPO for San Diego County, encompassing all 18 incorporated cities and the County of San Diego (Higgins, 2020b; SANDAG, 2025). Established in 1980, SANDAG is responsible for developing long-range regional transportation plans, allocating federal and state transportation funding, and coordinating land use, housing, and environmental strategies across the region. It also functions as the county authority for self-help transportation funding, administering voter-approved sales tax revenues through TransNet (Higgins, 2020b).

Originally created as a planning-focused entity, SANDAG underwent a major transformation with the passage of Senate Bill 1703 (SB 1703) in 2003. This legislation consolidated the capital development functions of the Metropolitan Transit Development Board (MTDB) and the North San Diego County Transit Development Board (NCTD) into SANDAG, granting the agency authority to design, fund, and construct transportation infrastructure projects (SANDAG, 2025). This marked SANDAG's evolution into a vertically integrated regional transportation authority, combining planning, funding, and implementation under a single institutional framework.

APDM legislation. SANDAG's capacity to deliver large-scale transportation projects was significantly expanded by Senate Bill 1549 (SB 1549), enacted in 2012, which granted the agency authority to use CM/GC as an APDM. SB 1549 enabled SANDAG to apply CM/GC to an unlimited number of public transportation projects, contingent upon a written finding that the method would offer advantages over traditional DBB, such as cost savings, accelerated timelines, or otherwise unattainable project features. This legislation supported SANDAG's broader evolution from a pure planning entity to an integrated planning and project delivery agency, capable of managing complex regional initiatives.

While maintaining internal planning and engineering divisions, SANDAG primarily outsources design and construction management to consultants, with CM/GC becoming the agency's preferred delivery method, particularly for projects involving multiple jurisdictions, complex coordination, and early-stage risk mitigation. A prominent example is the Mid-Coast Trolley Extension, a multi-billion-dollar transit project that required close collaboration with Caltrans District 11, local cities, and transit operators. Although SANDAG also holds DB authority under statewide legislation such as SB 785, CM/GC remains its primary APDM due to its compatibility with SANDAG's consultant-led structure and multi-stakeholder implementation model. Thus, CM/GC will only be discussed in this case study. Project delivery decisions are supported by formal evaluations and internal oversight from legal, engineering, and executive leadership, allowing the agency to align planning, funding, and construction under a unified regional strategy.

SANDAG's experience illustrates how legislative flexibility and internal capacity-building can enable regional agencies to scale alternative delivery approaches. As a planning agency with capital

delivery authority and local funding control, SANDAG exemplifies a mature institutional model for implementing APDMs, particularly CM/GC, in a regional, multi-stakeholder context.

Regarding partnerships, SANDAG works extensively with Caltrans, particularly for projects on the SHS. The agency operates under a master agreement with Caltrans, executing individual cooperative agreements for each project. These agreements define project sponsorship, lead agency responsibilities, project management structure, and applicable regulations. The specific guidelines followed depend on whether the project involves state highways, rail systems, or local infrastructure.

5.3.2 Background of the Interviewee

The research team interviewed two (2) professionals involved in the implementation of CM/GC with SANDAG, one representing the public agency and the other from the construction industry. These professionals included the Director of Program Project Management at SANDAG, who has over two decades of experience in transportation infrastructure and has overseen major corridor improvements using CM/GC. The second interviewee was a Project Manager at Stacy and Witbeck, a firm experienced in collaborative delivery, who has been directly involved in CM/GC project execution, constructability review, and field implementation for complex, multi-stakeholder transit projects in the San Diego region. Details on the interviewees' backgrounds can be found in Appendix C.

5.3.3 Construction Manager/General Contractor (CM/GC)

5.3.3.1 CM/GC Advantages and Selection Factors

SANDAG personnel indicated that CM/GC provides greater flexibility in areas such as risk management, scheduling, and cost control, making it particularly beneficial for complex projects requiring early contractor involvement. The constructor's perspective indicated that when the CM/GC method is used correctly, the focus is on preventing problems throughout the project lifecycle, which increases the likelihood of the project being completed on time and within budget.

SANDAG evaluates whether CM/GC is a better fit than traditional low-bid DBB procurement methods through internal checks and balances. These evaluation processes are currently being refined and expanded under the newly established Project Management Office (PMO), which has been in operation for just eight months as of writing. Previously, these responsibilities fell under the Engineering and Construction division. The agency determines whether to use CM/GC based on several factors, primarily project complexity, funding constraints, timing, and opportunities for phased work packages. A key consideration is whether early contractor involvement would add value, particularly in constructability and risk management.

Once the selection is made, SANDAG selects CM/GC contractors based on qualifications and project-specific expertise, rather than low bids. The primary focus is ensuring the selected

contractor has the qualifications and experience for the project's unique challenges. For instance, on the I-5 North Coast Corridor project, which involved highway, rail, and environmentally sensitive lagoon areas, SANDAG sought contractors with both engineering and environmental expertise. Similarly, for the Otay Mesa border project, the agency prioritized firms with border infrastructure experience, including tolling systems and back-office operations.

From the constructors' perspective, the decision to pursue a CM/GC project starts with the evaluation criteria outlined in the RFP. This procedure includes ensuring that the required roles and qualifications are met. The company reviews the project's scope and the specific personnel needed, making sure that they have the right people to fulfill those roles. They also look at the previous company experience section of the RFP to ensure they can demonstrate their capabilities and qualifications. Staffing availability is a key factor in the decision-making process. Overall, the decision to propose is influenced by whether the agency is genuinely committed to the alternative procurement method and whether the company has the necessary personnel and experience to meet the project's demands.

5.3.3.2 Challenges and Barriers

SANDAG identified three main challenges:

- *Projects timing*. Bringing the contractor in at the right stage of design, ideally between 30% and 60% completion. Since funding is usually identified before the contractor is onboard, timing constraints often arise when integrating contractor recommendations into the design phase. While the goal is to leverage CM/GC for value engineering and cost-saving ideas, these changes can sometimes require additional funding or design time, causing delays. This is because SANDAG primarily uses consultants for design, meaning the design consultant is hired before the CM/GC contractor. If the contractor proposes significant changes, the consultant's scope and budget may need to be adjusted, leading to potential contract modifications. Thus, timing misalignment between the designer and contractor can lead to rework or extended contract durations.

- *Risks properly identified and assigned during design*. When risk ownership is unclear, it can lead to cost overruns and construction delays. Proper risk assessment before finalizing design and pricing is critical for a smoother construction phase.

Negotiating the GMP. In past CM/GC projects, GMP proposals have come in higher than anticipated, but all negotiations were successful, and SANDAG never had to switch a CM/GC project to DBB due to high costs. However, this can be a challenge if negotiations are not successful.

- The contractor interviewed provided the following perspective on CM/GC challenges and barriers:

- *Ability to have a project-first mentality*. This involves collaboration and relationship building. If an agency is unable to transition from a low-bid mindset to a more collaborative approach, the project is likely to be less successful. Agencies without experience in alternative contracting often struggle with bureaucratic, process-driven mindsets. Such mindsets can make it difficult for agencies to adapt to the flexibility and collaborative approach required by CM/GC. In particular, agencies need to be willing to transition from a low-bid mentality to a project-first mentality, which emphasizes collaboration and relationship building between contractors, owners, and consultants. It was emphasized that it is important for agencies to have organizational flexibility to maximize the value of the CM/GC approach. However, this shift is difficult for agencies that have been entrenched in traditional, low-bid processes for a long time.

- *The listing requirements in California*, specifically related to the Public Contract Code (PCC), can create complications. In a traditional low-bid process, contractors are required to list subcontractors with a fixed scope of work. However, in CM/GC, the scope of work is often negotiated during the project, which means subcontractor quotes may not be available upfront, making it difficult to list them according to traditional requirements. While owners can waive these requirements, many owners are not familiar with this flexibility, adding another layer of complexity.

- *Staffing*. The company's ability to submit a proposal often depends on whether they have the right people available to meet the staffing requirements specified in the RFP. Many proposals include a personnel section, and if the company lacks the necessary personnel, it will not make sense to pursue the project.

5.3.3.3 Effectiveness

- Performance is evaluated based on time, cost, and quality. While cost-efficiency is always a concern, CM/GC is not necessarily a cheaper alternative—its value lies in reducing risks, improving constructability, and increasing flexibility in scheduling. The interviewee highlighted that project quality is a key success factor in CM/GC, as this method is specifically used for complex projects requiring specialized contractor expertise.

- One of SANDAG's major CM/GC projects, the Mid-Coast Trolley Extension, was considered highly successful because it was completed on time and met quality expectations. Time was a critical performance metric, and SANDAG structured the contract so that risk was transferred to the contractor early. Unlike Caltrans, which typically retains some risk and resolves issues as they arise, SANDAG negotiated risk costs upfront and handed responsibility over to the contractor, ensuring minimal construction delays. This approach proved effective in maintaining the project schedule.

- CM/GC projects funded by local sales tax measures undergo third-party audits to assess effectiveness. While this auditing process is not exclusive to CM/GC, projects that receive local funding are subject to additional performance reviews. The Mid-Coast Trolley Extension audit is pending as the project is still being finalized, as of writing.

- From the contractor's perspective, the effectiveness of the CM/GC method is evaluated in terms of time, cost, and quality. An example of its success is the Mid-Coast Corridor Transit project, which was completed in half the time of similar mega projects. While the project cost was approximately equal to other comparable projects, the major benefit was the significantly reduced timeline. The key metric for evaluating effectiveness is not the initial cost but the final cost and whether the project is delivered on time and within budget.

- The success of this project was also highlighted by Elkind et al.'s (2022) study which revealed that CM/GC projects, such as Mid-Coast, typically complete construction in half the time compared to similar mega-projects. They also provided recommendations for the use of alternative contracting such as updating state law and creating grants to reward agencies that prioritize the use of efficient procurement strategies. This evidence underscores the effectiveness of CM/GC in streamlining the construction process while maintaining budgetary constraints. Overall, CM/GC is considered an effective method for ensuring projects are completed on time and within budget when properly managed.

5.3.3.4 Recommendations

SANDAG suggested the following recommendations for improved use of CM/GC in transportation projects:

- *Strategic application of CM/GC*. CM/GC should be applied to projects where early contractor involvement and risk mitigation provide clear benefits. For smaller, less complex projects, traditional DBB remains a more efficient and resource-effective choice.

- *Importance of early coordination*. Engaging the CM/GC contractor before 30% design completion allows for better alignment on quantities and cost estimates, risk identification, design considerations, payment methods, and schedule expectations. Early involvement enables contractors to provide valuable input on constructability and efficiencies, which can lead to cost savings, a smoother project timeline, and less ambiguity, creating a more predictable project outcome. However, timing constraints and budget considerations must be managed to prevent unnecessary design changes

that could extend schedules. This is why early bidding plays a crucial role in project success.

- *Building trust and collaboration is essential for CM/GC success*. Unlike traditional low-bid procurement, CM/GC requires a team-oriented mindset, where the contractor, consultant, and agency work together toward a common goal. Establishing strong relationships early in the process and across all levels in the organization, as well as clear expectations early on, fosters better communication and problem-solving, ultimately leading to a more efficient construction phase.

- *Building the right team & communication channels*. Internally, the agency must have the appropriate expertise in place before bringing in a CM/GC contractor to ensure effective collaboration and trust. Over-communication is crucial in APDMs; thus, establishing clear channels for communication and collaboration between contractors, owners, and consultants is essential for success.

- *Clear risk allocation from the start*. Properly defining who owns which risks, along with cost assumptions, minimizes disputes and budget surprises later in the process. SANDAG has found that when risks are clearly defined upfront, the construction phase progresses more smoothly, reducing unexpected cost escalations or delays.

- *Realistic Expectations*. Owners must have clear, achievable goals and understand that CM/GC is not necessarily cheaper or faster but provides value through constructability input and risk mitigation.

- *Executive-level support*. Executive-level involvement and buy-in should be ensured, as CM/GC and similar methods require more relationship-based management compared to traditional methods.

Regarding legislation improvements, SANDAG indicated the following aspects:

- *Funding constraints*, particularly under SB1, pose challenges for CM/GC projects, as local agencies must cover any cost overruns. Allowing for greater flexibility in state and federal funding mechanisms would help mitigate financial risks and improve project delivery.

- *Legislative approval to use PDB.* SANDAG would benefit from using PDB as it aligns well with the agency's reliance on contracted design work. Expanding the available project delivery methods would provide greater flexibility in managing complex projects. While SANDAG is not actively pursuing PDB legislation at this time, it is monitoring Caltrans' PDB pilot project on the Coronado Bridge to assess its potential use in future projects.

The constructor's perspective suggested that a more streamlined process for obtaining approval to use CM/GC could be beneficial. They noted that agencies often face delays in obtaining the necessary legislative and board approvals, which can hinder the implementation of APDMs. A blanket approval or an easier path to approval would help speed up the process.

5.4 Case Study 4. Santa Barbara County Associations of Governments (SBCAG)

The case study includes the following sections: (1) Agency Background, (2) Interviewee Background, and (3) CM/GC. The CM/GC section covers the following aspects: advantages and selection factors, challenges and barriers, effectiveness, and recommendations.

5.4.1 Agency and Project Background

SBCAG serves as both the MPO and the Local Transportation Authority (LTA) for Santa Barbara County. Established in 1966 as a JPA representing the county and its eight incorporated cities, SBCAG is responsible for regional transportation planning, funding allocation, and project delivery. As the administrator of Measure A, a voter-approved half-cent sales tax expected to generate over $1 billion from 2010 to 2040, SBCAG plays a vital role in delivering transportation improvements throughout the region (Higgins, 2020c).

SBCAG employed the CM/GC method for the Highway 101: Carpinteria to Santa Barbara project—an 11-mile corridor expansion aimed at relieving severe congestion and enhancing mobility along one of the most critical regional corridors in the county. The project widens U.S. 101 to six lanes, including new High Occupancy Vehicle (HOV) lanes, and involves complex elements such as bridge replacements, interchange reconstructions, and substantial coastal permitting. Due to its multi-jurisdictional scope, extensive environmental permitting requirements, and phased implementation, the project was well-suited for CM/GC. This project was delivered through partnership with Caltrans District 5. This project reflects how SBCAG integrates innovative delivery methods to manage complexity, accelerate timelines, and align construction with regional planning priorities.

Through its dual roles and strategic use of APDMs, SBCAG demonstrates how regional agencies can effectively plan, fund, and execute transformative infrastructure projects to meet evolving mobility needs.

5.4.2 Background of the interviewees

The research team interviewed one (1) professional involved in the implementation of CM/GC, representing the agency perspective. The interviewee, the Director of Project Delivery and Construction at SBCAG, has over 25 years of experience in transportation infrastructure and public project delivery. Details on the interviewee's background can be found in Appendix C.

5.4.3 Construction Manager/General Contractor (CM/GC)

SBCAG has only implemented CM/GC in partnership with Caltrans and has not undertaken a CM/GC project independently. However, local agencies have shown interest in APDMs, and SBCAG's growing expertise could position it to support member agencies looking to adopt CM/GC in the future.

During the procurement process, instead of awarding the contract solely based on price, the evaluation focused on experience, expertise, and the contractor's ability to collaborate during pre-construction. Contractors were assessed based on their past work in similar environments, such as coastal zones and bridge construction, and their ability to provide constructability insights and risk management strategies.

The Caltrans Innovative Delivery Unit oversees CM/GC projects, ensuring compliance with risk assumption logs, contract negotiations, and change orders. While not an independent external evaluator, this unit tracks and reports CM/GC project performance to the California Transportation Commission (CTC), contributing to a broader understanding of its effectiveness as a delivery method.

5.4.3.1 CM/GC advantages and selection factors

SBCAG identified several advantages in the use of CM/GC delivery method:

- The *ability to meet and evaluate the project team before selection* is something not possible in DBB. The selection process included an interview phase, allowing SBCAG and Caltrans to directly engage with the contractors, assess their problem-solving approach, and determine their compatibility with the integrated project team. This approach was similar to pre-selecting an engineering or architectural firm, ensuring the contractor had the necessary expertise and alignment with project goals.

- *Flexibility in handling unforeseen delays*, such as utility relocations. Under DBB, such delays could have postponed the entire project, but CM/GC allowed SBCAG and Caltrans to move forward with 90% of the work while postponing the affected area for later completion via a change order.

- *Reduced risk.* Even though CM/GC does not necessarily result in the lowest bid, it provides a reasonable or mid-level price, balancing cost certainty with a reduced risk of claims and unexpected expenses. Contractors are less likely to low-bid a project and later file claims for missing details as they are already engaged in pre-construction reviews and fully understand project complexities.

- *Better public communication*. Early contractor involvement helps provide more accurate information to the public about construction schedules, traffic impacts, and project timelines.

For the Highway 101: Carpinteria to Santa Barbara project, CM/GC provided:

- Early contractor involvement helped manage construction risk, improve scheduling, and coordinate closely with concurrent projects.
- Constructability reviews to ensure that architectural details and design intent are fully understood by the contractor, preventing costly rework due to misinterpretation of plans.
- A way to streamline project execution, improve efficiency, and maintain consistency across segments, ensuring project delivery within budget and schedule constraints
- Flexibility, reduced risks, and a more efficient project delivery process.
- A way for SBCAG and Caltrans to successfully agree upon pricing for all awarded contracts without disputes

The decision to use CM/GC for the 12-mile Highway 101 corridor project was influenced by several key factors, primarily project complexity, resource limitations, and the need for better coordination. Given SBCAG's role as a small regional agency, managing multiple construction segments under DBB posed risks, such as potential delays, contractor conflicts, and coordination issues. Further, a significant factor in the decision was the project's location within the coastal zone, which introduced strict permitting and environmental requirements. Early contractor involvement through CM/GC ensured that construction methods aligned with environmental compliance and local agency expectations. Additionally, public outreach was critical, and CM/GC allowed for more accurate communication on timelines, traffic control, and potential project impacts.

5.4.3.2 Challenges and Barriers

SBCAG highlighted several challenges, most of them related to the nature of the project and not necessarily associated with the CM/GC method:

- *New project delivery method adjustment*. Some resource agencies and Caltrans staff had to adapt to this new delivery method. While some designers welcomed contractor collaboration, others were initially resistant to having their work reviewed and influenced.
- *Managing three project segments simultaneously*. A major challenge during design and construction was managing three project segments simultaneously, especially after

securing SB1 funding, which required meeting strict project delivery schedules. Each segment had its own right-of-way needs, environmental considerations, and technical requirements, making coordination complex. To address this, SBCAG and Caltrans developed corridor-wide task teams specializing in areas such as traffic and hydraulics, allowing for streamlined decision-making and consistency across segments.

- *Multiple project submittals*. During design, a major issue was ensuring that multiple project submittals did not overwhelm Caltrans' oversight staff. To mitigate this, the team created a master schedule to properly sequence design reviews and prevent bottlenecks.

- *Large volume of deliverables*. Another challenge was the large volume of deliverables and technical evaluations required for project approvals, necessitating careful resource allocation and scheduling.

From a legal standpoint, there were no major issues specific to design or construction, but the project faced a legal challenge related to its environmental approval process. While the challenge only affected local road improvements and not the highway design, it had the potential to cause significant delays. To keep the project on track, SBCAG made the decision to proceed with design at risk, recognizing that waiting for full resolution would have made the project ineligible for SB1 funding in 2018. This decision ultimately allowed the project to stay on schedule and avoided a potential three-year delay.

5.4.3.3 Effectiveness

SBCAG's experience with CM/GC has demonstrated effectiveness in delivering projects on budget and within or ahead of schedule. Every project constructed under CM/GC has met its financial and timeline targets, showing that early contractor involvement improves planning and risk management. Compared to DBB, where unforeseen site conditions can lead to change orders, CM/GC allows the contractor to anticipate challenges early, reducing the likelihood of cost overruns and delays.

To measure CM/GC's effectiveness, SBCAG and Caltrans use performance metrics such as innovation logs, which document cost savings, schedule improvements, and quality enhancements introduced through the CM/GC process. This helps quantify benefits such as avoided delays rather than just cost reductions.

5.5.3.4 Recommendations

SBCAG provided the following recommendations for improved use of CM/GC:

- *Be prepared for increased pre-construction effort*. CM/GC requires more time and collaboration during the design phase, as agencies must work closely with the contractor to review plans, resolve issues early, and refine constructability before construction begins.

- *Coordination.* SBCAG learned that managing a large, multi-segment project under CM/GC requires careful coordination and proactive stakeholder engagement. Small design details, such as a roundabout implementation, can significantly impact construction feasibility and should be reviewed early with contractors. Further, strong collaboration with third-party partners, particularly utility companies, is essential to prevent delays in relocation and avoid disruptions to the construction schedule. All stakeholders must be considered and engaged, no matter how small their role, to ensure they understand the project objectives and contribute to solutions rather than becoming problems in the process.

- *Collaborative Approach*. CM/GC fosters a team-oriented environment, but agencies must be prepared for more frequent meetings and discussions with the contractor and design teams to ensure alignment.

- *Use of tasks team*s. The task teams empowered technical staff to make decisions within their areas, reducing the need for management to be involved in every detail while still ensuring alignment with project goals.

Regarding legislative improvements, SBCAG suggested that to maximize the benefits of CM/GC, agencies should be given greater flexibility in deciding when to use this delivery method, rather than requiring case-by-case approvals. Many local agencies have shown interest in CM/GC but may lack the expertise or awareness of how to implement it effectively. Providing technical guidance, training, and clear legislative support could help expand its adoption, allowing more agencies to take advantage of early contractor involvement, improved risk management, and streamlined project delivery.

5.5 Case Study 5. Placer County

The case study includes the following sections: (1) Agency Background, (2) Interviewees Background, (3) CM/GC, and (4) Role of ICE in APDMs. The CM/GC section covers the following aspects: advantages and selection factors, challenges and barriers, effectiveness, use of ICE and recommendations.

5.5.1 Agency and Project Background

The Placer County Department of Public Works (DPW) is responsible for managing and maintaining the county's transportation infrastructure, including roads, bridges, and public

facilities. Placer County, located in Northern California, is known for its diverse geography, from the Sierra Nevada foothills to urbanized areas near Sacramento. As a result, DPW oversees a wide range of transportation projects, from small-scale repairs to large-scale infrastructure improvements.

One of the department's most prominent and complex projects is the Yankee Jims Bridge Replacement, a significant undertaking that highlights the department's growing capabilities in APDMs. The Yankee Jims Bridge, which spans the North Fork of the American River, serves as a critical connection between the town of Colfax and the small community of Yankee Jims. The existing bridge has a limited load capacity of just three tons, making it unsuitable for modern fire trucks and larger emergency vehicles. This poses a significant safety concern, especially in the case of fire emergencies or other needs for large vehicles to access the area.

The project aims to provide emergency and fire access across the river by replacing the outdated bridge with a new structure capable of supporting HL-93 loading, which would allow fire trucks and other large vehicles to travel in both directions simultaneously. The project is divided into two phases: Phase 1 involves improving the access route to the bridge site, which includes approximately four and a half miles of unimproved, single-lane road; and Phase 2 focuses on the construction of a new, stronger bridge to meet the modern load-bearing requirements necessary for emergency response and general transportation. The goal of the project is to enhance emergency access and improve overall transportation safety for the Yankee Jims community.

Given the project's complexity, especially its remote location and environmental challenges, the Placer County DPW sought to use the CM/GC method, which would allow early contractor involvement and better risk management. At the time, existing public contract codes restricted the use of APDMs for such bridge projects, requiring new legislation. To address this, the county worked closely with Assemblyman Brian Dahle and Caltrans to integrate the request into Assembly Bill 2374, which was signed into law in 2016. This legislation granted Placer County the authority to use CM/GC for the Yankee Jims Bridge Replacement Project, making it the first project in the county to use this delivery method.

The successful application of CM/GC enabled Placer County DPW to effectively manage the logistical, environmental, and coordination challenges of the project. By involving the contractor early in the design phase, the county was able to better manage costs, schedule, and potential risks. The Yankee Jims Bridge Replacement Project demonstrates how local agencies can leverage legislative support and APDMs to deliver complex infrastructure projects efficiently while mitigating risks and reducing costs. The project underscores the importance of integrating early contractor involvement through APDMs, making it a key case study in the effective use of CM/GC for complex infrastructure initiatives.

5.5.2 Background of the interviewees

The research team interviewed three (3) professionals involved in the implementation of CM/GC, including one from the public agency, one from a private construction firm, and one serving as the ICE. The public agency representative, the Engineering Manager, has over 20 years of experience in civil engineering and has led the delivery of complex, grant-funded transportation projects, including the use of CM/GC for high-risk rural bridge replacements. The Project Manager from the private construction firm brought significant hands-on experience in CM/GC delivery, overseeing contractor engagement, preconstruction coordination, and field execution. The ICE, with over 30 years of experience in cost estimating and project controls, provided third-party validation and constructability input, supporting risk pricing and cost negotiations throughout the preconstruction phase. Further details on the interviewees' backgrounds can be found in Appendix C.

5.5.3 Construction Manager/General Contractor (CM/GC)

In the CM/GC procurement of the Yankee Jims Project, Placer County set a rigorous two-step selection process to ensure the most qualified contractor is chosen. The first step involved an RFQ, which assessed firms based on their capabilities, qualifications, availability of key personnel, project understanding, approach, and value analysis. This initial evaluation narrowed down the pool of applicants to a select number of firms. In the second phase, the shortlisted firms participated in detailed interviews where they were required to provide an opinion of probable construction cost. However, rather than selecting a contractor based on the lowest bid, Placer County evaluated the methodology behind the cost estimates, ensuring a realistic and transparent pricing approach. This helped identify firms that might underbid initially only to introduce unexpected cost increases later in the project.

The selection criteria also included (1) estimating methodologies and processes, (2) project understanding and approach as demonstrated in the interview, (3) ability to answer detailed, technical questions with confidence and expertise, and (4) proposed construction methods and quality control measures. From the contractor's perspective, during procurement, they had to provide detailed cost breakdowns for staff roles and tasks, including a schedule of values for meetings, alternative design sessions, and innovation workshops. Regarding regulations, they mentioned the federally funded DBE participation requirements as a factor during the procurement of subcontractors.

5.5.3.1 CM/GC Advantages and Selection Factors

Placer County reported several advantages in the use of the CM/GC method:

- *Contractor Early Involvement.* By bringing a contractor on board early in the process (before the 30% design phase), the county ensured expert input in type selection,

environmental review, and risk mitigation. This approach (according to the interviewee) contrasts with Caltrans' standard practice of involving contractors after 65% design completion. Early contractor involvement allowed proactive issue resolution, preventing delays caused by late-stage design modifications.

- *Improved cost transparency*. The use of a structured bid assumptions process allowed detailed cost negotiations, avoiding unnecessary expenses. One such instance involved consolidating costs for job site maintenance and Best Management Practices (BMP) maintenance, resulting in savings of approximately $250,000–$300,000. These types of cost efficiencies would have been difficult to achieve under a rigid DBB structure.

- *Quality Control* has been enhanced by involving the contractor in discussions with regulatory agencies to refine project requirements. For example, an initial permit restriction from the California Department of Fish and Wildlife (CDFW) prohibited concrete placement if rain was forecasted within 15 days, which would have made scheduling nearly impossible. By engaging with the agency, the team tried to come up with innovative ideas to allow for protective curing methods instead, which was possible only because it was a CM/GC project.

- *Risk Management Process*. The risk assessment process under CM/GC played a crucial role in managing uncertainties. In a traditional DBB contract, contractors may inflate costs due to perceived risks or, conversely, fail to anticipate challenges, leading to cost overruns and project delays. By identifying and allocating risks upfront, Placer County retained ownership of certain high-cost risks, thereby preventing inflated contractor pricing while ensuring funds were available to address unforeseen conditions. The county's proactive approach in mitigating risks through detailed planning and early engagement with stakeholders has been a critical factor in maintaining project viability.

- *Ability to conduct test excavations*, which helped determine that costly and complex excavation methods, such as blasting and wagon drills, were unnecessary. This early evaluation process built contractor confidence in production rates and ultimately reduced estimated costs.

- *Innovative solutions*. The CM/GC approach allowed the contractor to propose an innovative solution—using the excavated material to build a much-needed parking area within the Auburn State Recreation Area, managed by the Bureau of Reclamation and State Parks. Despite initial environmental concerns, early engagement with stakeholders, including environmental groups and tribal representatives, led to widespread approval of the plan. This collaborative approach not only reduced costs but also created operational efficiencies, providing additional workspace for the contractor.

From the point of view of the contractor, CM/GC is highly effective, especially for *technically complex and unique projects*. It allows for the contractor's experience and lessons learned to be integrated into the project early on, which can lead to better outcomes in cost, time, and risk mitigation. The interviewee emphasized that in traditional DBB models, by the time the contractor is brought in, it is often too late to make meaningful changes or introduce innovations due to rigid deadlines or complete designs. CM/GC, in contrast, provides a collaborative space for exploring better alternatives.

Regarding CM/GC selection factors, the decision to utilize the CM/GC for specific projects within Placer County was driven by unique challenges associated with *complex, high-risk infrastructure projects*. The Yankee Jims Bridge Replacement Project was the county's first CM/GC project, chosen due to the *bridge's remote location, difficult access, and environmentally sensitive surroundings*. Spanning the North Fork of the American River, a waterway eligible for Wild and Scenic River designation, the project required coordination with multiple agencies, including the Bureau of Reclamation, the U.S. Bureau of Land Management, and tribal resource entities. Additionally, the presence of threatened species and access constraints increased the complexity of the project. Given the technical nature and environmental risks, Placer County sought to avoid the traditional low-bid approach, where contractors might struggle with unforeseen challenges. As of writing, for the upcoming CM/GC project involving the removal of bridge debris from the American River, they opted for this APDM because, in contrast to normal DBB projects, this one needed a *lot of coordination with contractors to figure out the best way to get rid of the waste,* any possible *permit needs*, and the *presence of contaminants* such as mercury.

While CM/GC is not widely used for every project, it remains a viable tool for specialized situations. The interviewee mentioned an example from a Caltrans CM/GC conference that highlighted a highly time-sensitive project in Southern California, where freeway expansion joint hinges had to be replaced over a single weekend. By involving the contractor early, the agency developed a precise work plan to execute the replacement efficiently without extended road closures. Similar time-sensitive or technically complex projects would likely prompt Placer County to consider CM/GC again in the future.

From the contractor perspective, risk is the main factor consider with deciding to pursue a CM/GC project. They noted that the CM/GC model is attractive because it allows for early contractor involvement, which is increasingly favored over traditional large DB contracts. Risk identification and management as a team are essential.

5.5.3.2 Challenges and Barriers

- There were several challenges identified in the process of using CM/GC:
- Adversarial dynamics. Initially, adversarial dynamics between engineers and contractors resurfaced, but proactive mediation helped restore a collaborative working relationship.

- Time needed for the design phase. This was a challenge for the agency that had to manage the contractor's involvement during the extended environmental review process. The contractor was brought on board early in 2019, before the 30% design phase, to provide input. However, due to prolonged regulatory approvals, staff turnover led to a loss of institutional knowledge and project momentum, requiring reorientation of new team members. This was also mentioned by the contractor as a main challenge in this CM/GC project.

- Staffing constraints have also posed a challenge, particularly in recruiting mid-career engineers, often referred to as the "pink unicorn" due to their scarcity. Many professionals have transitioned to private-sector roles, making it difficult for Placer County DPW to attract and retain experienced talent. As a result, senior engineers have taken on additional project management responsibilities, increasing workload and potential burnout. In this regard, even though the regulatory landscape for CM/GC in California has evolved, staffing remains a significant constraint. CM/GC demands strong project management leadership, as the success of the method relies on active project oversight rather than rigid contract stipulations. In this project, the agency has successfully collaborated with external consultants, such as ICEs, to supplement limited in-house resources.

- Securing regulatory approvals has been a significant hurdle, as the Caltrans Highway Bridge Program process does not fully align with CM/GC projects. The project's construction authorization was delayed due to pending National Environmental Policy Act (NEPA) clearance, which was held up by slow processing at the Bureau of Reclamation, disrupting the project timeline.

5.5.3.3 Effectiveness

In Placer County and for this project, performance metrics for evaluating the effectiveness of the CM/GC approach have not been formally established; however, key indicators include cost efficiency, construction quality, and regulatory compliance. The project's total estimated cost ranges between $75–$80 million and maintaining budget control has been a priority. Cost was also the effectiveness metric highlighted by the contractor.

5.5.4 Role of Independent Cost Estimator (ICE) in APDMs

This section includes the perspective of the ICE as it relates to the Jankee Jims Bridge project and to other projects using other APDMs such as DB and PDB.

5.5.4.1 ICE on CM/GC projects

ICE typically becomes involved in CM/GC projects when the design is at either 30% or 60% completion. ICE's firm is always hired by the owner to provide an independent estimate and help negotiate with the owner the contract price. At the time of ICE's involvement, the contractor is already on board, and there are typically three parallel estimates: (1) one from the designer, as part of the design contract; (2) one from the contractor, based on their means, methods, and risks; and (3) one from the ICE's team, who does not see the contractor's estimate beforehand. ICE's team prepares their estimate by developing a work breakdown structure (WBS) and applying project-specific logic to estimate quantities, productivity rates, labor, equipment, contingency, and escalation. The WBS serves as the roadmap for aligning cost elements and supports transparency during reconciliation. The reconciliation process includes reviewing the differences in estimates and working collaboratively to arrive at a price that satisfies all parties.

Some of the benefits cited by the interviewee in CM/GC included:

- *Ensuring accountability*. The contractor is required to justify their pricing and reconcile with an independent and qualified third party.
- *Robust validation*. Unlike typical engineer estimates, which are often based on historical bid tabs and escalated costs, ICEs develop project-specific pricing based on market and construction experience.
- *Like-for-like comparison*. The ICE uses the same scope and assumptions as the contractor, allowing for meaningful alignment.
- *Budget control*. At early design stages, such as 30% or 60%, ICEs enable the owner to make strategic decisions (cutting or adding scope) depending on whether the cost is trending over or under budget.

Some of the common challenges faced by the ICE in CM/GC projects as cited by the interviewees are:

- *Contractors' pricing is high*. Contractors frequently submit estimates that are significantly higher than what the ICE determines as fair. The ICE's role often involves pushing back and providing a rationale for lower costs.
- *Embedded risk in base costs*. Contractors tend to build in risk and contingency into their direct costs, inflating the estimate. The ICE must "de-risk" the estimate by moving these uncertainties into the contingency and ensuring the base cost reflects only known, quantifiable work.

- *Slow productivity assumptions*. Contractors often underestimate productivity to extend schedule duration, thereby increasing labor and equipment costs. This, in turn, drives up supervision, traffic control, and overhead.

- *Exaggerated site requirements*. For example, contractors may claim the need for multiple access yards or staging areas, including the purchase of offsite land, which the ICE may determine as unnecessary after analyzing spatial and logistical constraints.

- *Estimate structure manipulation*. Contractors may use confusing units or illogical structuring in their estimates to obscure inflated costs, especially if the ICE joins the project after the contractor has already established their format.

The ICE in the CM/GC Yankee Jims Bridge Replacement project. The ICE became involved in the Yankee Jims Bridge Replacement Project at approximately 65% design completion. While the ICE may have had early involvement, the project experienced a slowdown during the COVID-19 pandemic (2019–2021), which affected momentum. The ICE engagement resumed at the 65% stage and continued through 95% and 100% design. The ICE was selected through a competitive proposal process to provide CM/GC consulting support and staff augmentation for Placer County. The ICE worked alongside other estimators and a project manager to assist the county, specifically supporting the county's representative throughout the procurement and cost reconciliation phases. The interviewee emphasized that hiring an ICE for cost estimating is a relatively low investment (less than 1% of the program value), but it can result in substantial cost savings, especially in complex, high-risk projects such as Yankee Jims.

The Yankee Jims Bridge replacement involved constructing a bridge across the American River in a remote location with significant access constraints on both sides. The project required extensive rock excavation, including drilling and blasting, and the contractor proposed a particularly tedious and costly method. The ICE's personal background in rock quarrying and blasting allowed them to challenge the contractor's assumptions. For example, the contractor proposed 13 people working for 27 weeks to remove slopes via drilling and blasting. Based on the ICE's experience, the ICE countered that similar work could be done much faster and with fewer resources, highlighting the overestimation.

In addition to the ICE's excavation expertise, the ICE's firm brought in a seasoned bridge estimator from the Bay Area who had experience on hundreds of bridges, further strengthening the accuracy and reliability of the ICE. A notable intervention involved identifying an alternative method for slope excavation. The contractor proposed using a high-cost machine known as the "Spider-Man," which required intensive support crews and ran at $1,000/hour, contributing to millions in estimated costs. Through collaboration, the team engaged an equipment supplier to test a cutter head attachment for an excavator, which proved to be a faster and more cost-effective solution. This ultimately shifted the approach, eliminating the need for the Spider-Man and other excessive support resources.

Challenges faced in the project. The ICE noted that many of the challenges in this project mirrored those common to CM/GC. The contractor's initial cost and schedule proposals were nearly double the owner's budget—around $50 million and 3 years, respectively. The ICE played a central role in reconciling estimates, adjusting scope, and reducing the schedule, resulting in a more affordable and acceptable solution for the owner. A major challenge was slow productivity assumptions, particularly in the rock excavation scope, which the ICE actively contested and revised. The contractor insisted that drilling and blasting were the only viable solutions, presenting rigid methods supported by high resources and duration estimates. By introducing alternative equipment and methods and backing them with real-world performance data, the ICE was able to validate more efficient solutions. The result was a reduction in both time and cost, demonstrating the value of field-informed ICE involvement.

5.5.4.2 The ICE on DB Projects

The ICE has typically got involved during early- to mid-level design stages, most commonly at 60% or even 90% design. The ICE's team supported the owner in the procurement stage. Once a design-builder was selected and awarded the contract, the ICE role typically concluded. Post-award estimating was not part of ICE's responsibilities.

Challenges faced in DB projects as cited by the ICE interviewee included:

- *Limited collaboration post-award*. In CM/GC or PDB, there is ongoing interaction between the owner, contractor, and the ICE. In DB, the contractor takes over design, and the owner has less influence during final design execution.

- *Risk assumptions and contingencies*. At procurement, contractors must price uncertainties like contaminated materials. Without allowances or shared risk strategies, this leads to significant cost padding by contractors to cover unknown risks.

- *Design advancement without intent*. The interviewee observed a common pitfall: Owners advanced design to 60%, 90%, or even 95%, then decided to switch to DB. This results in duplicative design efforts, since DB contractors typically redo the design using their engineers, even when near-final documents are available.

- *Misalignment between DB theory and practice*. The interviewee noted, in his experience, most DB procurements occurred at 60% or more, limiting opportunities for innovation and increasing risk for bidders.

5.5.4.3 The ICE on PDB Projects

The ICE involvement begins very early in the process, at around 10–15% design, a stage the interviewee referred to as "pre-30%." At that stage, the ICE was part of the team supporting the owner's selection process for the PDB contractor.

During this selection phase, the ICE participated in interviews with four candidate DB teams, each consisting of a contractor and their designer. The interviews brought in key personnel from each team—project manager, safety lead, right-of-way manager, and quality assurance lead—allowing the owner to assess which team had the skills and collaboration mindset to work within the budget and project constraints. The contractor's selected designer would then advance the owner's concept through the design stages (30%, 60%, and in some cases 90%). By around 60% design, the team aimed to reach a locked-in price and proceed to construction.

Benefits of bringing ICE to a PDB project included:

- *Pricing validation and transparency*. The ICE acts as a check and balance on the contractor's evolving cost estimate, ensuring fairness and alignment.
- *Cost model development*. The ICE helps build a WBS used by both parties throughout the project.
- *Risk allocation*. The ICE assists in identifying areas where costs should be included in risk or contingency allowances, rather than padded into direct costs.
- *Schedule sensitivity*. One unique benefit the interviewee described is the ICE's role in assessing schedule acceleration scenarios. For example, if a contractor initially prices a project at $101 million with a 2-year schedule and then is asked to deliver in 18 months, the ICE can evaluate whether the contractor's new price (e.g., $102 million or $98 million) is reasonable.

Challenges faced by ICE in PDB projects included:

- *Productivity assumptions*. Contractors sometimes propose slow production rates, inflating time and cost. For example, they may assume a pipe installation takes three shifts instead of two, or claim only half a pipe can be installed per day—an unrealistic scenario flagged by the ICE.
- *Risk loading in base estimates*. As with CM/GC, contractors may include "what if" scenarios in their direct costs. The ICE helps reclassify those into a contingency or a risk register, ensuring the owner isn't paying for risks that might never occur.

- *Scope ambiguity*. Unclear design details can lead to significant cost variance between the ICE and contractor, requiring deep dives into assumptions (e.g., excavation depths, underground utility locations).

However, the interviewee stated that PDB tends to have fewer challenges overall, primarily because of earlier involvement, shared goal-setting, and greater collaboration.

5.5.5 Overall Recommendations for Improvement

From the agency's perspective, recommendations for improving the use of CM/GC are the following:

- *Importance of a Strong Project Manager*. The project manager must not only have technical expertise but also be an effective leader capable of fostering collaboration between multiple stakeholders. Their ability to manage different perspectives and align team members is essential for project success. A proactive project manager can push the project forward, balance multiple responsibilities, and maintain momentum. In the case of Yankee Jims, the project benefited from a collaborative relationship with an experienced design project manager who helped keep the process on track when workload pressures threatened delays. Without strong leadership and adequate staffing, CM/GC projects risk stagnation and inefficiencies.

- *Need for a strong collaborative culture among engineers, contractors, and consultants*. Initially, team members defaulted to adversarial roles, but fostering open communication helped maintain alignment on project goals. The constructor's perspective also highlighted this aspect, indicating that there needs to be alignment among contractors, clients, designers, and regulatory agencies, even if all stakeholders are not always in the room simultaneously.

- *Construction Experience within the Team*. Having someone on the team with hands-on construction experience is critical in identifying cost-effective and practical solutions. A team member with this background can effectively challenge contractors' methods, ensuring the most efficient and feasible approach is chosen.

- *Selection of a Strong ICE*. Having a reliable and experienced ICE is crucial in ensuring realistic cost estimates and avoiding unnecessary cost inflations. An ICE with extensive construction experience can effectively challenge assumptions and push back on inflated pricing. The ICE in this project identified an amount of unnecessary expenses by strategically challenging costs at key decision points. This underscores the value of an experienced ICE in improving pricing transparency and controlling costs.

From the constructor's perspective, recommendations for improving the use of CM/GC are the following:

- *Involve actual builders throughout*. The personnel who will actually build the project, such as superintendents, should be involved from the beginning and remain engaged throughout the CM/GC process. Their practical knowledge and input are essential, even if it means exceeding initially budgeted hours.

- *Build schedule and cost model early*. At the start of the process, develop a detailed schedule and cost model that reflects construction realities, risks, and constraints. Focus efforts on major cost drivers and long-duration activities rather than minor details.

- *Order of precedence in contracts*. It is critical to ensure that the mutual understanding efforts and collaborative work done during the preconstruction phase are properly documented and placed high in the order of precedence in the contract documents. When this is not done, valuable input and agreements risk being ignored during construction.

From the ICE's perspective, recommendations for agencies who start using CM/GC are the following:

- Engage the ICE early before the contractor is onboard. This enables the ICE and the owner to set the WBS and estimating standards. It prevents the process from being dragged out by having to reverse-engineer the contractor's structure.

- Build strong relationships with the CM/GC contractor. A collaborative and respectful environment facilitates smoother reconciliation and negotiations. Relationship-building activities (e.g., team lunches, informal meetings) can soften tensions during tough negotiations and build mutual trust.

- Hire ICEs with contractor experience. This gives the ICE the ability to speak the contractor's language, understand their strategies, and interpret underlying assumptions. This background helps ensure the contractor's pricing is challenged credibly and respectfully.

- Value soft skills in ICE selection. The ICE emphasized the importance of choosing people who can be firm yet respectful during reconciliation. Aggressively challenging a contractor's pricing without relationship-building leads to friction, whereas a more collaborative, diplomatic tone helps reach consensus.

- Leverage negotiation and CM/GC experience. *ICEs with experience in negotiating cost differentials, particularly with contractors estimating high durations or crew sizes, can identify and correct inefficiencies, saving owners from paying for nonexistent or unlikely risks.*

- *Use ICEs to uncover embedded contingencies.* The project illustrated the tendency of contractors to embed excess risk into direct costs. The ICE's team isolated these risks and reallocated them into contingency, resulting in clearer cost visibility and better-informed decisions.

From the ICE's perspective, recommendations for agencies who start using DB are the following:

- Standardize bid formats and use allowances. When dealing with cost uncertainties, agencies should specify standardized allowances rather than leaving it to each contractor's assumptions. This results in more consistent and comparable bids, preventing cost variations among bidders for the same scope.

- Decide on DB early. If an agency plans to use DB, they should decide early and stop design advancement around 30%, preserving contractor innovation and cost-efficiency. Advancing to 90% design before converting to DB wastes significant resources, as the design-builder will not rely on owner-prepared plans.

- Understand the trade-offs. Agencies must recognize that DB offers less collaboration compared to CM/GC or PDB. Such an arrangement can make risk sharing, pricing clarity, and innovation more difficult, especially if project complexity is high or scope uncertainties exist.

- Engage ICEs at early design stages only. The ICE's role in DB should be focused on early-phase estimating (15–60%) to set budgets and expectations before bidding. Once the contractor is selected, there is no further role for the ICE, as design and cost responsibilities shift entirely to the design-builder.

From the ICE's perspective, recommendations for agencies who start using PDB are the following:

- Bring the ICE on board before selecting the PDB contractor. Early involvement allows the ICE to shape the cost structure and estimating methodology, and it also allows them to work alongside the owner to establish expectations before pricing begins. It avoids adapting to a contractor's pre-established (and potentially opaque) format.

- Foster strong relationships among all parties. As with CM/GC, successful PDB delivery depends on trust and collaboration. When contractors view the ICE and owner as partners—not adversaries—negotiations are smoother, and pricing is fairer.

- Retain the owner's designer through the process. In the ICE's experience, the owner kept their initial designer onboard to support and advise the contractor's design team. This ensured that original intent—such as avoiding environmentally or publicly sensitive areas—was not lost in translation, it also and helped streamline decision-making.

- Leverage ICE to manage scope changes and schedule shifts. The ICE should support cost assessments related to schedule changes, scope adjustments, or alternate construction approaches. This provides the owner with confidence that changes are priced fairly and justified.

- Recognize PDB as a balance of flexibility and structure. The interviewee viewed PDB as combining the collaboration of CM/GC with the design-builder control of DB, offering the "best of both worlds." Agencies should treat PDB as an opportunity to structure projects with shared responsibility, continuous cost insight, and adaptability to change.

From the legislative standpoint, some of the recommendations suggested related to CM/GC include the following:

- Legislative reforms should focus on establishing a framework that allows agencies to use CM/GC more efficiently without requiring individual project-specific bills. A general authorization for agencies to use CM/GC, while incorporating a qualification or oversight process, would streamline project delivery without unnecessary bureaucratic hurdles. A possible approach is implementing an approval system, such as requiring agencies to follow Caltrans' Alternative Delivery Guide, ensuring that CM/GC is applied only where it provides significant benefits.

- Clearer guidelines and standardized procedures for local agencies using CM/GC should be established at the state level. The lack of predefined processes in California required Placer County to develop its own procedures and secure approvals from both Caltrans and Federal Highway Administration (FHWA). Having a standardized approach would reduce project delays and administrative burdens.

- Finally, efforts should be made to educate decision-makers and agencies on the appropriate use of CM/GC. While CM/GC is a powerful tool for complex or time-sensitive projects, it is not a one-size-fits-all solution. Training programs and case studies should be developed to help agencies determine when CM/GC is the most effective delivery method, ensuring that it is used strategically to maximize efficiency, cost savings, and project success.

5.6 Case Study 6. County of Sonoma

The case study includes the following sections: (1) Agency Background, (2) Interviewees Background, and (3) CM/GC. The CM/GC section covers the following aspects: advantages and selection factors, challenges and barriers, effectiveness, and recommendations.

5.6.1 Agency and Project Background

The Sonoma County Department of Public Works (DPW) is responsible for managing and maintaining the county's transportation infrastructure, including roads, bridges, and public facilities. Sonoma County, located in Northern California, features a diverse landscape ranging from coastal regions to rolling hills, requiring a variety of transportation projects. One of the key infrastructure projects managed by the Sonoma County DPW is the Sonoma County Airport Apron Reconstruction Project. This project involves the replacement of four existing aircraft parking spots at the Charles M. Schulz–Sonoma County Airport, with two of the spots located on deteriorated asphalt. The new configuration will add six new parking spaces, constructed using Portland cement concrete paving. This upgrade is vital for improving airport operations, especially as it accommodates modern aircraft and improves overall operational efficiency.

The Sonoma County Airport Apron Reconstruction Project is complex due to several factors, including the need to maintain at least three operational parking spaces at all times during construction. Additionally, the project relies on Federal Aviation Administration (FAA) grant funding, which is distributed in increments, requiring the work to be executed in phases, each tailored to the available funding at a given time. The CM/GC delivery method was selected for this project due to its ability to effectively manage the challenges of phased funding, scheduling, and contractor involvement from the early stages of design. The decision to use CM/GC for the Apron Reconstruction Project was supported by the California Public Contract Code 20146, which allows counties to use this delivery method for public works projects exceeding $1 million. This statute grants counties the ability to implement CM/GC for a wide range of public infrastructure projects, providing flexibility in managing risk, cost, and timeline, especially for projects that require early collaboration between contractors and project teams.

In addition, Senate Bill 914 (SB 914) also supports the use of CM/GC by counties for certain public works, though it specifically excludes road projects from the CM/GC framework. However, airport infrastructure projects, like the Apron Reconstruction, may not fall under the exclusion of road projects and are considered part of general public works eligible for CM/GC. The Sonoma County Board of Supervisors authorized the use of CM/GC for this project, ensuring compliance with the state's statutory framework and facilitating more efficient project delivery.

At the time of the interview, the project was in the pre-construction phase, with construction planning and material reviews underway. The contractor has worked closely with the design team to review materials, finalize design details, and prepare for the full-scale construction phase. The

phased construction process, supported by FAA funding, ensures that the project can continue progressing as new grant funding becomes available, while maintaining operational capacity at the airport.

In conclusion, the Sonoma County Airport Apron Reconstruction Project serves as a prime example of how Sonoma County DPW has effectively utilized APDMs like CM/GC to manage complex public works projects. The project demonstrates the county's ability to navigate funding complexities, maintain operational continuity, and ensure that critical infrastructure projects are delivered on time and within budget. Through the integration of early contractor involvement, CM/GC has provided significant benefits, including enhanced collaboration, risk mitigation, and more efficient project delivery.

5.6.2 Background of the interviewees

The research team interviewed three (3) professionals involved in the implementation of CM/GC, representing the public agency, designer, and contractor perspectives. The first interviewee, the Airport Manager for Charles M. Schulz–Sonoma County Airport, has over 25 years of experience in airport and public works project delivery and has led the County's first use of CM/GC on a major airfield improvement project. The second interviewee, the Department Manager of the Civil Engineering team at a private engineering firm, has over 20 years of experience in transportation design and brought deep insight into risk management, constructability reviews, and phased design coordination under CM/GC. The third interviewee, a Construction Manager overseeing North Coast operations for a major construction firm, contributed more than 25 years of field and preconstruction experience and was responsible for leading the contractor team through CM/GC procurement, preconstruction planning, and early work packages. Details on the interviewees' backgrounds can be found in Appendix C.

5.6.3 Construction Manager/General Contractor (CM/GC)

Initially, Sonoma County's policies limited construction procurements to traditional DBB methods, with awards based solely on low bids. Thus, adopting CM/GC required changes within county procurement policies rather than new legislation. The process to gain approval for CM/GC was lengthy—approximately one and a half years—due to internal county resistance and unfamiliarity with alternative methods. The situation improved significantly with the support of the newly appointed director to the CM/GC approach. In addition, by demonstrating a well-managed solicitation and selection process based on qualifications, the airport convinced county officials and policymakers to revise existing procurement policies, subsequently establishing a new procurement template used by other county departments.

The procurement process for selecting bidders under CM/GC involved careful consideration of contractors with prior experience in similar projects. Specifically, for the terminal improvement project, the airport prioritized contractors experienced with small airport construction who already

understood the CM/GC method, avoiding firms unfamiliar with this approach. The selection procedure included an extensive solicitation document containing approximately 180 questions, structured in stages. Initially, there was a set of 10–12 basic qualification questions designed as screening criteria; any negative response in this phase immediately disqualified an applicant. A diverse and sizable evaluation panel—consisting of 15 individuals—reviewed proposals. This panel comprised representatives from architecture, internal facility operations, other local agencies, and the airport's external construction manager. The external construction manager significantly contributed expertise to the procurement documents, drawing from their experience with APDMs on projects conducted at the San Diego Airport. Additionally, the airport collaborated closely with both internal and external legal counsel to ensure thoroughness and compliance in procurement documentation.

In this project, the design is executed by an engineering firm. These types of firms are typically selected under a five-year on-call services contract, not for a specific CM/GC project. This means they are pre-qualified to provide design services, and if a CM/GC delivery method is later chosen by the client for a project within that period, the firm can fulfill the design role without additional procurement. Therefore, they are not selected directly for CM/GC delivery but are positioned to participate in it when applicable.

5.6.3.1 CM/GC Advantages and Selection Factors

The following advantages were cited by the interviewees:

- Collaboration for better outcomes. The project owner set expectations early that the purpose of using CM/GC was to encourage contractor input into the design. This top-down message helped foster a collaborative, team-oriented environment where contractors and designers could work together to optimize the plans. Specifically, using CM/GC in project phasing becomes a collaborative process where the contractor can provide input to optimize construction plans, rather than the designer making all decisions upfront. This can reduce the likelihood of costly change orders, conflicts, and disputes later in the project. While FAA quality standards apply to all delivery methods, CM/GC allows contractor insight to potentially enhance constructability, execution and overall project alignment.

- Better adaptation to incremental funding. CM/GC allows the project to move forward incrementally as funding becomes available, rather than waiting to secure the full budget upfront. This has enabled the airport to begin construction in phases, with new parking spots for aircraft becoming available sooner. The construction firm and the owner agree on a GMP based on near-final design plans, and the contract is amended accordingly. This allows flexibility and the ability to make improvements or adjustments in future phases without being locked into a full project scope from the beginning.

- Cost and schedule dynamic adjustment. As for timelines and costs, the CM/GC project delivery is more dynamic. The contractor can help adjust and guide the schedule, in contrast to DBB where the schedule is fixed and enforced at bidding.

Regarding the selection factors considered to decide on the use of CM/GC, in the specific case of the airport's terminal improvement project, the choice was primarily driven by the need to manage construction complexity while maintaining continuous operations, including passenger flow. The project required extensive phasing since it involved significant remodeling within an operational environment, impacting every part of the existing facility. In general, in these types of projects the need for phasing, scheduling, and operational constraints were key factors influencing the decision to use CM/GC, ensuring minimal disruption to airport operations.

From the construction firm standpoint, their decision to pursue a CM/GC project includes the ability to work closely with the owner, contribute to design through early involvement, and reduce claims by addressing issues in the preconstruction phase. Additionally, QBS being used was a key competitive advantage, as the construction firm's resume was strong, and QBS limits competition from less experienced contractors that typically operate in standard low-bid environments.

5.6.3.2 Challenges and Barriers

The following challenges were identified:

- Staffing. Staffing was identified as a notable constraint. The airport's limited internal staff, lacking engineers or dedicated construction managers, relied heavily on external consultants for oversight and management throughout construction. Communication among all parties—the airport team, architects, construction managers, and contractors—was critical. Although cooperation was generally strong, there were moments during the nearly four-year project when one team member—airport, architect, Construction Manager (CM), or contractor—struggled or failed to meet expectations even though the owner described their management style as direct,

- Adapting to different processes, different from the ones used in DBB. The design leader explained that his team was accustomed to handling most contractual and review steps toward the end of the design phase in traditional projects, but CMAR required those steps to be completed much earlier. This involves also including a third stakeholder to the typical dynamic between engineer and owner, requiring additional meetings and a new review cycle for contractor input.

- Significant upfront effort. CM/GC projects demand significant upfront effort and staffing compared to traditional DBB projects. From the constructor's perspective, preparing proposals for CM/GC involves responding to detailed RFQs or RFPs, developing rough pricing, organizing interviews, and listing committed staff

members—often across documents that can reach 100 pages. Staff working on pre-construction tasks are not bringing in immediate revenue, unlike those engaged in active construction. This staffing intensity, along with the delayed financial returns during the pre-construction phase, presents a resource challenge for the contractor.

- Owner's experience with APDMs. The importance of owners having experience with CM/GC delivery in horizonal construction is crucial to facilitating smooth coordination between all the stakeholders.

- Late contractor involvement. The contractor was brought onto the CM/GC project when the construction plans were already 60% complete. This timing limited their ability to provide meaningful input on design decisions, which was identified as a challenge. The contractor's earlier involvement—around the 30% design stage—would have allowed better discussions on design and value engineering. The designer disagreed with this view, considering that 60% of the design completed provides enough design progress to incorporate the constructor's input.

- FAA approval. Gaining FAA approval and demonstrating that the project warrants this APDM is a lengthy process and hinders the ability of CM/GC to streamline the project duration.

- Balancing workloads. From the constructor's standpoint, once the team enters construction for the first phase while still managing preconstruction for future phases, it could place a heavy workload on the project team. Balancing active construction and preconstruction work for multiple packages may strain staffing and reduce their ability to take on other revenue-generating work.

The interviewees also mentioned challenges related to the project itself, not necessarily related to the use of CM/GC, such as the following:

- During the terminal improvement project, the main challenge faced in the design and construction phase under the CM/GC method was staying within the initial project budget, initially estimated at around $26 million. Given budget constraints, extensive value engineering and phasing discussions were necessary. Regular meetings where stakeholders collaboratively discussed cost-saving strategies played a crucial role. Additional funding became available later, which ultimately increased the project's budget to about $43 million. This was due to the inclusion of COVID relief funds (Coronavirus Aid, Relief, and Economic Security [CARES] and American Rescue Plan Act [ARPA]), which led to design changes during construction.

- The complexity of managing multiple federal funding grants through the FAA posed another significant challenge. FAA funding required project costs to match clearly

defined work units, which complicated financial management under the CM/GC method due to its integrated cost structure. Despite these challenges, regulatory approvals from the FAA for using CM/GC were straightforward because clear justifications, particularly regarding phasing and operational constraints, were presented.

5.6.3.3 Effectiveness

The owner emphasized that, despite the terminal project's significant increases in scope, budget, and schedule—which grew approximately 50% in cost (from $26 million to $43 million) and about 30% in duration—the CM/GC delivery method was essential to the project's overall success. He noted explicitly that a traditional DBB approach would likely not have succeeded, given the project's complexity and the numerous unforeseen issues encountered, such as hidden structural problems within the old building. Because the CM/GC contractor was actively involved from the design phase, they clearly understood the project's intent, budget, and phasing requirements, enabling the team to efficiently handle problems without significant delays. The owner acknowledged that formal performance metrics were not established, primarily because this was the county's first experience with CM/GC.

Although from a strict metrics standpoint (cost and timeline increases), the project could be perceived negatively, the owner personally considered CM/GC highly effective, emphasizing the importance of collaborative problem-solving and flexibility that the method provided throughout the project. Further, due to the uncertainty in project funding from FAA grants, it would have been extremely difficult to deliver the project using a traditional DBB method. However, the contractor recognized that the team does not currently use formal performance metrics like surveys or quantitative evaluations, but they regularly assess effectiveness through discussions to ensure everyone is satisfied with the process. Since construction has not yet started, cost and quality performance are still to be determined.

Finally, the effectiveness of the project is mainly evaluated by the County of Sonoma and the FAA, with the latter focusing largely on cost due to its role in providing federal grants.

5.6.3.4 Recommendations

Some of the recommendations provided to improve the use of CM/GC were:

- Selecting contractors based on qualifications rather than solely on cost ensures a qualified team familiar with CM/GC and project-specific complexities.
- Early planning and clear communication among the entire project team significantly contribute to project success and efficient problem resolution.

- Integrate CM/GC processes into early planning and contracts and adjust internal workflows to accommodate CM/GC. One of the key takeaways was the importance of building CM/GC-specific steps—like contractor involvement and coordination meetings—into project scopes and timelines from the beginning. The team had to adapt to new communication structures and meeting schedules, including more collaborative and iterative reviews with the contractor; this required a shift from the typical design-bid-build routine.

- Bringing the contractor on board earlier in the design phase allows for more meaningful input and better outcomes.

- Conducting early investigations of existing site conditions, such as potholing and locating utilities, helps avoid conflicts and informs design decisions effectively.

- Maintaining a risk register is important for tracking project risks and their magnitude and assigning ownership between the contractor and the owner.

- Keeping an innovation or value log helps document the contractor's contributions, such as cost savings or improved phasing, which can later be used to demonstrate the benefits of the CM/GC process.

Regarding improvements related to legislation, the owner did not see an immediate need for legislative changes since CM/GC is permitted under existing state regulations. However, they highlighted that *continued education and acceptance by funding agencies* regarding APDMs could further support the use of CM/GC. He recommended that decisions regarding the use of CM/GC versus other methods, such as PDB, should remain project specific. For FAA regulated pavement projects, CM/GC is preferable due to the exact regulatory standards required, whereas PDB might be more suitable for simpler, less regulated facilities such as rental car centers. Finally, they underscored that QBS should remain a key criterion rather than low bid, emphasizing long-term project quality and sustainability.

From the designer's perspective, they recommended that the FAA adopt a more open and standardized approach to the CM/GC process, allowing it to be used more widely without requiring extensive justification. While CM/GC may not always result in the lowest bid, it often delivers greater long-term value through improved collaboration and reduced change orders. Focusing solely on the lowest cost can lead to adversarial situations or costly changes during construction. Enabling easier approval for CM/GC—especially on projects where complexity and phasing demand early contractor input—would help agencies get better overall outcomes while still staying within funding constraints.

The contractor's perspective suggested that agencies should track benefits, such as cost savings, scheduling flexibility, and reduced risk exposure, so they can justify the use of CM/GC to

legislators and oversight bodies. He acknowledged that legislative changes are outside his direct expertise but emphasized that gaining FAA support for alternative contracting methods will be essential. The more success stories agencies can document, the easier it will be to secure continued or expanded use of CM/GC in transportation infrastructure.

5.7 Case Study 7. Fresno County Transportation Authority (FCTA)

The FCTA is not currently using any APDMs but envisions using them in the short term. Thus, this case study includes the following sections: (1) Agency Background, (2) Interviewees Background, (3) Reasons for not using APDMs, (4) Plans for future use, and (5) Perspectives on CM/GC and DB. The last section also covers the advantages, selection factors, challenges and barriers, effectiveness, and recommendations for CM/GC and DB that were reported by the interviewees.

5.7.1 Agency and Project Background

The FCTA is a self-help transportation agency responsible for managing the collection and allocation of Measure C funds to support transportation projects within Fresno County. The agency was established to address the growing transportation needs of the Fresno region, which has experienced significant population growth and increasing demand for a modern, efficient transportation network. FCTA plays a critical role in overseeing the implementation of Measure C, a half-cent sales tax measure passed by voters in 2006, which generates substantial funds for local transportation projects. This funding structure allows FCTA to take on a variety of large-scale projects, including road construction, maintenance, and improvement, as well as transit-related projects that support the region's development and sustainability. The authority has a small staff and typically works with consultants and partner agencies to carry out its projects. This limited staff capacity presents challenges, particularly when it comes to managing more complex projects that may require the use of APDMs.

While FCTA currently lacks the legal authority to independently use DB or CM/GC on its projects, the agency has expressed a keen interest in leveraging these APDMs to streamline project delivery, reduce costs, and improve efficiency. For projects on Caltrans facilities, FCTA would need to either partner with Caltrans or seek new enabling legislation to authorize the use of APDMs. Despite these barriers, FCTA is actively working toward utilizing these methods in the future, with several projects identified as ideal candidates for DB and CM/GC approaches.

The FCTA is an important case study for understanding the challenges and opportunities faced by self-help transportation agencies in California when adopting APDMs. Despite the current limitations in legal authority and staffing, FCTA's efforts to adopt APDMs, particularly DB, demonstrate the potential for such methods to improve project delivery and efficiency. The FCTA's approach offers valuable insights into how self-help agencies can integrate more

innovative delivery methods into their operations, thereby improving the effectiveness and timeliness of transportation projects.

5.7.2 Reasons for Not Currently Using APDMs

The research team interviewed one (1) professional involved in the implementation of CM/GC, representing the public agency perspective. The interviewee, the Executive Director of FCTA, has over 30 years of experience in transportation planning, project delivery, and policy. Prior to joining FCTA, the interviewee held senior leadership roles at Caltrans, where the interviewee was directly involved in advancing APDMs, including DB and CM/GC. Thus, they were able to provide valuable insights on how APDMs could be implemented within FCTA's institutional constraints. Details on the interviewee's background can be found in Appendix C.

5.7.3 Reasons for Not Currently Using APDMs

Currently, the FCTA is not using APDMs such as CM/GC or DB. The interviewee explained that there are several contributing factors to this. First and foremost, FCTA does not have the legal authority to implement DB on its own. To use such a method, the agency would either need new enabling legislation or would have to partner with Caltrans, which has limited DB authority.

Another barrier is staffing capacity—FCTA only has a small team of three people. If they were to pursue their own project, they would need to hire a consultant to bring the project to at least 30% design and obtain environmental clearance. The interviewee observed that although they could collaborate with Caltrans for environmental clearance and preliminary design, Caltrans is often expensive and has a reputation for retaining control over projects. Agencies frequently incur expenses for Caltrans participation that exceed the original scope, particularly as Caltrans retains authority over its facilities.

More broadly, the interviewee pointed out that many public agencies in California are afraid of APDMs, especially DB. They worry about losing control over projects and are hesitant to let go of responsibilities, which leads them to retain risk instead of transferring it to the contractor—undermining one of the main advantages of APDMs.

In addition, there is a general reluctance due to the negative perception of DB resulting from the high-profile struggles of California's High-Speed Rail (CAHSR) projects. These projects, which used DB, faced significant delays, cost overruns, and change orders. The interviewee believed that this has unfairly shaped the public narrative, causing many agencies—particularly in the Central Valley—to avoid DB altogether. They also mentioned the influence of staff unions, especially within Caltrans, which may resist APDMs because they can shift work away from their members. Moreover, the process of pursuing enabling legislation or navigating a partnership with Caltrans can be complex and discouraging for local agencies.

Despite these challenges, the interviewee is a proponent of APDMs and has identified a few projects they believe would be ideal candidates. However, to move forward, they emphasize the need to work through legislative limitations, overcome institutional fear, and educate both agencies and the broader industry about the successful use of APDMs elsewhere.

5.7.4 Plans for Future Use of APDMs

Despite the current barriers, FCTA is interested in adopting APDMs, particularly DB. The interviewee expressed a strong desire to bring these methods to the agency, citing their potential to deliver certain projects more efficiently. They identified a couple of projects that are straightforward in scope and well-suited for alternative delivery, and they believed that using DB could streamline delivery, reduce overall project timelines, and minimize public disruption during construction. Their goal is to sponsor FCTA-led projects using these methods, potentially in partnership with Caltrans, and ultimately demonstrate their benefits in the Fresno region.

To pursue an APDM project, especially one on a Caltrans facility, the interviewee outlined the general steps FCTA would need to follow. First, they would either hire a consultant or partner with Caltrans to carry the project to a 30% design level and complete the environmental clearance. Although partnering with Caltrans is an option, the interviewee mentioned that Caltrans is typically expensive and tends not to fully relinquish control, which can create long-term obligations and reduce flexibility. Alternatively, using a consultant would offer more control but would still require coordination with Caltrans for access to their facility. Once the environmental clearance and 30% design milestones are met, FCTA would then coordinate with Caltrans to use their DB infrastructure and criteria, rather than creating a separate process. After receiving approval and buy-in, FCTA would solicit a DB team to carry out the project. This process could also apply to CM/GC or PDB, depending on the selected method.

The interviewee noted that while FCTA itself lacks the legal authority to independently conduct DB, they can leverage Caltrans's limited authority for projects on state highways. Alternatively, if FCTA wanted to implement APDMs on a non-Caltrans facility, such as a county road, they would need to pursue enabling legislation to gain the necessary authority.

5.7.5 Perspectives on Construction Manager/General Contractor (CM/GC) and Design-Build (DB)

5.7.5.1 CM/GC and DB Advantages and Selection Factors

The interviewee finds CM/GC effective for delivering higher quality projects with better collaboration and fewer claims, contributing to a smoother construction process. On the other hand, DB is particularly effective for delivering projects quickly. For example, on one DB project, four large design packages were delivered in 16 months—a timeline that would have taken over three years in a traditional Caltrans process.

Decisions to use CM/GC or DB are often influenced by statewide targets rather than purely project-specific needs. For example, Caltrans may set a target, such as approving a specific number of CM/GC projects statewide in a given year. Once that target is established, districts or project teams are encouraged to identify projects that might be suitable for that delivery method. This process is similar for DB, though opportunities are more limited—Caltrans might only authorize a handful of DB projects statewide.

5.7.5.2 Challenges and Barriers

The interviewee confirmed there are legislative, regulatory, and staff-related barriers to using APDMs. They stated that agencies other than Caltrans typically do not have the authority to implement CM/GC or DB directly and would need a legislator to sponsor a bill granting them that power. This process is often a deterrent, as many agencies are unwilling to undertake that effort. The interviewee also pointed to internal staff dynamics, especially within Caltrans, where project teams may be reluctant to give up control of large projects. Furthermore, unions representing agency engineers may resist APDMs, viewing them as a threat to in-house work opportunities. These factors combined make it difficult for agencies to pursue CM/GC or DB, even when the methods might be beneficial.

Focusing on CM/GC, the interviewee pointed out to agency readiness as the primary challenge during the design and construction phase of CM/GC projects. Many agencies are not fully prepared when they release a project using an APDM. This includes failing to clear critical elements such as right-of-way, utilities, agency agreements, and railroad coordination. When these are not addressed in advance, the risks intended to be transferred to the contractor often end up with the agency, which undermines the effectiveness of the delivery method. In CM/GC, the contractor is supposed to provide input during design and help identify issues early. However, if the agency is not ready or has not provided enough information, the contractor may identify risks that get factored into the cost, especially since CM/GC does not follow a competitive low-bid model. In DB, these challenges are amplified. If a project is released before these foundational items are resolved, it can lead to cost overruns and complications, as seen in the high-speed rail projects.

Southern California on Interstate 10 was a successful project, where the agency had done a good job resolving issues in advance, such as right-of-way, utilities, agency agreements, and railroad coordination. The CM/GC project on Highway 99 between Clinton and Ashlan was also successful due to similar preparation. However, even in these successful examples, challenges still emerged—such as pricing issues in change orders when no other contractor was available to provide competition.

5.7.5.3 Effectiveness

Effectiveness varies by agency preparation and contract strength. DB effectiveness is undermined when readiness is lacking or oversight remains overly intrusive. Overall, CM/GC is viewed as less risky and a better entry point for agencies new to APD.

5.7.5.4 Recommendations

The following are recommendations for agencies planning to use APDMs such as CM/GC or DB:

- Be fully prepared before releasing the project. Agencies must ensure that all components such as right-of-way, utilities, agency agreements, and railroad coordination are addressed before releasing a CM/GC or DB project. This preparation is essential for pushing risk to the contractor and avoiding increased costs later.

- Have a strong and accurate RFQ/RFP. The importance of preparing a well-written and thorough RFQ and RFP cannot be overemphasized. Weak or unclear criteria can result in selecting an unqualified or unsuitable team.

- Do your homework on proposers. It is essential to research and verify the background of proposers, including calling references to understand their past performance and experience with APDMs.

Further, to better support the adoption of APDMs, the interviewee recommended legislative reform to extend authority beyond Caltrans to local agencies. This could involve local legislatures sponsoring bills or amendments to existing measures like Measure C. Additionally, professional organizations such as the Association of General Contractors (AGC) and American Council of Engineering Companies (ACEC) should take the lead in pushing for reforms. The interviewee believed that starting with CM/GC is a less intimidating step for agencies and could pave the way for broader acceptance of DB. Increased education and dissemination of successful case studies are also critical to overcoming resistance rooted in past project failures.

5.8 Case Study 8. City of Santa Cruz

The case study includes the following sections: (1) Agency Background, (2) Interviewees Background, and (3) CM/GC. The CM/GC section covers the advantages and selection factors, challenges and barriers, effectiveness, and recommendations.

5.8.1 Agency and Project Background

The City of Santa Cruz, located along California's central coast, is responsible for maintaining and improving vital public infrastructure, including transportation systems, water management systems,

parks, and civic facilities. The DPW manages these responsibilities under local governance codes and statewide regulations. In recent years, the city has increasingly faced challenges associated with climate change, including sea-level rise and more frequent extreme weather events, which threaten critical infrastructure such as transportation corridors and flood control systems.

A key example of the city's recent infrastructure initiatives is the Bethany Culvert Replacement Project, launched following the failure of a 100-year-old culvert during the severe storms of January 2023. The culvert failure resulted in the closure of West Cliff Drive, a vital coastal roadway, disrupting access for emergency services and the public. The project involved replacing the deteriorated culvert, raising the roadway to reduce wave overtopping, and constructing new headwalls and barriers to comply with modern safety standards. The urgency of restoring access and improving infrastructure resilience required a rapid project delivery approach under emergency conditions.

Although the City of Santa Cruz does not possess specific legislative authorization to broadly use APDMs such as CM/GC or DB for typical projects, it leveraged emergency procurement flexibility during the Bethany Culvert Replacement Project. While the city did not explicitly cite California PCC Section 22050, the emergency procurement approach—bypassing formal competitive bidding following a declared emergency—aligns with the authority granted under California PCC Section 22050. This statute allows public agencies, through a four-fifths vote of their governing body, to directly procure services necessary to address an emergency without a formal bidding process.

In parallel, the project qualified for environmental clearance under California Environmental Quality Act (CEQA) Guidelines Section 15269(b), which exempts emergency repairs to public facilities from the full CEQA review process. This legal framework enabled the city to adopt a CM/GC-inspired delivery approach, engaging a contractor through a pre-construction services agreement during the final stages of design. Although not formally procured as a CM/GC under traditional statutory authority, the project effectively incorporated the core principles of early contractor involvement, collaborative risk management, and cost control—leading to substantial schedule acceleration and $1.5 million in cost savings. The Bethany Culvert Replacement thus demonstrates how APDMs concepts can be adapted and applied flexibly under emergency conditions, even in the absence of broad enabling legislation.

The City of Santa Cruz's approach provides an important case study on how local agencies can flexibly adapt APDM principles to meet urgent infrastructure needs, even when formal legislative frameworks are absent. It highlights the value of early contractor involvement for improving project outcomes, particularly under time-sensitive and resource-limited conditions. This experience offers valuable lessons for other municipalities exploring how APDMs can be deployed creatively to improve project efficiency and resilience, especially in emergency response contexts.

5.8.2 Background of the interviewee

The research team interviewed one (1) professional involved in the implementation of CM/GC, representing the contractor's perspective. The interviewee, a Project Executive at Granite Construction, brings 35 years of industry experience, including a decade leading an estimating team and multiple roles in CM/GC and DB projects. Details on the interviewee's background can be found in Appendix C.

5.8.3 Construction Manager/General Contractor (CM/GC)

The construction firm was selected for CM/GC projects based on a variety of evaluation criteria, including price, past project successes, and demonstrated understanding of the owner's needs. Customer satisfaction and post-project interviews are important in demonstrating the value delivered. QBS ensures that the contractor understands the owner's pain points and goals and reflects them in a compelling proposal.

5.8.3.1 CM/GC Advantages and Selection Factors

Collaboration between designers and construction teams during the design phase was highlighted. The constructor noted an example where a young engineer from Caltrans gained significant insight and growth by participating in constructability reviews. This kind of hands-on exposure helps both agencies and contractors improve outcomes on current and future projects, whether CM/GC or otherwise.

From the constructor's perspective, his organization's decision to pursue a CM/GC project is influenced by multiple factors, including the availability of funding, the nature of the client relationship, and familiarity with how the client operates. Other key considerations include the proximity of the project to the organization's offices, the type of work involved (ensuring alignment with the company's capabilities), and staffing qualifications. These factors all feed into what they call a "win strategy," which helps determine whether to pursue a specific project.

5.8.3.2 Challenges and Barriers

Staffing can be a limiting factor during procurement, as having the right team with the necessary experience is key to qualifying and being competitive. Once selected, staffing during the design and construction phases is generally stable. However, the challenge lies in training enough qualified individuals to support multiple CM/GC projects, which require long-term investment and rotation of staff to gain experience. The company has an internal Engineer Acceleration Program to prepare the next generation of project leaders. This includes rotating young engineers through various roles and offices to build their capabilities. While leadership roles in CM/GC often require around 20 years of experience, the program aims to accelerate learning and create a pipeline of future leaders.

Another key challenge identified was the *need for trust and collaboration* among all parties. Without this, it becomes difficult to move the project efficiently from design to construction. Open communication and a team-oriented mindset are essential for success in a CM/GC environment. Finally, constraints like lack of legislation at the local agency level can impact their ability to engage in CM/GC-type work.

5.8.3.3 Effectiveness

A common industry metric is that for every dollar spent on pre-construction, approximately ten dollars can be saved in construction costs due to improved design and constructability (10:1 return on pre-construction investment). As an example, in the CM/GC project for the Bethany culvert, which had a total value of $8.5 million, the company spent $65,000 on pre-construction services and ultimately saved about $1.5 million, demonstrating the significant value of early contractor involvement. In terms of performance metrics, completing the project on schedule is a key indicator. For quality, the goal is to achieve zero deficiencies and zero accidents. The company uses internal quality reports to track rework. Any rework exceeding $5,000 is logged as an incident, followed by a postmortem review to determine the cause. A corrective work plan is then developed to prevent similar issues in future projects. This approach mirrors their safety program. The CM/GC effectiveness is not evaluated by any external entity.

5.8.3.4 Recommendations

Recommendations to improve the use of CM/GC included:

- *Use of risk registers.* Early in a project, risk registers should be created to identify areas where the most value can be gained through design optimization. Each issue is assigned a value and an owner to maintain accountability and focus.

- *Continued collaboration.* Emphasizing collaboration among stakeholders enhances project outcomes and learning for everyone involved.

- *Knowledge transfer and training*. CM/GC projects accelerate learning for less experienced team members, such as young engineers, by providing exposure to contractor thinking and constructability practices.

In terms of legislative support, while the interviewee is not deeply involved in legislation, they mentioned that there is a need for local agencies to have the legal framework to pursue CM/GC projects. Many local agencies lack the authority or internal capacity to implement CM/GC, and often it is too late in the process to establish it. Self-help counties, which have passed local tax measures to fund infrastructure, are more likely to implement CM/GC due to more flexible and available funding.

5.9 Case Study Findings Summary

This section summarizes the findings from the case studies conducted, including the APDM characteristics (advantages, barriers/challenges, selection factors, and effectiveness perceptions) and recommendations provided by the different agencies.

APDMs Characteristics and Selection Factors. Tables 12, 13, and 14 summarize the selection factors, advantages, disadvantages, and effectiveness considerations across the case study agencies for each APDMs. All methods respond to project complexity and the need for collaboration but differ in execution and suitability. CM/GC stands out for early contractor involvement (mentioned as an advantage by most of the agencies), promoting risk mitigation and allowing flexibility with phased funding delivery. DB emphasizes expedited delivery through concurrent design and construction but is mainly recommended if the agency has full upfront funding. PDB merges benefits of CM/GC and DB by facilitating smoother transitions between design and construction and reducing potential adversarial dynamics between the design team and contractor during the design stage. However, PDB is still in its early stages and lacks long-term performance data. Common advantages across all methods include improved coordination and potential for innovation, while barriers often involve lack of enough and/or skilled staffing, misaligned expectations, and procurement challenges.

Recommendations for Improvement. Tables 15, 16, and 17 summarize the recommendations for each APDM in general and also specifically related to legislation that emerged from the case study agencies. To improve delivery outcomes across CM/GC, DB, and PDB, the case studies recommended early engagement of contractors during design, fostering a collaborative and "project-first" culture through partnering sessions and reinforcing staff capabilities through targeted training. For CM/GC projects, agencies recommended the use of tools such as task teams and Independent Cost Estimators (ICE) to address pricing and risk concerns. The ICEs can also be used in DB and PDB for the same purpose. DB recommendations focused on clear procurement documents, clearly defined risk allocation, and integrated project offices, while PDB recommendations emphasized frequent cost updates and early decision-making around budget and scope. Across all methods, documenting innovations and outcomes is crucial for continual improvement.

As for the ***legislative recommendations***, they primarily aimed to broaden the use and improve the governance of APDMs. For CM/GC and PDB, expanding authority to local and federal agencies, providing standardized guidance, and offering agency training are key strategies. There is also a call for legislative recognition of CM/GC and PDB as more suitable than lump-sum DB for risk management. Supporting these methods through updated fiscal policies, clearer procurement frameworks, and continuous education for funding agencies can further institutionalize their use and foster legislative acceptance.

Table 13. Case Studies: CM/GC Implementation

CM/GC Agencies' Perspective		Caltrans	LA Metro	SANDAG	SBCAG	Placer County	Sonoma County	FCTA	CM/GC Contractors' Perspective
Selection Factors	Project complexity and risk-sharing	X	X	X	X	X			Familiarity with project scope, understanding the owner's needs Relationship with the owner Internal capacity to deliver Desire for early involvement in high-risk or complex projects
	Design and contractor coordination needs due to project complexity*		X	X	X		X		
	Unique environmental or permitting conditions					X			
Advantages	Early contractor involvement improves constructability and risk mitigation.	X		X	X	X	X	X	Clear scope alignment and reduced disputes Opportunities for real-time collaboration Transparency in cost estimation Early risk mitigation and innovation input Better adaptation to incremental funding
	Enhanced stakeholder engagement and collaboration	X		X	X				
	Flexibility with funding and phased work	X		X	X				
	Better schedule adherence and budget control	X			X			X	
	Support for the owner's limited resources	X							
	Better communication with permitting agencies	X							
Barriers/ Challenges	Staffing demands and lack of experienced personnel	X	X			X	X	X	Owner-side lack of collaboration readiness Delayed involvement in design phases Bureaucracy and siloed team structures Concerns about price fairness due to a lack of competitive bidding
	Delayed contractor involvement reduces benefits.	X		X					
	Timing issues with early work packages	X			X				
	Legal/legislative rigidity or limitations	X				X		X	
	Balancing innovation with internal standards	X							

CM/GC Agencies' Perspective		Caltrans	LA Metro	SANDAG	SBCAG	Placer County	Sonoma County	FCTA	CM/GC Contractors' Perspective
	Budget limitations	X							Long timelines and delayed reimbursement Staffing limitations and the need for trust and collaboration among parties
	Managing two contracts and relying on external consultants		X				X		
	Complexity of pursuing enabling legislation							X	
Effectiveness	Improved project outcomes (on time, within budget, safer, more innovative)	X		X	X				Success is highly dependent on collaboration, trust, and staff continuity. Regular discussion to assess effectiveness, but no formal metrics have been established. Better outcomes in terms of time, cost, and quality with full design integration
	Effective for managing complex, multi-phase, or environmentally constrained projects	X		X	X		X		
	Measured through innovation logs, cost savings, and schedule adherence				X	X			

*Project Complexity: including but not limited to overlapping project schedules, multiple funding sources or funding constraints, need for coordination across segments, project technical, operational complexity, constructability issues or/and substantial risks.

Table 14. Case Studies: DB Implementation

DB Agencies' Perspective		Caltrans	LA Metro	DB Contractors' Perspective
Selection Factors	Expedited delivery is needed due to project urgency	x	x	Project risk profile assessment
	Full upfront funding availability	x		Existing presence and resources in the project region
	Lack of in-house design resources	x		Level of competition expected.
	Complexity in coordinating with third parties (e.g., utilities, rail)		x	
	Projects with milestone deadlines like the Olympics		x	
	Regulatory requirements for project approval before award	x		
Advantages	Faster project delivery compared to DBB	x	x	Opportunity for an integrated team approach improves efficiency
	Concurrent design and construction activities	x	x	Lower competition—3 to 4 bidders vs. 13 to 14 in DBB
	Useful when design resources are constrained	x		Strong alignment with contractors who already have regional presence
Barriers/Challenges	Incomplete right-of-way and utility coordination before construction	x	x	Misalignment of expectations due to a fixed price before full design
	Need for highly detailed and bulletproof specifications	x	x	Lack of early constructability review leads to inefficiencies
	Aggressive pricing strategies leading to disputes and claims		x	Schedule pressure often compromises thorough planning.
	Risk allocation difficulties and misunderstanding that DB eliminates change orders	x	x	Heavy risk burden without design control
	Cultural misalignment between engineers and contractors		x	Disputes due to incomplete or vague scope definitions

DB Agencies' Perspective		Caltrans	LA Metro	DB Contractors' Perspective
Effectiveness	Measured by accelerated timelines and innovation implementation	x	x	Key metrics: schedule adherence, cost tracking, and quality
	Not always successful—case-by-case analysis is necessary.		x	

Table 15. Case Studies: PDB Implementation

PDB Agencies' Perspective		**Caltrans**	**LA Metro**	**PDB Contractors perspective**
Selection Factors	Preferred for large, complex, schedule-sensitive projects	x	x	Familiarity with project scope
	Phased funding and evolving design requirements	x	x	Established relationship with client/agency
	Collaborative design is needed to manage risk	x		Internal capacity and interest in design-phase collaboration
	Project tied to major milestone events		x	Preference over traditional DB due to shared risk and flexibility
Advantages	Flexibility in transitioning design into construction	x		Improved alignment on scope, risk, schedule, and cost
	Enhanced collaboration with stakeholders and regulators	x		Early collaboration allows innovation and smoother execution
	Reduces disputes through transparent, feedback-driven process	x	x	Encourages proactive stakeholder involvement
	Fewer construction-phase issues due to thorough preconstruction planning	x		Reduces adversarial dynamics seen in traditional DB
Barriers/Challenges	Limited internal expertise in procurement and phased negotiation	x	x	Perception of pricing uncertainty and fairness due to lack of competition
	Lack of staff familiar with PDB-specific requirements	x	x	Lack of clarity in risk sharing unless structured agreements are followed
	Difficulties in determining when to transition from design to construction	x		Staffing challenges, particularly with engineering support during evolving design
	Cost uncertainty due to negotiated pricing without upfront GMP	x		
Effectiveness	Still under evaluation—only initial projects underway	x	x	Too early to assess long-term performance; effectiveness tied to collaboration and risk alignment

Table 16. Case Studies: CM/GC Recommendations for Improvements

Recommendation	Caltrans	LA Metro	SANDAG	SBCAG	Placer C	Sonoma C	FCTA	Santa Cruz
General CM/GC improvement								
Engage the contractor early in the design phase	x	x	x	x				
Ensure strong internal resources and a collaborative team mindset	x	x	x		x			
Promote trust-building through partnering sessions	x	x	x					x
Train agency staff in CM/GC culture and processes		x	x					x
Use task teams for focused issue resolution.	x		x					
Use Independent Cost Estimators (ICE) to validate pricing	x				x			
Select contractors based on qualifications rather than cost							x	
Use risk, value added, and innovation log	x							
Related to legislation								
Expand CM/GC authority to local and federal agencies	x			x	x			x
Allow greater flexibility in fiscal programming and funding mechanisms	x							
Provide standardized guidance and training for local agencies.			x		x			
Continued education and acceptance by funding agencies						x	x	
Document CM/GC successes to justify legislative support	x						x	
Document innovations and risk mitigation for continuous improvement	x	x				x		
Train agency staff in CM/GC culture and processes.		x	x					

Table 17. Case Studies: DB Recommendations for Improvements

Recommendation	Caltrans	LA Metro
General DB improvements		
Ensure early and thorough constructability reviews	x	x
Conduct early partnering sessions to establish a shared "project-first" mindset		x
Develop clear and detailed procurement documents	x	x
Define risk allocation explicitly in contracts	x	x
Maintain strong collaboration to avoid DBB-like adversarial dynamics		x
Use integrated project offices for better coordination	x	
Maintain institutional knowledge through consistent DB usage	x	
Related to DB legislation		
Be aware that there is an industry trend of considering CM/GC and PDB delivery methods instead of the traditional lump-sum DB to better control the risks assigned to contractors.	x	

Table 18. Case Studies: PDB Recommendations for Improvement

Recommendation	Caltrans	LA Metro
General PDB improvements		
Frequent cost estimate updates in early design to avoid budget overruns		x
Early discussions and decision-making on whether GMP are trending over budget		x
Foster collaboration and a "project-first" mindset through early partnering sessions	x	x
Document innovations and risk mitigation for continuous improvement	x	x
Related to DB legislation		
Expand use of PDB to other public infrastructure agencies, especially at the federal level	x	x
Develop clearer procurement guidance and state-level frameworks for local agency use	x	

6. Comprehensive Analysis & Main Findings

This section will address the four research questions (RQs) based on the findings from all three sources of data collection: content analysis of legislation, survey data, and case studies.

6.1 RQ1. What are the current enabling legislation and policies to implement APDMs in local transportation agencies in California?

Construction Manager/General Contractor (CM/GC). California's use of CM/GC began with AB 2498 (2012), allowing Caltrans to pilot six projects under strict rules. It expanded with AB 2126 (2016) and AB 115 (2017), increasing project limits and including counties such as Riverside. SB 1262 (2018) removed project caps and cost thresholds, requiring two-thirds of projects to use Caltrans or consultants for design. RTAs gained limited CM/GC authority through AB 1171 (2015), later expanded by AB 2374 (2016), AB 115 (2017), and AB 1475 (2019) to include more project types and regions. Transit agencies also received CM/GC authority: SB 1549 (2012) for SANDAG, AB 797 (2013) for Santa Clara and San Mateo, SB 502 (2018) for Metrolink, and AB 427 (2023) for a cross-border project. Pending bills SB 1068 and AB 2235 aim to extend CM/GC use further. Over time, positive results led to broader adoption and fewer restrictions across agencies. The case studies additionally revealed CM/GC project-specific legislation, such as that by Placer County, AB 2374 (2016) which authorized the use of CM/GC for the Yankee Jims Bridge Replacement.

This need for legislation contrasts with larger agencies like the Caltrans or LA Metro, where CM/GC is already institutionalized under existing laws. For example, SB 1262 (2018) grants Caltrans unrestricted authority to use CM/GC for large-scale projects without the project caps and cost thresholds that were originally in place under AB 2498 (2012). Another key finding from the case studies was how CM/GC principles of leveraging collaborative framework were adopted informally without specific legislation in urgent or emergency contexts. The City of Santa Cruz applied CM/GC practices during an emergency culvert replacement caused by storm damage despite lacking formal statutory authority.

Design-Build (DB). California's adoption of the DB began with AB 958 (2000), allowing transit operators to streamline project delivery. This authority was extended by SB 1130 (2004) and significantly expanded through SBX2-4 (2009), which included state highways and introduced Public-Private Partnerships. AB 401 (2013) allowed Caltrans and RTAs to use DB for 10 projects near state highways, while SB 785 (2014) consolidated and standardized DB laws across agencies. AB 1499 (2021) extended Caltrans and RTA DB authority to 2034. The case study also revealed that AB 1499 aimed at enhancing oversight and ensuring increased project accountability by shifting the responsibility for construction inspection services from the contractor to Caltrans. AB 400 (2023) broadened DB access to local agencies for diverse infrastructure projects through 2031. In contrast, SB 985 (2021) focused narrowly on the Otay Mesa East Port of Entry, granting

SANDAG authority to use DB and manage tolling in collaboration with U.S. and Mexican entities. While AB 400 and AB 401 offer broad frameworks for DB use, SB 985 ensures dedicated oversight and funding for a specific cross-border toll facility. From the case studies, it was clear that even though smaller agencies such as the Fresno County Transportation Authority (FCTA) express interest in adopting DB, they face legislative barriers to doing so independently. These agencies, lacking the extensive authority of Caltrans or LA Metro, must either collaborate with a state entity or secure new enabling legislation, thereby constraining their capacity to utilize DB flexibly or on a large scale.

Progressive Design-Build (PDB). California has recently expanded the use of PDB through a series of targeted legislative efforts. SB 991 (2022) first authorized local agencies—such as cities, counties, and special districts—to use PDB for up to 15 water-related infrastructure projects over $5 million, emphasizing early-stage, qualifications-based selection. SB 146 (2023) extended this authority to a broader range of public works projects, allowing up to 8 projects per department over $25 million and included transit districts and RTAs while excluding state-owned properties. SB 706 (2023) further broadened PDB's scope, removing the water-only restriction and permitting local agencies to use PDB for up to 10 projects involving roads, bridges, parks, and buildings. Finally, SB 617 (2023) focused on transit infrastructure, enabling transit agencies and RTAs to use PDB for up to 10 projects over $5 million, aiming to improve delivery and reliability. Together, these laws reflect California's commitment to flexible, efficient infrastructure development across sectors. Caltrans case study provided an example of its first pilot project where the design-builder was selected before pricing, with cost elements (fees and design hours) negotiated later, aligning with SB 146's intent to prioritize collaboration and reduce early-stage risk pressure.

Overall. A legislative trend analysis shows a clear shift toward greater flexibility and broader implementation authority of APDMs in California. Key developments include increased project caps, expanded agency eligibility, and varied cost thresholds based on project type. Laws now often permit QBS and Best Value (BV) procurement, encouraging the selection of highly qualified teams. There's also a rise in collaborative agreements across state, regional, and local agencies, including for projects on state highways and international borders. Many bills require internal design services and mandate reporting to ensure transparency and assess APDM effectiveness. The case studies also revealed that some agencies (such as LA Metro) have legislative authority to use all APDMs through a single California Public Contract Code (PCC), Section 130242. This allows LA Metro to seamlessly implement methods like CM/GC, DB, and PDB, integrating project phases more efficiently. The case study participants recommended uniform enabling legislation across agencies that would facilitate APDMs adoption, eliminate project-specific approval burdens, and enhance delivery speed and flexibility, particularly for smaller agencies with limited resources.

The Caltrans interviews also evidenced that the agency relies on incremental legislation (e.g., AB 2498 for CM/GC, SBX2-4 for DB) to expand APDMs authority, starting with pilot programs that included limitations. As the benefits of these methods became evident, Caltrans gradually expanded the authority to use CM/GC and DB more broadly. This incremental method differs

from smaller agencies such as Placer County Department of Public Works (DPW), which must pursue specific legislation for each initiative. This requirement slows APDMs adoption for smaller agencies, in contrast to Caltrans, which can implement these methods without seeking separate legislative approval for each project. The surveys revealed that for some of these agencies, the key feature for implementing APDMs was the development of intergovernmental agreements to coordinate construction responsibilities, extend project coverage across jurisdictions, define funding arrangements, and clarify operational roles when projects involve state agencies (such as Caltrans), cities, counties, or multiple regional stakeholders.

6.2 RQ2. What is the current state of practice of the use of APDMs in CA local transportation agencies?

While ***CM/GC*** is gaining traction in some agencies, a significant number of agencies have not yet adopted it. It was evident from the case studies that CM/GC was used widely by larger agencies such as Caltrans, LA Metro, and the San Diego Association of Governments (SANDAG). These agencies have institutionalized CM/GC through internal procedures and legislative authority, allowing for more seamless implementation. As for the procurement selection method, most agencies use either BV or QBS for CM/GC projects. Caltrans typically brings CM/GC contractors on board when the design is around 30% complete, allowing for early input on constructability, staging, and risk management. Their selection process is primarily QBS, often including interviews and problem-solving exercises to assess team qualifications. Cost plays a minor role; for example, LA Metro places 80–90% weight on qualifications, emphasizing early alignment and collaboration. In contrast, SBCAG onboarded the CM/GC contractor for the Highway 101 Corridor project when the first segment was already about 95% designed under a traditional model. In 2015, SBCAG and Caltrans jointly decided to shift the full corridor to CM/GC to improve coordination and delivery efficiency. Despite the late stage of design, the contractor provided constructability input and supported the transition, illustrating CM/GC's flexibility in adapting to project needs. CM/GC is preferred for complex, multi-phase, or high-risk projects, where early contractor involvement supports constructability, risk mitigation, and cost management.

DB is moderately mature and more advanced than CM/GC among the survey respondents. It was reported to be used on large-scale projects. Caltrans and LA Metro regularly use DB for infrastructure projects with well-defined scopes and tight timelines, such as bridge replacements and corridor upgrades. DB allows for parallel design and construction, which supports schedule acceleration. For instance, Caltrans used DB on the $400M US-50 project to respond to public and political pressure to expedite delivery. DB is favored when the scope is complete, environmental clearance is obtained, and the agency seeks speed over design flexibility. For example, Caltrans has used DB for standard infrastructure projects where acceleration is key, and design risks are manageable.

However, DB faces limitations in complex, multi-jurisdictional environments due to third-party coordination issues, especially on rail or utility relocation projects. Agencies typically use a BV approach, issuing a request for qualification (RFQ) followed by a request for proposal (RFP). LA Metro applies an 80/20 weighting favoring qualifications over cost, while Caltrans used an 85/15 cost-to-qualifications ratio on the US-50 project, reflecting a priority on budget. Some agencies, like Caltrans, also allow Alternative Technical Concepts (ATCs) during the RFP phase to encourage innovative solutions. Design-builders are generally brought on after environmental clearance and near 100% design scope definition, as seen in Caltrans' DB projects.

PDB, being the newest method, remains in its early adoption or experimental phase for most public agencies and was reported as the least used across most project types. Caltrans and LA Metro are early adopters: They reported using PDB for projects with evolving scopes, where early contractor involvement is essential to manage environmental permitting, third-party coordination, and design refinement before setting cost parameters. Caltrans selected PDB for its first pilot project, where the agency sought phased scoping, environmental coordination, and cost flexibility. LA Metro also uses PDB in projects that benefit from progressive scope development and iterative design validation.

While both agencies see value in PDB's flexibility, internal staffing constraints—particularly around Guaranteed Maximum Price (GMP) negotiation and cross-departmental collaboration—propose ongoing challenges. LA Metro emphasized that implementation success also depends on aligning procurement, engineering, and financial teams. PDB projects follow a QBS process, typically issued as an RFQ without a separate RFP. Agencies like Caltrans and LA Metro place strong emphasis on collaboration and team capability, with design pricing (fees and hourly rates) making up only 10–15% of the evaluation; the rest is focused on qualifications and interviews. For example, in Caltrans' Coronado Bridge PDB pilot, the agency noted that GMP negotiations are expected to occur after approximately 60% of the design is complete, allowing time for scope development and iterative risk assessment. This phased approach provides flexibility in refining project requirements before finalizing cost commitments.

Overall. The survey results showed that public agencies overall demonstrate extensive maturity level with DBB, yet their adoption of APDMs is still largely absent or in early stages. However, the private sector appears to be further along in adopting APDMs. Upon a deeper dive into the spectrum of public agencies, results indicated that PDM maturity levels vary significantly by agency type and delivery method. For example, state agencies demonstrated advanced implementation across all APDMs while special agencies show a more mixed profile, and County Public Works agencies show strong maturity in DBB but limited adoption of other methods.

DBB continues to be the most widely used PDM across all project types compared to APDMs used mostly for traditional projects (e.g., roads). Larger agencies like Caltrans, LA Metro, and SANDAG actively use APDMs due to their legislative authority, internal staff capacity, and established procurement frameworks. These agencies typically select delivery methods based on

project complexity, risk profile, and schedule needs. In contrast, smaller agencies such as Placer County must pursue project-specific legislation and often face internal resource or staffing constraints, which together limit their ability to adopt APDMs, sometimes preventing use altogether. As for procurement selection methods, more progressive procurement methods (QBS and BV) are tightly coupled with APDMs (CM/GC, DB, and PDB) that emphasize qualifications.

Comparing both private and public in terms of their ***future plans*** to use APDMs, private entities are more proactive in expanding the use of CM/GC and PDB. DB is the most contested method: Public agencies are split, with most having no plans to use it and some planning to increase use, whereas private entities are more skeptical, with the majority planning to reduce use or avoid it. For PDB, the private sector showed the strongest growth interest (66.7% plan to increase use), while public sector was more cautious, with 41.5% having no plans to use it and 34.1% planning to increase use. Overall, statistical tests indicated that private agencies have more future plans compared to the public to adopt APDMs. This indicates a private industry that is ready for more APDM projects.

It was interesting to note from the FCTA case study that the agencies who do not use APDMs worry about losing control over projects and are hesitant to let go of responsibilities, which leads them to retain risk instead of transferring it to the contractor—undermining one of the main advantages of APDMs. Moreover, for those with no enabling APDM legislation, the process of pursuing enabling legislation or navigating a partnership with Caltrans can be complex and discouraging for local agencies.

6.3 RQ3. What are the APDMs' advantages and disadvantages, as well as the opportunities and barriers for its use?

CM/GC. *Advantages.* Overall, the survey findings showed that collaboration is consistently rated as a favorable characteristic across all PDMs by the public and private sectors. This emphasis on collaboration is echoed in the case study data, where agencies such as Caltrans, LA Metro, SANDAG, SBAG, and Placer County cited early contractor involvement—a defining feature of CM/GC—as a key benefit leading to improved constructability reviews, risk mitigation, and stronger team coordination. Early collaboration also supports better schedule adherence and budget control by aligning expectations early and addressing potential conflicts before construction begins. Constructors appreciate the opportunity for real-time input on design, which enhances constructability, innovation, and risk management. The method also allows contractors to develop a stronger understanding of the owner's needs, leveraging their internal capacity and experience to deliver better results.

Agencies further highlighted improved stakeholder engagement, streamlined communication with permitting bodies, and greater flexibility in managing phased work and incremental funding.

These factors are particularly beneficial in projects with unique environmental conditions or tight regulatory requirements.

Disadvantages/Barriers. Public agencies perceived higher barriers, more constraints, and more complexity overall, especially for CM/GC, compared with the private sector. Public agencies, such as Caltrans, LA Metro, SANDAG, SBAG, and Placer County, reported that one of the most pressing issues is the demand for experienced staff and internal resources. Many agencies struggle with staffing limitations and a lack of personnel familiar with CM/GC processes, which can hinder effective collaboration and implementation. Additionally, delayed contractor involvement—primarily if not engaged early in the design phase—can reduce the intended benefits of the model. Bureaucratic hurdles and siloed team structures were also identified by private industry as factors that complicate project execution.

Survey and case studies results indicated that legal and legislative constraints, such as limited authority to use CM/GC or rigid procurement frameworks, are also barriers that further limit the flexibility and scalability of this delivery method in certain agencies. While legislative constraints are not barriers for agencies such as LA Metro, expertise gaps in procurement procedures for APDMs still pose a challenge, which leads them to depend on external legal counsel to establish procurement frameworks and contract documents. An example of procurement regulations constraints is the subcontractors' listing requirements related to the Public Contract Code (PCC) which can create complications; in CM/GC, the scope of work is often negotiated during the project, which makes it difficult to list the subcontractors upfront. While there is a way for owners to waive these requirements, many owners are not familiar with this flexibility, adding another layer of complexity. Some agencies noted challenges in managing two separate contracts (design and construction) and a reliance on external consultants, which can introduce coordination issues and inefficiencies. The public and private sector agreed on higher perceived costs for CM/GC and concerns about price fairness due to the absence of competitive bidding, which can generate mistrust or scrutiny from stakeholders.

DB. *Advantages*. One of the primary benefits of DB is faster project delivery compared to traditional Design-Bid-Build (DBB). This accelerated timeline is made possible by allowing design and construction activities to proceed concurrently, which reduces delays and compresses the overall schedule. This can be an advantage for projects requiring expedited delivery due to urgent infrastructure needs. Agencies also noted that DB is especially useful when in-house design resources are limited, as the method enables them to outsource design responsibilities. Private industry highlighted that the DB procurement process typically involves a smaller, more qualified pool of bidders—usually three to four as opposed to over a dozen in DBB—which increases the likelihood of winning contracts and fosters more meaningful competition.

Disadvantages. Caltrans and LA Metro indicated that one of the major drawbacks is the risk of incomplete right-of-way acquisitions and utility coordination prior to construction, which can disrupt project timelines and increase costs. Another significant concern is the misalignment of

expectations that can arise from establishing a fixed price before the design is fully developed. This fixed-price approach can lead to disputes and claims, especially when detailed and precise specifications are lacking. Agencies also observed that the need for highly detailed and bulletproof contract documents can slow down the procurement process and place additional pressure on early-stage planning. Moreover, the DB model sometimes leads to aggressive pricing strategies by contractors, who may underbid to win the contract.

Public agencies were also more critical of DB's impact on quality and owner involvement, while private entities did not highlight cost concerns as strongly. However, based on the case studies, private firms see DB as riskier than CM/GC or PDB because they do not have the chance to work together with the owner in the early stages of the design, leading to a lack of knowledge of potential risks that can materialize during construction. For agencies that did not use DB before, it was interesting to note that there was a general reluctance due to the negative perception of DB resulting from the struggles of high-profile DB projects; these projects faced significant delays, cost overruns, and change orders, and they led to an unfairly shaped public narrative, causing many agencies—particularly in the Central Valley—to avoid DB altogether. The influence of staff unions is also not to be undermined, as DB could be also perceived to shift work away from their members.

PDB. *Advantages*. PDB appears to be the most favorably viewed overall regarding collaboration and owner involvement. Agencies such as Caltrans and LA Metro recognize that PDB provides greater flexibility in transitioning from design into construction, which is especially beneficial when project requirements or funding evolve over time. Early involvement of the contractor facilitates innovative solutions and smoother project execution, as the owner, designers, and contractor can proactively identify risks and resolve issues during the preconstruction phase. Both agencies and contractors value PDB's ability to reduce construction-phase disputes through a feedback-driven and transparent design process, which promotes alignment on scope, risk, cost, and schedule. Contractors particularly appreciate how PDB encourages proactive engagement and minimizes the adversarial dynamics often seen in traditional DB models. Thorough preconstruction planning under PDB leads to fewer issues during construction, supporting more efficient and predictable project delivery.

Disadvantages. One key challenge identified by public agencies is the limited internal expertise among public agencies in managing phased negotiations and procurement processes specific to PDB. This can lead to inefficiencies or delays, particularly when agency staff are unfamiliar with the nuances of the method. Additionally, there is a perception of pricing uncertainty and fairness, as PDB does not rely on competitive bidding at the initial stage. Instead, pricing is negotiated later in the process, which can raise concerns about transparency and cost control. Agencies also face difficulties in determining the appropriate moment to transition from design to construction, a decision that requires careful planning and clear criteria. Staffing shortages, especially in engineering roles during the evolving design phase, can limit the ability of agencies to actively engage and make timely decisions. Contractors, in turn, must navigate the uncertainty of cost due

to the absence of an upfront Guaranteed Maximum Price (GMP), which can complicate budgeting and risk management.

Applicable to All APDMs (CM/GC, DB, PDB). Overall, the survey and case studies found collaboration as a favorable characteristic across all PDMs by the public and private sectors, especially in CM/GC and PDB.

One of the most frequently reported challenges across methods is their inherent complexity. This complexity is further compounded in newer methods like PDB by legislative and regulatory constraints. Although NEPA compliance and local contractor buy-in are generally not perceived as major barriers across the board, procurement challenges remain a consistent concern. Specifically, in both public and private sectors, the complexity of the procurement process is widely ranked as the most significant issue. In DB, risk transfer was deemed a more concerning issue, highlighting a key reason why the private sector anticipates reduced future use of DB.

The availability of skilled contractors was typically ranked as a lesser concern for most delivery methods, but this was a consistent theme across the case studies. Thus, this barrier is perceived as less relevant than others, but it is still a barrier faced by most agencies. This highlights the need for greater education and familiarity with APDM processes. Further analysis based on agency type revealed nuanced differences in perceived challenges. While many agencies—such as Metropolitan Planning Organizations (MPOs), Special Districts, and State Agencies—agreed that complexity is the top barrier, others—County Public Works departments and RTPAs—highlighted different issues. Some Special Districts identified regulatory compliance as their primary obstacle, whereas County Planning and Building Departments emphasized a lack of internal experience. This suggests that the type of agency and its organizational structure significantly shape which barriers are most acute.

Lastly, the influence of legislative and regulatory frameworks is generally felt more strongly by public sector agencies than their private counterparts. This influence is especially pronounced in the procurement phases of APDMs, with PDB and CM/GC being the most affected, followed by DB and traditional DBB. Agencies without experience in alternative contracting often struggle with bureaucratic, process-driven mindsets that can make it difficult for agencies to adapt to the flexibility and collaborative approach required by APDMs generally. Contractors also emphasized the importance of owners having experience with APDMs as it facilitates smooth coordination between all the stakeholders.

6.4 RQ4. What key aspects should be considered in the APDMs' selection and implementation in local transportation agencies?

Table 18 summarizes the key selection factors for each APDM based on the case study interviews and survey responses. The survey is designated by an "S," followed by parentheses that indicate the ranking of the factor based on the agency respondents. The case study is designated by a "C" and

is included if referenced by more than one agency of those interviewed. For example, the need for collaboration was ranked as the first factor S(1) for selecting CM/GC and PDB in the survey and was also mentioned by more than one case study respondents (C), while for selection of DB, it ranked second S(2) in the survey. The bold designations are considered the most relevant to the respective APDM (ranked in the top 3 in the survey or mentioned by more than 2 out of 8 case studies). The selection factors are organized into two categories: internal project-specific factors and external factors.

Table 19. Agencies' APDM Readiness and Selection Factors Across Case Study and Survey Data

Factors		**CM/GC**	**DB**	**PDB**
Internal Factors – Project	Need for collaboration (including collaborative design development)	**C, S(1)**	**S(2)**	**C, S(1)**
	Expedited project timeline/schedule	**S(2)**	**C, S(1)**	S(4)
	Need for creative solutions	**S(2)**	S(4)	S(5)
	Need for flexibility (e.g., design)	**S(3)**	S(5)	**S(2)**
	Need for cost savings	S(4)	**S(3)**	**S(3)**
	Complex projects (e.g., means and methods or Third-party coordination challenges)	**C**	C	**C**
	Scope uncertainty/Evolving design	**C**	-	**C**
	Need for early risk mitigation/high risk profile	**C**, S(4)	C, S(6)	**C**, S(5)
	Limited in-house design staff	-	**C**	-
External Factors	Phasing requirement due to funding	**C**	-	**C**
	Multiple funding sources	**C**	-	-
	Full funding is available up-front	-	**C**	-

* C: emerged from Case Study, S(1): emerged from Survey (rank number based on other factors in survey)

In summary, CM/GC is best suited for:

- *High-risk, complex, or environmentally sensitive projects*. Agencies selected CM/GC when traditional low-bid methods were unlikely to manage the risks and complexities effectively. For example, Placer County selected CM/GC for the Yankee Jims Bridge Replacement due to the project's remote location, limited access, and environmentally sensitive setting, which required coordination with the Bureau of Reclamation, Bureau of Land Management (BLM), and tribal entities. SBCAG similarly applied CM/GC on the Highway 101 corridor, where coastal zone regulations and environmental permitting made early contractor input essential.

- *Projects requiring coordination and staging are critical*. Caltrans selected CM/GC to manage overlapping construction segments and multiple funding streams on the Santa Barbara U.S. 101 corridor, preventing contractor conflicts and delays. SBCAG leveraged CM/GC to improve phasing across work packages, while SANDAG highlighted CM/GC's value in scenarios with staggered or uncertain funding that required delivering segments as funds became available.

- *Project where early contractor input is needed on constructability and risk management*. SANDAG and LA Metro emphasized the importance of early contractor involvement for constructability reviews and risk identification. LA Metro used CM/GC when design responsibility remained with the agency, but contractor insight was critical during preconstruction. SANDAG applied the method to extract input for phasing and early risk management in technically constrained projects.

DB is best suited for:

- *Projects where speed is critical and agency staffing is limited*. For example, Caltrans selected DB for a $400 million project specifically to fast-track the schedule. By transferring design responsibilities to the contractor, Caltrans overcame an internal shortage of design engineers, avoiding delays that would have occurred under traditional DBB delivery.

- *Projects with well-defined scope and full funding*. Federal rules require at least 30% design completion and environmental clearance before DB contracts can be awarded. Caltrans applied DB in cases where scope was fixed, funding was secured upfront, and risks were clearly understood, all of which are conditions that reduce uncertainty in lump-sum pricing.

- *Projects where it is needed to shift responsibility to the contractor*. DB transfers both design and construction responsibilities to the contractor, reducing the owner's workload. Caltrans found this structure beneficial in projects where internal staffing was limited, allowing the agency to focus on oversight while the contractor managed delivery execution.

PDB is best suited for:

- *Large, schedule-driven projects.* LA Metro favored PDB for milestone-sensitive projects like those tied to the 2028 Olympics, where accelerated delivery and contractor-led design management were critical. PDB enabled early involvement while preserving design flexibility, making it ideal for large, high-stakes initiatives.

- *Projects where collaborative design development is critical before pricing*. PDB allows design to progress to ~60% before the GMP is negotiated, enabling shared risk identification, scope refinement, and improved pricing alignment. This feature was particularly emphasized in LA Metro's internal delivery approach for complex projects.

- *Projects where QBS is critical.* Because the final price is negotiated later in the process, selecting the right team upfront is essential. Agencies implementing PDB emphasize QBS to identify teams with strong collaborative skills, technical capability, and experience navigating phased delivery models.

Overall, the organizations need to consider the following before implementing any APDM:

- *Agency readiness*: Agencies should assess their internal capacity and expertise before selecting an APDM. Some methods require specialized knowledge and more experienced staff, especially in handling negotiations and managing evolving designs. Further, intense resource allocation needs to be considered in the pre-construction phases, and agencies need to plan how to balance their workload with the rest of the projects they are executing. Finally, successful APDM implementation requires a "project-first mindset," avoiding siloed structures and leveraging collaboration, which might be a cultural shift in the organization that needs to be managed.

- *Stakeholder engagement:* Early and continuous engagement with stakeholders (e.g., local communities, regulatory agencies, and third-party contractors) is critical for ensuring smooth project execution and avoiding delays.

- *Legislative support*: Ensure that legislative or regulatory frameworks support the chosen APDM. This approach can involve reviewing state laws or obtaining necessary legislative approvals before starting the procurement process, or as mentioned by some of the survey respondents, developing agencies intergovernmental agreements.

As for reasons not to use CM/GC and PDB, the top ranked reasons were insufficient in-house expertise or resources and legislative or regulatory barriers. The unfamiliarity and lack of experience in implementing an open negotiation process was also ranked higher for CM/GC. On the private end and for PDB specifically, similar to the public sector, the lack of in-house expertise and unfamiliarity and lack of experience in implementing an open negotiation process were reported as the highest.

7. Conclusions & Recommendations for Future Studies

The objective of this study was to benchmark the existing use of APDMs in local transportation agencies of different types and sizes in California, while considering the characteristics of each APDMs and the authorizations enabling its implementation, as well as provide recommendations for key factors to consider in APDMs selection and implementation by California's local transportation agencies. To achieve this objective, the team conducted a four-pronged approach including a review of existing literature, content analysis of 30 APDM bills from 1999 to 2024, a survey of transportation agencies, and case studies of eight agencies. The comprehensive analysis of APDMs—CM/GC, DB, and PDB—in California's local transportation agencies reveals evolving implementation landscape shaped by legislative authority, agency capacity, and project-specific demands. This section will provide a summary of the key research highlights followed by practical recommendations for legislators, agencies, and contractors stemming from the research findings, as well recommendations for future research.

7.1 Conclusions

Legislative Evolution and Institutional Readiness. California's legislative framework has progressively expanded to support APDMs, particularly for larger agencies like Caltrans and LA Metro. These agencies benefit from broad, often consolidated statutory authority (e.g., PCC Section 130242 for LA Metro), enabling them to implement CM/GC, DB, and PDB without project-specific legislation. In contrast, smaller agencies such as Placer County need to pursue individual legislative approvals, limiting APDM implementation flexibility. The legislative trend shows a shift toward broader eligibility, increased project caps, and more collaborative procurement models like QBS and BV.

Current State of Practice. CM/GC is increasingly used for complex, high-risk, or phased projects where early contractor involvement enhances constructability, risk mitigation, and stakeholder coordination. Agencies like Caltrans and SANDAG have institutionalized CM/GC, while others like SBCAG have adopted CM/GC mid-project to improve delivery. DB is more mature and widely used for schedule-driven projects with well-defined scopes and full funding. While it enables concurrent design and construction, it limits owner involvement. PDB, though newer, is gaining traction for large, evolving projects requiring collaborative scope development and phased pricing. Caltrans and LA Metro are piloting PDB for milestone-sensitive projects, such as those tied to the 2028 Olympics. Private agencies showed a higher maturity level compared to the public sector across all APDMs in general, with a growing trend to pursue more CM/GC and PDB than DB projects.

Advantages, Barriers, and Agency Type Differences. Across all APDMs, collaboration is the most valued feature, especially in CM/GC and PDB. These methods support early alignment, innovation, and risk-sharing. However, barriers persist—particularly for public agencies—

including limited internal expertise, legislative constraints, and complex procurement processes. CM/GC and PDB face challenges in managing open negotiations and GMP development. DB, while efficient, is criticized for reduced owner control and rigid scope requirements.

Selection and Implementation Considerations. Key factors influencing APDM selection include project complexity, risk profile, funding structure, and agency readiness. Survey and case study data emphasize the importance of internal staffing, stakeholder engagement, and legislative support. Agencies must align delivery methods with project needs—CM/GC for high-risk, phased projects; DB for speed and scope clarity; and PDB for collaborative, evolving scopes. Structured evaluation processes, such as Caltrans' internal review for DB projects, ensure suitability and public value.

7.2 Study Recommendations

Based on the bills content analysis, survey, and case study data collected and analyzed, the following are recommendations tailored to legislators, agencies, and contractors related to CM/GC, DB, and PDB adoption and implementation.

7.2.1 Recommendations for Legislators

- *External guidance and legislative support to enable APDM adoption.* Provide technical guidance, training, and clear legislative support could help expand its adoption, allowing more local agencies to take advantage of early contractor involvement, improved risk management, and streamlined project delivery. Many local agencies have shown interest in CM/GC but may lack expertise or awareness of how to implement it effectively.

- *Education & Training on APDM implementation.* Educate decision-makers and agencies on the appropriate use of APDMs. For example, while CM/GC is a powerful tool for complex or time-sensitive projects, it is not a one-size-fits-all solution. Training programs and case studies should be developed to help agencies determine when CM/GC is the most effective delivery method, ensuring that it is used strategically to maximize efficiency, cost savings, and project success. In some cases, the local agency might have authorization for using CM/GC, but the lack of internal familiarity leads to lengthy internal approval processes.

- *Evaluate current fiscal programming requirements.* Fiscal programming requirements mandate detailed project plans, budgets, and spending allocations years in advance, creating challenges for agencies when addressing complex or evolving project needs. This rigidity limits flexibility, particularly in cases where unforeseen challenges arise late in the design or construction process. For example, some projects might benefit from breaking the overall work into smaller phases, such as starting construction on critical components early. Still, the current system requires full project scope and cost

clarity well in advance, leaving little room for adjustments. Another example is the funding provided under SB1, where local agencies must cover any cost overrun. Allowing greater flexibility in state and federal funding mechanisms would help mitigate financial risks and improve project delivery.

- *Evaluate the possibility of establishing a framework that allows agencies to use CM/GC more efficiently* without requiring individual project-specific bills. A general authorization for agencies to use CM/GC, while incorporating a qualification or oversight process, would streamline project delivery without unnecessary bureaucratic hurdles.

- *Launch pilot programs* and further investigate the benefits of PDB to improve project outcomes.

- *Adopt a more open and standardized approach* to APDMs statewide, allowing them to be used more widely without requiring extensive justification. Agencies often face delays in obtaining the necessary legislative and board approvals, which can hinder the implementation of APDMs. A blanket approval or an easier path to approval would help speed up the process.

- To foster broader APDM adoption, especially among smaller agencies, the study recommends uniform enabling legislation, capacity-building initiatives, and intergovernmental agreements to streamline implementation. These steps will enhance delivery efficiency, promote innovation, and ensure that APDMs are applied where they offer the greatest benefit to California's transportation infrastructure.

7.2.2 Recommendations for Agencies

- *Staff dedication and qualifications*. Organizations should dedicate entire design teams to CM/GC projects rather than spreading their efforts across multiple contracts to ensure the necessary focus and collaboration for CM/GC. Experienced personnel are crucial to understanding how jobs are priced. If the agency design is outsourced, ensure that the agency staff has the ability, skills, and experience to manage and coordinate the design contract and the CM/GC contract. In the case of DB, it is important to assign dedicated staff for design reviews and oversight. For PDB, the agency must have skilled personnel who understand the entire delivery process and can support the necessary negotiations to transition from design to construction.

- *Be prepared for increased pre-construction effort*. CM/GC and PDB require more time and collaboration during the design phase, as agencies must work closely with the contractor to review plans, resolve issues early, and refine constructability before construction begins.

- *Training and external support*. Staff should be trained on APDMs. Organizations should identify and address expertise gaps in procurement procedures and design and construction processes. Further, they should analyze if there is a need for an external legal counsel to establish APDM procurement frameworks and contract documents.

- *Timing*. In CM/GC, if the agency design is outsourced, ensure that you have funds to hire the CM/GC at the appropriate time during the design stage (30%–60%). If the contractor is onboarded later, their recommendations might require design rework that will impact the designer's contractual scope, leading to additional costs. This situation also hinders the CM/GC's ability to fully engage in the design process.

- *Leverage genuine collaboration*. Although APDMs are adopted in part to align risk with contractor capacity, some teams continue to treat these contracts like DBB, leading to adversarial relationships. It is suggested to conduct early partnering sessions to establish project goals, working agreements, and a shared "project-first" mindset from the outset.

- *Ensure well-prepared procurement documents, including clear project specifications and risk allocation.* In DB projects, providing clear and detailed project specifications is very important to avoid misinterpretations. Further, risk allocation should be clearly included in contract language to prevent disputes between owners and contractors, as there is often a misconception that DB eliminates change orders entirely.

- *Use of task teams.* In CM/GC, it is recommended that small task groups composed of both contractor and design team members be formed to efficiently resolve specific issues. This reduces the need for management to be involved in every detail while ensuring alignment with project goals.

- *Understand cost differences and leverage ICEs*. Traditional low-bid and alternative delivery estimates can differ substantially. Ensure the public agency has a strategy to address the different price perceptions between the owner and the construction manager or design-builder. Onboarding an ICE can help identify discrepancies and provide negotiation leverage. This process ultimately builds confidence in cost assessments and ensures fair pricing. In the case of PDB, consider frequent cost estimate updates during early design phases to address any differences in cost projections before significant resources are committed.

- *When planning to board an ICE,* select a professional with experience negotiating cost differentials, particularly with contractors estimating longer durations or misaligned crew sizes. Further, having someone on the team with hands-on construction experience is critical in identifying cost-effective and practical solutions. A team member with this background can effectively challenge contractors' methods, ensuring the most efficient and feasible approach is chosen.

- *In CM/GC projects, engage the ICE early before the contractor is onboard*. This enables the ICE and the owner to set the Work Breakdown Structure (WBS) and estimating standards. It prevents the process from being dragged out by having to reverse-engineer the contractor's structure.

- *In DB projects, engage ICEs at early design stages only*. The ICE's role in DB should be focused on early-phase estimating (15–60%) to set budgets and expectations before bidding. Once the contractor is selected, there is no further role for the ICE as design and cost responsibilities shift entirely to the design-build team.

- *In PDB projects, bring the ICE on board before selecting the PDB contractor*. Early involvement allows the ICE to shape the cost structure and estimating methodology and work alongside the owner to establish expectations before pricing begins. It avoids adapting to a contractor's pre-established (and potentially opaque) format.

- *Track benefits, such as cost savings, scheduling flexibility, and reduced risk exposure*, so agencies can justify the use of APDMs to legislators and oversight bodies. The more success stories agencies can document, the easier it will be to secure continued or expanded use of APDMs.

7.2.3 Recommendations for Contractors

- *Staffing*. The company's ability to submit a proposal often depends on whether they have the right people available to meet the staffing requirements specified in the RFP. APDMs require a significant upfront effort that does not bring immediate revenue compared to those engaged in active construction. It is important to be able to balance workloads, specifically if the contract includes several construction packages with different levels of pre-construction/construction simultaneously.

- *Involve actual builders throughout*. The personnel building the project, such as superintendents, should be involved from the beginning and remain engaged throughout the pre-construction process. Their practical knowledge and input are essential, even if it means exceeding the initially budgeted hours.

- *Establish efficient project management processes during pre-construction phase*. Collaborate with the owner to set up effective and efficient processes for communication, collaboration, and reporting. This includes holding regular status meetings with clear agendas, defined action items, and consistent follow-up—all of which are standard practice in construction but often lacking in pre-construction phases.

- *Adopt a project-first mentality and prioritize transparency.* Always focus on what is best for the project. Being transparent builds trust, which in turn accelerates problem-solving.

- *Build schedule and cost model early.* At the start of the process, develop a detailed schedule and cost model that reflects construction realities, risks, and constraints. Focus efforts on major cost drivers and long-duration activities rather than minor details.

- *Be aware of the listing requirements in California* (specifically related to the PCC) and make sure the owner knows how to manage them under APDMs. In a traditional low-bid process, contractors are required to list subcontractors with a fixed scope of work. However, in APDMs, the scope of work is often negotiated during the project, which means subcontractor quotes may not be available upfront, making it difficult to list them according to traditional requirements. While there is a way for owners to waive these requirements, many owners are not familiar with this flexibility, adding another layer of complexity.

- *Order of Precedence in Contracts.* In CM/GC, it is critical to ensure that all mutual understanding and collaborative work done during the preconstruction phase are properly documented and placed high in the order of precedence in the contract documents. When this is not done, valuable input and agreements risk being ignored during construction.

- *Maintain and keep a risk register and innovation/value log* to document the contractor's contributions, such as cost savings or improved phasing, and allow for continuous improvement in future projects. This will also allow the agency to assess the return on investment on spending upfront to mitigate risk impacts during construction and provide a case for future APDM implementation.

- *Procurement document analysis*. In DB procurement, ensure that your team deeply analyzes all the procurement documents and project background to understand the 30% design provided by the owner. Exercise caution when proposing new Alternative Technical Concepts (ATC), evaluate the risks involved in the new solutions, and determine whether they align with the project history. Make sure that the new solution does not introduce additional risks.

- *Focus more on early constructability review*, as in DB, it would help prevent delays caused by unforeseen field conditions. Balancing design accuracy with schedule constraints is crucial to maintaining project timelines in a design-build environment.

- *Develop a joint risk register.* CM/GC and PDB benefit from a jointly developed risk register that pre-defines responsibilities. If a risk occurs, there is a mechanism to be paid for it. This collaborative risk-sharing contrasts sharply with design build.

7.3 Limitations and Recommendations for Future Research

Findings and recommendations of this research should be interpreted considering the study's constraints. The study included 86 survey responses and 8 agency case studies (5 out of 7 types of agencies in the survey were represented). The data set collected provides breadth and depth but cannot capture every local context across California's 500-plus transportation entities and limits the comprehensiveness of organizational perspectives. Additionally, while the study includes a sizable survey sample, the early-stage nature of PDB adoption and varying levels of CM/GC maturity among agencies restrict the ability to assess long-term effectiveness or draw robust comparative conclusions. Smaller agencies in particular remain underrepresented and often face unique barriers such as limited staffing, funding constraints, or the need for project-specific legislative authority—all of which merit closer examination.

A key limitation of this study is that multiple analyses were conducted across APDMs without adjustment for multiplicity, increasing the risk of Type I error, so APDM-level findings should be considered exploratory and interpreted with caution. The modest sample size (n = 78) may have limited statistical power, particularly in subgroup analyses, meaning some nonsignificant results could reflect Type II error. Finally, while several statistically significant differences were identified, their practical significance is harder to assess because much of the data came from Likert-scale responses analyzed with non-parametric methods, which do not yield standardized effect sizes as readily as parametric tests. Future studies may employ designs that allow for more precise effect size estimation.

Given these limitations, several directions for future research emerge, which include:

- A deeper dive into the internal structure, governance, and decision-making cultures of different agency types is needed to understand better how APDMs can be tailored and supported in each context, given the agencies' specific barriers and challenges.

- Targeted studies focusing on smaller agencies are especially important; these organizations often lack institutional knowledge or capacity and would benefit from practical guidance and education programs tailored to their needs. While both the survey and case studies revealed a widespread desire for more training and clearer implementation frameworks, it was also clear that there are disparities in the maturity and the experience levels across the agency types. Therefore, a strategic education and outreach initiative—possibly led by experienced agencies or professional associations—could significantly accelerate APDM readiness across California and encourage its adoption where possible.

- An agency APDM readiness assessment tool specific to California unique local transportation agencies can help agencies assess their readiness to adopt APDMs. It could also identify necessary organizational requirements that need to be capitalized on (such as staffing experience and training). This would help agencies assess their internal capacity and expertise before selecting an APDM.

- Future research should move beyond traditional metrics such as cost and schedule performance to evaluate effectiveness against a broader set of goals, including funding flexibility, stakeholder engagement, and preconstruction efficiency. Such performance assessments should be stratified by agency type to ensure more nuanced and applicable findings.

- Finally, there is a need to develop a California-specific APDM decision support system—ideally informed by both public-sector data and private-sector experience—that guides agencies (particularly these venturing into APDMs) in selecting the most appropriate delivery method based on project characteristics, organizational readiness, and performance objectives. This tool could serve as a practical bridge between high-level policy recommendations and day-to-day implementation challenges.

Appendix A. Survey Questionnaire

Survey Flow

1. General information
    a. Agency
    b. Respondent
2. APDMs utilization
    a. Maturity levels
    b. Future plans for the use of APDM
    c. Reasons why an agency is not using certain PDM
    d. Enabling legislation
    e. Types of projects, scope use, cost range in APDM projects
3. APDMs selection
    a. Where is it currently used?
    b. Factors leading the selection
4. APDMs procurement
    a. Types
    b. Challenges
    c. Improvements
    d. Influence of Legislative and Regulatory Factors
5. APDMs implementation
    a. Experiences
    b. Barriers
    c. Influence of Legislative and Regulatory Factors
6. APDMs lessons learned & recommendations
    a. Lessons learned
    b. Recommendations
7. Case Study Interest and specific projects
    a. Interest in participating in case study
    b. Project information

1. General Information

Agency

1. **Name of Agency**: (open-ended)
2. **Type of Agency:** (multiple choice)

- State Agency,
- County Agency,
- Local Agency,
- Special Agency (such as transit, water, etc.)
- Other, please specify:

Respondent

3. Your role in the Alternative Project Delivery Method (APDM) projects? (Select all that apply) (multiple answers)

    - Agency Director of Alternative Delivery
    - Program Manager
    - Project Manager
    - Engineer
    - Construction Manager
    - Quality Assurance/Control
    - Contract Administrator/Procurement Engineer
    - Legal Advisor
    - Others: [Specify]

4. Years of Experience in the Construction industry: (Select one) (multiple choice)

    - Less than one year
    - 2-5 years
    - 6-10 years
    - 11-20 years
    - More than 20 years

5. Years involved in each of the following project delivery methods. Select "Never" if you were never involved in the project delivery methods listed (for each PDM, provide a drop-down menu)

Delivery Method	Never	Less than 1 year	2–5 years	6–10 years	11–20 years	More than 20 years
Design-Bid-Build	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Construction Manager/General Contractor (CM/GC)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Design-Build (DB)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Progressive Design Build (PDB)	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

2. APDMs Utilization

Maturity levels

6. What is your agency's level of maturity in implementing these alternative project delivery methods? For each project delivery method? (Likert scale question)

    - Not implemented. The project delivery method has not been introduced or used by the agency

- Initial awareness. The agency is aware of the project delivery method, but its use is rare or in an experimental phase
- Early adoption. The project delivery method is used on selected projects, but practices are inconsistent, case-by-case, and not standardized across the agency
- Developing The agency regularly uses the project delivery method with established processes, though improvements are still being made.
- Fully mature. The project delivery method is fully integrated across the agency with well-established practices, measurable results, and continuous improvement processes

Delivery Method	1 Not implemented.	2 Initial awareness.	3 Early adoption.	4 Developing	5 Fully mature.
Design-Bid-Build	[ ]	[ ]	[ ]	[ ]	[ ]
Construction Manager/General Contractor (CM/GC)	[ ]	[ ]	[ ]	[ ]	[ ]
Design-Build (DB)	[ ]	[ ]	[ ]	[ ]	[ ]
Progressive Design-Build (PDB)	[ ]	[ ]	[ ]	[ ]	[ ]

7. How many projects on average (new construction or maintenance) does your agency have ongoing in a given year?

   - 1–5 projects
   - 6–10 projects
   - 11–15 projects
   - 16–20 projects
   - 20–30 projects
   - 30–50 projects
   - 50–75 projects
   - >75 projects

8. From these (answer piping from question 7) projects, what percentage utilize the various PDMs below in a given year?

   - Logic: If not implemented selected in question 6, PDM does not appear

PDM	None	10%	20%	30%	60%	100%
Design-Bid-Build (DBB)						
Construction Manager/General Contractor (CM/GC)						
Design-Build (DB)						
Progressive Design-Build (PDB)						

Future plans

9. **In your agency, what are future plans for the use of the following PDMs? (**I would suggest splitting into three questions, one per PDM, and applying the same logic as in questions 7-9)

Project Delivery Method (APDM)	No Plans to use	Maintain current use	Reduce Usage	Increase Use	Explain Why: [Open Text Field]
Construction Manager/General Contractor (CM/GC)	[ ]	[ ]	[ ]	[ ]	[Open Text Field]
Design-Build (DB)	[ ]	[ ]	[ ]	[ ]	[Open Text Field]
Progressive Design-Build (PDB)	[ ]	[ ]	[ ]	[ ]	[Open Text Field]

Reasons why the agency is not using certain PDM

10. Please~~.~~ rank the reasons below from 1 to 10 on why your agency is not currently using the Construction Manager/General Contractor project delivery method. (rank question)

Logic: appears only if, in question 6, option CM/GC, the answer "1" was selected

1) Cultural/organizational resistance
2) Insufficient inhouse expertise or resources
3) Legislative or regulatory barriers
4) Perceived higher owner risks or uncertainties
5) Unfamiliarity and lack of experience in implementing an open negotiation process
6) Lack of Independent cost estimators (ICE) to support negotiation process
7) High project administration costs
8) Inflexible contracting regulations and procedures
9) Lack of experience and/or pushback among external stakeholders (other agencies and contractors)
10) Cultural/organizational resistance
11) Others, please specify; _____

11. Please rank the reasons below from 1 to 10 on why your agency is not currently using the Design-Build project delivery method. (rank question)

Logic: appears only if, in question 6, option DB, the answer "1" was selected

1) Preference to control design
2) Availability of inhouse staff to develop design
3) Insufficient inhouse expertise or resources

4) Legislative or regulatory barriers
5) Perceived higher owner risks or uncertainties
6) High project administration costs
7) Inflexible contracting regulations and procedures
8) Lack of experience and/or pushback among external stakeholders (other agencies and contractors)
9) Cultural/organizational resistance
10) Others, please specify; _____

12. Please. rank the reasons below from 1 to 10 on why your agency is not currently using the Progressive Design-Build project delivery method. (rank question)

Logic: appears only if, in question 6, option PDB, the answer "1" was selected

1) Insufficient expertise or resources
2) Legislative or regulatory barriers
3) Perceived risks or uncertainties
4) High project administration costs
5) Inflexible contracting regulations and procedures
6) Lack of experience and/or pushback among agencies and contractors
7) Unfamiliarity and lack of experience in implementing an open negotiation process
8) Lack of Independent cost estimators (ICE) to support negotiation process
9) Cultural/organizational resistance
10) Others, please specify; _____

Enabling Legislation

13. What legislation enables your agency to use the Construction Manager/General Contractor? (open-ended question)

Logic: appears only if, in question 6, option CM/GC, the answer "1" was not selected

14. What legislation enables your agency to use Design-Build? (open-ended question)

Logic: appears only if, in question 5, option DB, the answer "1" was not selected

15. What legislation enables your agency to use Progressive Design-Build? (open-ended question)

Logic: appears only if, in question 6, option PDB, the answer "1" was not selected

Types of projects, scope, and cost range

16. **In what type of projects are ~~A~~PDM primarily used within your agency? (**I would suggest splitting into three questions, one per PDM, and applying the same logic as in questions 7-9)

Project Type	DBB	Construction Manager/General Contractor (CM/GC)	Design-Build (DB)	Progressive Design-Build (PDB))
Highways and Roads	[ ]	[ ]	[ ]	[ ]
Bridges and Overpasses	[ ]	[ ]	[ ]	[ ]
Tunnels	[ ]	[ ]	[ ]	[ ]
Rail and Transit Systems	[ ]	[ ]	[ ]	[ ]
Airports	[ ]	[ ]	[ ]	[ ]
Ports and Harbors	[ ]	[ ]	[ ]	[ ]
Bicycle and Pedestrian Paths	[ ]	[ ]	[ ]	[ ]
Parking Structures	[ ]	[ ]	[ ]	[ ]
Other Transportation: _____	[ ]	[ ]	[ ]	[ ]

17. **What is the common scope of ~~A~~PDM Projects in your agency?** (I would suggest splitting into three questions, one per PDM, and applying the same logic as in questions 7-9)

Scope	DBB	Construction Manager/General Contractor (CM/GC)	Design-Build (DB)	Progressive Design-Build (PDB))
New Construction	[ ]	[ ]	[ ]	[ ]
Rehabilitation/Improvements	[ ]	[ ]	[ ]	[ ]
Repairs/Maintenance	[ ]	[ ]	[ ]	[ ]
Others (Specify): _____	[ ]	[ ]	[ ]	[ ]

18. Indicate the size (cost range) of project where each Alternative Project Delivery Method (APDM): PDB, DB, and CM/GC, is preferably used. Select al that apply if used in multiple cost ranges.

Preferred Size (Cost Range)	Design-bid-build (DBB)	Construction Manager/General Contractor (CM/GC)	Design-Build (DB)	Progressive Design-Build (PDB)
Less than $1M		[ ]	[ ]	[ ]
$1M - $10M		[ ]	[ ]	[ ]
$10M - $50M		[ ]	[ ]	[ ]
$50M - $100M		[ ]	[ ]	[ ]
Over $100M		[ ]	[ ]	[ ]

3. APDMs Selection

Factors leading the selection

19. Please rank the factors that lead your agency to select a Construction Manager/General Contractor as the project delivery for design and building your projects.

(Rank question)
Logic: appears only if, in question 6, option CM/GC, the answer "1" was not selected

- Cost Savings:
- Time Savings:
- Collaboration between owner, contractor, designer, and other stakeholders
- Flexibility in project changes (design, scope, etc.):
- Fosters creative solutions
- Others: Please specify

20. Please rank the main factors that lead your agency to select Design-Build as the project delivery for design and building your projects.

(Rank question)
Logic: appears only if, in question 6, option DB, the answer "1" was not selected

- Cost Savings:
- Time Savings:
- Collaboration between owner, contractor, designer, and other stakeholders:
- Flexibility in project changes (design, scope, etc.):
- Fosters creative solutions
- **Others**: Please specify

21. Please rank the main factors that lead your agency to select Progressive Design-Build as the project delivery for design and building your projects.

(Rank question)
Logic: appears only if, in question 6, option PDB, the answer "1" was not selected

- Cost Savings:
- Time Savings:
- Collaboration between owner, contractor, designer, and other stakeholders
- Flexibility in project changes (design, scope, etc.):
- Fosters creative solutions
- **Others**: Please specify

4. APDMs Procurement

Type of procurement

22. What type(s) of procurement are most commonly used in the Construction Manager/General Contractor in your agency? (Select all that apply)

(Multiple answer question)
Logic: appears only if, in question 6, option CM/GC, the answer "1" was not selected

- Low Bid: Selection only based on price.
- Best-value: Selection based on price and technical factors
- Qualifications-Based Selection (QBS): Selection is based primarily on qualifications and experience.

23. What type(s) of procurement are most commonly used in the Design-Build in your agency? (Select all that apply)

(Multiple answer question)
Logic: appears only if, in question 6, option DB, the answer "1" was not selected

- Low Bid: Selection only based on price.
- Best-value: Selection based on price and technical factors
- Qualifications-Based Selection (QBS): Selection is based primarily on qualifications and experience.

24. What type(s) of procurement are most commonly used in Progressive Design-Build in your agency? (Select all that apply)

(Multiple answer question)
Logic: appears only if, in question 6, option PDB, the answer "1" was not selected

- Low Bid: Selection only based on price.
- Best-value: Selection based on price and technical factors
- Qualifications-Based Selection (QBS): Selection based primarily on the qualifications and experience.

Challenges in the procurement

25. Please rank the most significant challenges your agency faces during the procurement process of Construction Manager/General Contractor projects.

(Rank question)
Logic: appears only if, in question 6, option CM/GC, the answer "1" was not selected

- The complexity of the Procurement Process:

- Transparency and Fairness
- Balancing Cost vs. Quality
- Regulatory Compliance:
- Market Competition
- Inhouse experience to run the process
- Availability of skilled contractors
- Other [Please, specify]

26. Please rank the most significant challenges your agency faces during the procurement process of Design-Build projects.

(Rank question)
Logic: appears only if, in question 6, option DB, the answer "1" was not selected

- The complexity of the Procurement Process:
- Transparency and Fairness
- Balancing Cost vs. Quality
- Regulatory Compliance:
- Market Competition
- Availability of skilled contractors

- Inhouse experience to run the process

- Other [Please, specify]

27. Please rank the most significant challenges your agency faces during the procurement process of Progressive Design-Build projects.

(Rank question)
Logic: appears only if, in question 6, option PDB, the answer "1" was not selected

- The complexity of the Procurement Process:
- Transparency and Fairness
- Balancing Cost vs. Quality
- Regulatory Compliance:
- Market Competition
- Availability of skilled contractors
- Inhouse experience to run the process
- Other [Please, specify]

Improvements

28. What improvements would you recommend to the procurement process of Construction Manager/General Contractor projects? (Select all that apply)

(Multiple answer question)

Logic: appears only if, in question 6, option CM/GC, the answer "1" was not selected

- Simplifying the Procurement Process:
- Enhancing Transparency
- Focusing on Value-Based Selection:
- Increasing Stakeholder Involvement (such as third-party agencies or contractors):
- Other [Specify]

29. What improvements would you recommend to the procurement process of Design-Build projects? (Select all that apply)

(Multiple answer question)
Logic: appears only if, in question 6, option DB, the answer "1" was not selected

- Simplifying the Procurement Process:
- Enhancing Transparency
- Focusing on Value-Based Selection:
- Increasing Stakeholder Involvement such as third-party agencies or contractors):
- Other [Specify]

30. What improvements would you recommend to the procurement process of Progressive Design-Build projects? (Select all that apply)

(Multiple answer question)
Logic: appears only if, in question 6, option PDB, the answer "1" was not selected

- Simplifying the Procurement Process:
- Enhancing Transparency
- Focusing on Value-Based Selection:
- Increasing Stakeholder Involvement such as third-party agencies or contractors):
- Other [Specify]

Influence of Legislative and Regulatory Factors

31. Based on your agency's experience with APDM, indicate how significant is the influence of legislative and regulatory factors in the procurement process of each PDM your agency uses. Select "Not apply" if your agency does not use the project delivery method. (Likert scale question)

Project Delivery Method (APDM)	Not apply	Significant Influence	Moderately Influence	Slightly influence	Do not influence
Construction Manager/General Contractor (CM/GC)	[ ]	[ ]	[ ]	[ ]	[ ]
Design-Build (DB)	[ ]	[ ]	[ ]	[ ]	[ ]
Progressive Design-Build (PDB)	[ ]	[ ]	[ ]	[ ]	[ ]

32. Do you need to obtain approvals to implement the APDMs internally within your organization, and externally to XXX

33. For the APDM that your agency uses, please state any particular legislative or regulatory factor that has either enabled or impeded the procurement process of an APDM in your agency. (Open-ended question)

5. APDMs Implementation

Experiences

34. Based on <u>your agency's experience</u> with the Construction Manager/General Contractor method, rate your agreement with the following statements. (Likert scale question)

Logic: appears only if, in question 6, option CM/GC, the answer "1" was not selected

Construction Manager/General Contractor…	1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree
accelerates project completion:					
enhances project collaboration:					
increases project costs:					
improves project quality					
offers the owner the chance to provide input to the design:					
reduces the amount of preparation required by an owner:					
helps owner identify and allocate risks appropriately					
allows an opportunity for an effective off-ramp option					
Others, please specify:					

35. Based on your agency's experience with the Design-Build method, rate your agreement with the following statements. (Likert scale question)

Logic: appears only if, in question 6, option DB, the answer "1" was not selected

Design Build-	1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree
accelerates project completion:					
enhances project collaboration:					
increases project costs:					
improves project quality					
offers the owner the chance to provide input to the design:					
moves most of the project risks to the contractors					
reduces the amount of preparation required by an owner:					
shows the magnitude of key risks:					
Others, please specify:					

36. Based on your agency's experience with the Progressive Design-Build methods, rate your agreement with the following statements. (Likert scale question)

Logic: appears only if, in question 6, option PDB, the answer "1" was not selected

Progressive design-build…	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
accelerates project completion:					
enhances project collaboration:					
increases project costs:					
improves project quality					
offers the owner the chance to provide input to the design:					
moves most of the project risks to the contractors					
reduces the amount of preparation required by an owner:					
shows the magnitude of key risks:					
allows an opportunity for an effective off-ramp option					
Others, please specify:					

Barriers

37. Based on your agency's experience with the Construction Manager/General Contractor method, rate your agreement with the following statements. (Likert scale question)

Logic: appears only if, in question 6, option CM/GC, the answer "1" was not selected

The following are barriers that hinder CM/GC implementation	1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree
Legislative/Regulatory Constraints (such as procurement methods, project scope, and size)					
Higher perceived costs					
Lack of inhouse expertise/Experience					
Complexity of Process (such as managing integrated teams and negotiating costs)					
NEPA compliance					
Lack of buy-in from local contracting community					
Other [Specify]					

38. Based on your agency's experience with the Design-Build method, rate your agreement with the following statements. (Likert scale question)

Logic: appears only if, in question 6, option DB, the answer "1" was not selected

The following are barriers that hinder DB implementation	1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree
Legislative/Regulatory Constraints (such as procurement methods, project scope, and size)					
Higher perceived costs					
Lack of inhouse expertise/Experience					
Complexity of Process (such as managing integrated teams)					
Lack of buy-in from inhouse staff					
NEPA compliance					
Lack of buy-in from local contracting community					
Other [Specify]					

39. Based on your agency's experience with the Progressive Design-Build methods, rate your agreement with the following statements. (Likert scale question)

Logic: appears only if, in question 6, option PDB, the answer "1" was not selected

The following are barriers that hinder PDB implementation	1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree
Legislative/Regulatory Constraints (such as procurement methods, project scope, and size)					
Higher perceived costs					
Lack of inhouse expertise/Experience					
Complexity of Process (such as managing integrated teams and negotiating costs)					
Lack of buy-in from inhouse staff					
NEPA compliance					
Lack of buy-in from local contracting community					
Other [Specify]					

Influence of Legislative and Regulatory Factors

40. Based on your agency's experience with APDM, indicate how significant is the influence of legislative and regulatory factors in the delivery process of each PDM your agency uses. Select "Not apply" if your agency does not use the project delivery method. (Likert scale question)

Project Delivery Method (APDM)	Not apply	Significant Influence	Moderately Influence	Slightly influence	Do not influence
Construction Manager/General Contractor (CM/GC)	[ ]	[ ]	[ ]	[ ]	[ ]
Design-Build (DB)	[ ]	[ ]	[ ]	[ ]	[ ]
Progressive Design-Build (PDB)	[ ]	[ ]	[ ]	[ ]	[ ]

41. Which of these statements apply in terms of conformance to legislative requirements (mark all that apply):

    a. Performance reports need to be submitted internally to inform future projects
    b. Performance reports need to be submitted internally for auditing purposes
    c. Performance reports need to be submitted internally to headquarters
    d. Performance reports need to be submitted externally to legislative authority
    e. Others

42. For the APDM that your agency uses, please state any particular legislative or regulatory factor that has either enabled or impeded the adoption of APDM in your agency. (Open-ended question)

6. APDMs Lessons Learned & Recommendations

Lessons learned

43. How are lessons learned from past projects incorporated into future planning in your agency for Construction Manager/General Contractor (CM/GC) projects? Please select all that apply

(Multiple answers question)
Logic: appears only if, in question 6, option CM/GC, the answer "1" was not selected

- Formal Debrief Sessions
- Updating internal guides and policies
- Training and Development programs
- Knowledge sharing platforms
- Integration into project templates and tools
- Peer Review Sessions
- Lessons Learned repository
- Stakeholder feedback survey
- Not having a formal system to incorporate lessons learned in future planning
- Other [Please, specify]

44. How are lessons learned from past projects incorporated into future planning in your agency for Design-Build (DB) projects? Please select all that apply

(Multiple answers question)
Logic: appears only if, in question 6, option DB, the answer "1" was not selected

- Formal Debrief Sessions
- Updating internal guides and policies
- Training and Development programs
- Knowledge sharing platforms
- Integration into project templates and tools
- Peer Review Sessions
- Lessons Learned repository
- Stakeholder feedback survey
- Not having a formal system to incorporate lessons learned in future planning
- Other [Please, specify]

45. How are lessons learned from past projects incorporated into future planning in your agency for Progressive Design-Build (PDB) projects? Please select all that apply

(Multiple answers question)
Logic: appears only if, in question 6, option PDB, the answer "1" was not selected

- Formal Debrief Sessions
- Updating internal guides and policies
- Training and Development programs
- Knowledge sharing platforms
- Integration into project templates and tools
- Peer Review Sessions
- Lessons Learned repository
- Stakeholder feedback survey
- Not having a formal system to incorporate lessons learned in future planning
- Other [Please, specify]

Recommendations

46. Please provide recommendations for best practices in planning, selecting, procuring and implementing the APDM your agency uses.

    CM/GC: (open-ended question)

    DB: (open-ended question)

    PDB (open-ended question)

7. Case Study Interest and Specific Projects

Case study interest

47. Are you interested in participating in a follow-up case study on your agency APDM utilization, **and/or** one of your completed APDM projects?

    No
    Yes, please provide details about the agency/project contact information:

APDM	Do not apply
[x] Agency information	Contact person name Contact person email
[x] Project Information 1	PDM type ☐ Construction Manager/General Contractor (CM/GC): ☐ Design-Build (DB) ☐ Progressive Design-Build (PDB): Project Name: Project Scope: Project Budget Project timeline (start and finish dates) Contact person name Contact person email
[x] Project Information 2	PDM type ☐ Construction Manager/General Contractor (CM/GC): ☐ Design-Build (DB) ☐ Progressive Design-Build (PDB): Project Name: Project Scope: Project Budget Project timeline (start and finish dates) Contact person name Contact person email

Appendix B. Case Study Protocol

This appendix outlines the structured protocol used to select case study agencies and conduct interviews in this research. It includes selection criteria, interview themes, and the tools used to collect and analyze qualitative data. The goal was to capture diverse agency experiences with Alternative Project Delivery Methods (APDMs) in California.

Case Study Overview

Background information

This case study investigates the implementation and effectiveness of Alternative Project Delivery Methods (APDMs), such as Construction Manager/General Contractor (CM/GC), Design-Build (DB), and Progressive Design-Build (PDB), within California transportation agencies. These methods are alternatives to the traditional Design-Bid-Build (DBB) approach and aim to streamline project delivery, improve collaboration, and enhance outcomes in terms of cost, schedule, and quality.

California's transportation infrastructure is managed through a complex network of agencies operating at the state, regional, county, and city levels, each with distinct governance structures, responsibilities, and legislative authorities. The increasing complexity and scale of transportation projects across this complex, multi-layered structure demands innovative approaches to project delivery. APDMs, which emphasize early contractor involvement and integrated project teams, are gaining traction as solutions to challenges such as delays, budget overruns, and fragmented stakeholder coordination. However, there is limited systematic research on their application and performance in the unique context of California's transportation landscape.

This study aims to address this gap by exploring how APDMs are utilized, identifying their advantages, disadvantages, challenges, and opportunities, and providing actionable recommendations for their effective implementation. It further analyzes how APDMs are applied across different agency contexts and how organizational capacity, legislative authority, and funding mechanisms shape their implementation. Special attention is given to the regulatory and legislative environment, including enabling statutes, procurement policies, and authorization frameworks that govern the use of these methods. These legislative factors influence all phases of project delivery, from pre-planning and decision-making to procurement and construction. By examining these dynamics, the study ensures that its policy recommendations are grounded in the practical realities agencies face during project delivery.

This research builds on insights gathered from comprehensive surveys conducted with California transportation agencies. The surveys provided a broad understanding of current PDM practices, their perceived advantages, and barriers to adoption. This case study complements the survey

findings by delving deeper into specific agencies to uncover nuanced details about implementation, legislative influences, challenges, and lessons learned.

Research Objectives

The primary objectives of this study are to

- Benchmark the current use of alternative project delivery methods (APDMs) across transportation agencies in California.
- Identify the advantages, disadvantages, opportunities, and barriers of APDMs such as CM/GC, DB, and PDB.
- Analyze how legislative frameworks and regulatory policies shape the selection, procurement, and execution of APDM projects at the state, regional, and local levels.
- Provide key recommendations for California's transportation agencies to ensure successful PDM selection and implementation.

Research Questions

To support these objectives, the following research questions guide the study:

- What are the current enabling legislation and policies to implement APDMs in local transportation agencies in California?
- What is the current state of practice of the use of APDMs in CA local transportation agencies?
- What are the APDMs' advantages and disadvantages, as well as the opportunities and barriers for its use?
- What key aspects should be considered in APDMs' selection and implementation in local transportation agencies?

Relevant Definitions

To prevent confusion among several vital terms important to this study, the following definitions have been provided.

Project Delivery Methods

Design-Bid-Build (DBB): A project delivery method where the design is completed either by in-house professional engineering staff or a design consultant before the construction contract is advertised. Also called the "traditional delivery method.

Construction Manager-General Contractor (CM/GC): A project delivery method where the owner hires a separate contractor during the design process and makes input to the design via constructability review, cost engineering, and value analysis reviews. Once the design is complete, the same entity builds the projects as the general contractor.

Design-Build (DB): A project delivery method where both the design and the construction of the projects are simultaneously awarded to a single entity.

Progressive Design-Build (PDB): PDB is a hybrid delivery method that combines the early contractor involvement benefits of construction manager/ general contractor (CM/GC) with the all-inclusive responsibilities of design-build.

Agency Types and Institutional Terms

Caltrans (California Department of Transportation): The state transportation agency responsible for planning, designing, constructing, and maintaining California's state highway system and interregional routes.

Metropolitan Planning Organization (MPO): A federally mandated regional planning body for urbanized areas with populations over 50,000. Responsible for long-range planning, transportation programming, and air quality conformity.

Regional Transportation Planning Agency (RTPA): A state-defined regional planning body responsible for preparing Regional Transportation Plans (RTPs) and Transportation Improvement Programs (TIPs), among other functions. Not all RTPAs are MPOs.

Self-Help County: A California county that has passed a local transportation sales tax measure to fund transportation projects, providing a critical source of local match funding for state and federal programs.

Transit Operator: Public agency responsible for managing and operating public transit services and, in some cases, executing transit-related capital infrastructure projects (e.g., LA Metro, BART).

Legislative and Procurement Terms

Enabling Legislation: State laws or regulations that provide transportation agencies with the authority to use specific project delivery methods such as DB or CM/GC.

Procurement Method: the formal process by which an agency solicits, evaluates, and awards contracts for goods or services. Common types include Low Bid, Best Value, and Qualifications-Based Selection (QBS).

Guaranteed Maximum Price (GMP): A cost ceiling established in Progressive Design-Build or CM/GC contracts that limits the maximum price the contractor may charge, barring approved change orders.

Low Bid: A competitive procurement method in which sealed bids are solicited, opened publicly, and awarded to the lowest responsive and responsible bidder. This method is most appropriate when the scope of work is well-defined, and price is the primary factor. It minimizes discretion and negotiation, relying entirely on the lowest cost submitted that meets all requirements.

Best Value: A competitive procurement method that allows the awarding agency to evaluate and compare factors in addition to price—such as technical design, management approach, delivery schedule, personnel quality, and past performance. This method supports selection of the offer that provides the greatest overall benefit to the agency, even if not the lowest priced. The evaluation criteria must be disclosed in the solicitation.

Qualifications-Based Selection (QBS): A procurement method used specifically for architectural and engineering services, as mandated by the Brooks Act. Under QBS, firms are evaluated and ranked solely on the basis of qualifications. Price is not considered until after the most qualified firm is selected. Once selected, the agency negotiates a fair and reasonable price with that firm. If agreement is not reached, negotiations move to the next-ranked firm.

Relevant resources

The protocol is based largely on the following documents and research reports:

- NCHRP Guidebook on Alternative Quality Management Systems for Highway Construction
- Case Study Research and Application Design and Methods by Robert K. Yin
- Federal Transit Administration Best Practices Procurement & Lessons Learned Manual (2016)

Field Procedures

Project Researcher

The following is a list of the project investigators and their contact information.

1. Dr. Ghada Gad – Principal Investigator
   Professor, Department of Civil Engineering
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   801 W. Temple Ave., Pomona, CA 91768
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2. Dr. Maria Calahorra-Jimenez – Co- Principal Investigator
   Assistant Professor, Construction Management Department
   Lyles College of Engineering
   California State University, Fresno
   2320 E. San Ramon Ave, Fresno, CA 93740
   559.278.8747
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3. Chaimae Nacir
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   cnacir@cpp.edu
4. Ronald Shrestha
   Graduate Student, Construction Management Department
   Lyles College of Engineering
   California State University, Fresno
   2320 E. San Ramon Ave, Fresno, CA 93740
   559.278.6056
   stharonaldo753@mail.fresnostate.edu

Case Study Delegation

To ensure methodological consistency and clear lines of communication across all case studies, research team members were assigned to specific agencies as lead investigators. Each lead was responsible for coordinating interview logistics, facilitating conversations, conducting follow-ups, and compiling case study summaries aligned with the thematic framework.

Details on the delegation of responsibilities—including the assigned lead investigator, the agency interviewed, interviewee roles, and the scheduled interview dates—are provided in Table B-1.

This structure ensured that each case study benefitted from a consistent point of contact and that stakeholder perspectives (e.g., public owner, designer, contractor, ICE) were thoroughly documented. Interviewee background details can be found in Appendix C, and full case summaries are presented in Appendix D.

Case Study Identification and Schedule

The transportation infrastructure in California is supported by a multi-layered governance system that operates across multiple administrative levels: state, regional, county, and city. Before outlining how case studies are selected, it is important to understand this agency structure, as it provides the foundation for how transportation decisions are structured and executed across jurisdictions. Each level plays a distinct and complementary role in the development and implementation of transportation projects, with responsibilities tailored to local, regional, and statewide priorities. This diversity directly influences how APDMs are authorized, implemented, and managed and is therefore central to understanding the rationale behind case study selection.

At the state level, the California Department of Transportation (Caltrans) leads the delivery of major infrastructure projects across the state highway system and interregional corridors. Caltrans also plays a key role in establishing strategic direction, managing funding programs, and advancing legislative frameworks that enable the use of APDMs such as DB, PDB, and CM/GC.

At the regional level, Metropolitan Planning Organizations (MPOs), Regional Transportation Planning Agencies (RTPAs), and transit operators such as LA Metro, SANDAG, and BART are responsible for coordinating transportation strategies that span multiple jurisdictions. These agencies oversee long-range planning, distribute regional funding, and often serve as implementing bodies for large-scale capital projects.

At the county and city levels, public works departments, county transportation authorities, and other local entities are responsible for delivering infrastructure improvements that meet community-specific needs. While these agencies may differ significantly in staffing, funding capacity, and technical expertise, they are often at the forefront of innovating within local constraints. Often, self-help counties, jurisdictions with voter-approved transportation sales tax measures, play a central role in project financing and implementation.

This administrative diversity serves as the foundation for case study selection. To ensure a comprehensive and representative analysis, this study includes transportation agencies from all levels of government. Each case is selected to reflect variation in governance structures, project complexity, institutional capacity, and legislative authority, all of which influence how APDMs are selected, executed, and adapted.

By incorporating agencies from across California's geographically and administratively diverse landscape, this research aims to develop a nuanced understanding of the conditions under which APDMs succeed, the challenges agencies encounter, and the strategies used to overcome those challenges. This approach enables the development of realistic, scalable recommendations tailored to agencies at different levels and in different contexts and supports a methodologically rigorous research framework grounded in the realities of transportation project delivery.

Case study agency selection criteria

To ensure that the findings of this study are relevant, representative, and scalable across California's diverse transportation landscape, case study agencies are selected based on a strategic set of criteria. These criteria are designed to reflect the variety of governance structures, delivery authorities, and operational contexts in which APDMs are implemented. The aim is to capture both common practices and unique challenges faced by agencies of different types and capacities. The selection process prioritizes diversity across the following dimensions:

Administrative Levels

- State-Level Agencies (e.g., Caltrans): Focus on large-scale, statewide, or interregional projects, with statutory authority for a range of APDMs.
- Regional Agencies and Transit Operators (e.g., MPOs, RTPAs, LA Metro, SANDAG): Often manage planning and funding across jurisdictions and implement major capital transit and multi-modal projects using APDMs.
- County and City Level Agencies (e.g., Public Works Departments, Transportation Authorities): These agencies vary in scale, staffing, and technical capacity but are central to California's transportation network.

Project Delivery Methods used

To provide a comprehensive analysis of APDM implementation, selected agencies must have experience with or be actively considering the use of at least one of the following methods:

- Design-Build (DB)
- Progressive Design-Build (PDB)
- Construction Manager/General Contractor (CM/GC)

Preference will be given to agencies with comparative experience across multiple methods, enabling the research to draw insights on method selection and suitability under different conditions.

Agency Scope and Complexity

Agencies will be selected to reflect a range of operational scopes and project complexities, from those delivering small-scale local improvements to those managing large, regional, or statewide infrastructure programs. This variation allows the study to capture how agencies of different sizes and capacities approach the implementation of APDMs. Consideration will also be given to the organizational structure, staffing resources, and coordination requirements that influence project

delivery. The roles and contributions of contractors across this range of agency scopes will also be evaluated to understand how agency complexity affects collaboration, procurement, and project execution.

Willingness to Participate and Data Availability

- Be willing to participate in semi-structured interviews.
- Have personnel available to speak to both organizational and project-specific experiences.
- Be able to share relevant documents (e.g., contracts, selection criteria, procurement guidelines).

Table 1. Case Study Agency Selection Matrix by Delivery Method and Jurisdictional Level

Case Study Selection Matrix			Delivery Method		
#	**Case Study Agency Name**	**Level**	**CM/GC**	**DB**	**PDB**
1	Caltrans	State	✓	✓	✓
2	LA Metro	Regional	✓	✓	✓
3	SANDAG	Regional	✓	-	-
4	SBCAG	Regional	✓	-	-
8	Placer County DPW	County	✓	-	-
6	County of Sonoma	County	✓	-	-
7	FCTA	County	Not using but willing to use		
5	City of Santa Cruz	City	✓	-	-
9	CalInfra	Lobbyist	✓	✓	✓

Case study informant selection

This study will collect insights from a range of key stakeholders involved in both organizational decision-making and project-level execution to develop a comprehensive understanding of how APDMs are implemented within California transportation agencies. Informants will be selected strategically to ensure that each case study reflects the full project delivery lifecycle, from policy development to design and construction. The objective is to capture diverse perspectives across agencies with varied structures, capacities, and delivery experiences.

Organizational Level Informants

These individuals provide insight into the agency's broader strategy, policy environment, and institutional capacity for adopting APDMs. Their perspectives will help contextualize the agency's decision-making framework and internal processes for selecting and managing alternative delivery methods.

- **Chief of Alternative Project Delivery (APD):** Oversees strategy, policy alignment, and high-level decisions related to PDMs.
- **Legal Counsel or Procurement Manager:** Provides expertise on legislative requirements, contractual matters, and regulatory compliance.
- **Agency Representatives:** Includes program managers, project managers, contracting managers, quality managers, or planning engineers who oversee the project's overall delivery and agency-side operations.

Project Level Informants

These participants provide detailed knowledge of individual project delivery experiences, including decision-making, collaboration, challenges encountered, and outcomes achieved. They offer valuable technical and operational insights into how APDMs perform in practice.

- **Owner Representatives:** Agency-side program managers, project managers, and project engineers responsible for managing scope, schedule, and budget throughout the project.
- **Designer Team:** Includes project design managers and project managers from the design consultant, focusing on preconstruction collaboration and design quality.
- **Contractor Representatives:** Includes business development, area managers, preconstruction managers, construction managers, and project managers from the contractor's team, focusing on constructability, execution, and quality control.
- **Third-Party Stakeholders:** Lobbyists, independent cost estimators, or other external consultants who play a role in ensuring compliance, transparency, or strategic alignment. These stakeholders may provide specialized technical reviews, advocate for policy or funding considerations, or offer independent verification of project scope, budget, or performance.

Informant Selection Process

Informants will be identified and invited based on:

- Their direct involvement with selected agencies that are involved in specific delivery methods (e.g., DB, CM/GC, PDB).
- Their understanding of institutional or legal contexts surrounding APDM adoption.
- Initial candidates will be recommended through agency liaisons, survey respondents, or identified during document review. Follow-up interviews may be scheduled to ensure coverage across all relevant perspectives.

Informant Confidentiality and Coordination

All interviews will be conducted with participants' informed consent, and the study will follow established research ethics and confidentiality practices. Interviewees will have the opportunity to:

- Review how their input is represented in case summaries
- Provide follow-up clarifications if needed
- Decline to answer questions that fall outside their expertise or comfort

TABLE 2. Case Study Interview Schedule and Research Team Delegation

S.N.	Agency Name	Interviewee Position	Interview Date	Follow-up Interview	Lead Investigator
1.	Caltrans	Chief of the Office of Innovative Design & Delivery	Dec 16, 2024	N/A	Dr. Maria Calahorra-Jimenez
2.		Area Construction Engineer	Dec 19, 2024	N/A	Dr. Maria Calahorra-Jimenez
3.		Acting Deputy for Project Management	Dec20, 2024	N/A	Dr. Maria Calahorra-Jimenez
4.		Design Manager	Jan 23, 2025	N/A	Dr. Maria Calahorra-Jimenez
5.		Project Executive (Granite)	Feb 24, 2025	N/A	Dr. Maria Calahorra-Jimenez
6.		Senior Project Manager (Granite)	Feb 7, 2025	N/A	Dr. Maria Calahorra-Jimenez
7.		Area Manager (Granite)	Feb 3, 2025	N/A	Dr. Maria Calahorra-Jimenez
8.		Project Manager (Flatiron)	Jan 31, 2025	N/A	Dr. Maria Calahorra-Jimenez
9.	LA Metro	Executive Officer for Government Relations	Feb 19, 2025	N/A	Dr. Ghada M. Gad
10.		Senior Director of Special Projects	Feb 4, 2025	N/A	Dr. Ghada M. Gad
11.		Executive Officer	Feb 25, 2025	N/A	Dr. Ghada M. Gad
12	SANDAG	Director of Program Project Management	Feb 4, 2025	N/A	Dr. Ghada M. Gad
13.		Project Manager (Stacy and Witbeck)	April 22, 2025	N/A	Dr. Ghada M. Gad
14.	SBCAG	Director of Project Delivery and Construction	Jan 30, 2025	N/A	Ronald Shrestha
15.	Placer County	Engineering Manager	Feb 11, 2025	N/A	Ronald Shrestha
16.		Project Manager (Flatiron)	April 8, 2025	N/A	Ronald Shrestha
17.		Estimating Director Independent Cost Estimator (ICE) (Jacobs)	April 15, 2025	N/A	Ronald Shrestha
18.		Airport Manager	April 16, 2025	N/A	Chaimae Nacir

S.N.	Agency Name	Interviewee Position	Interview Date	Follow-up Interview	Lead Investigator
19.	Sonoma County	Department Manager (Designer) (Mead and Hunt)	April 15, 2025	N/A	Chaimae Nacir
20.		Construction Manager (Granite)	March 20, 2025	N/A	Chaimae Nacir
21.	City of Santa Cruz	Project Executive (Granite)	March 3, 2025	N/A	Ronald Shrestha
22.	FCTA	Executive Director	April 4, 2025	N/A	Ronald Shrestha
23.	Calinfra	Executive Director	March 7, 2025	N/A	Dr. Ghada M. Gad

Data collection

To provide a comprehensive understanding of how Alternative Project Delivery Methods (APDMs) are implemented across California's transportation agencies, this study utilizes a multi-method data collection approach. Data will be collected from three primary sources: semi-structured interviews, requested document review, and survey result integration. This triangulated method enhances the validity of findings and ensures that insights are grounded in both policy and practice.

Semi-Structured Interviews

Semi-structured interviews are the core component of the strategy for collecting data in case studies. This approach enables the research team to explore agency-specific experiences with APDMs while maintaining consistency across different cases for comparison. Each delivery method follows a consistent framework of questions grouped into thematic areas, including

- Interviewee Background (e.g., current position, experience, agency role in APDM adoption)
- Decision-Making (e.g., how and why a particular APDM was chosen)
- Procurement (e.g., evaluation criteria, regulatory limitations)
- Design and Construction Phases (e.g., challenges, legal/staffing issues, coordination practices)
- Effectiveness and Performance Metrics (e.g., how APDMs compare to DBB in cost, schedule, quality)

- Lessons Learned and Recommendations (e.g., improvements in internal practices, suggested policy or legislative changes)

Document Review

Document analysis supports and contextualizes findings from interviews by providing evidence of agency policies, agency structures, procurement procedures, and implementation practices. Documents are collected from participating agencies where available. The following categories of documents may be requested from agencies:

1. Agency-Level Documents (e.g., Agency manuals, procurement policies, delivery method guidelines, internal memos, internal reports, inter-agency contracts)

2. Project-Level Documents (e.g., RFQs, RFPs, contracts, contractor selection matrix)

3. Legislative and Policy Documents (e.g., enabling legislation, board reports)

4. Oversight and Evaluation Reports (e.g., post-project evaluations, audit reports, third-party reviews)

Survey questions

To complement the case study analysis, a survey was conducted to gather insights from a broader range of stakeholders involved in transportation projects utilizing APDMs. The survey aimed to capture diverse perspectives on the effectiveness, challenges, and opportunities associated with PDMs, as well as the legislative and operational factors impacting their implementation. The survey findings serve as a foundational layer of understanding, which the case study interviews will explore in greater depth. A detailed list of the survey questions can be found in Appendix A.

Data Management and Confidentiality

All data (interview recordings, transcripts, and documents) will be securely stored and accessed only by the research team. Agencies and participants will be anonymized in the final report unless they explicitly consent to attribution. Draft case summaries will be shared with agencies for factual verification and contextual input prior to publication, ensuring accuracy and transparency.

Data Analysis Methods

The study employs qualitative content analysis to interpret the data collected through interviews, documents, and survey integration. The analysis process is designed to identify consistent patterns, agency-specific experiences, and broader lessons that inform APDM use across different contexts.

Thematic Coding

Interview transcripts will be coded using a thematic framework. Codes will be developed both deductively (based on research questions and interview themes such as decision-making, procurement, legislative context, and effectiveness) and inductively (emerging organically from participant responses). Common themes include implementation challenges, advantages and best practices, legislative and regulatory impacts, and outcomes related to time, cost, and quality.

Cross-Case Analysis

Findings from individual case studies will be compared across all selected agencies to identify:

- Recurring patterns and shared experiences
- Unique contextual factors influencing outcomes
- Differences in institutional capacity, project scope, and governance levels

This cross-case comparison will provide a structured lens to evaluate how APDMs function under different conditions and identify key enabling or limiting factors.

Triangulation and Validation

Themes and insights from interviews will be triangulated with findings from the initial statewide survey and reviewed project documentation to enhance credibility and reliability. Discrepancies or gaps in interpretation will be addressed through follow-up data review or clarification with participating agencies when feasible.

Recommendations Development

Based on the synthesized findings, the study will develop evidence-based recommendations for:

- Legislative and regulatory reforms
- Internal agency process improvements
- Enhanced practices for selecting and managing APDMs at various government levels

These recommendations aim to support the informed, effective, and scalable implementation of APDMs across California's transportation landscape.

Questionnaires

This study employed semi-structured interviews, guided by a comprehensive questionnaire protocol, to facilitate a thorough understanding of the selection, implementation, and evaluation of Alternative Project Delivery Methods (APDMs). The questions were developed to align with the research objectives and are organized into distinct sections tailored to different stakeholder roles—Agency representatives, Contractors, Independent Cost Estimators (ICE), and Lobbyists. The purpose of this structure was to provide a comprehensive understanding of the implementation of APDM, including both organizational strategy and project-level execution. Each section addresses thematic domains including decision-making, procurement, design and construction phases, effectiveness, and insights gained. While questions to agencies focus on internal processes and institutional readiness, those directed at contractors and third-party stakeholders explore collaboration dynamics, challenges in the field, and external validation. The interview protocols ensure consistency across cases while allowing flexibility to address agency-specific contexts, ultimately supporting a comparative and in-depth analysis of APDM use across California's transportation infrastructure landscape.

Introduction/Background

You have been selected to speak with us today because you directly work in supporting, facilitating, advocating, and/or implementing alternative project delivery methods (PDMs) such as Construction Manager/General Contractor (CM/GC), Design-Build (DB), and Progressive Design-Build (PDB) in Transportation Projects in California.

Our research project focuses on (1) understanding the use of legislation to implement alternative PDMs in local transportation agencies in California, (2) benchmarking alternative PDMs current use, (3) identifying alternative PDMs' advantages and disadvantages, as well as the opportunities and barriers for its use, and finally (4) providing recommendations for key aspects to consider in alternative PDM selection and implementation in California local transportation agencies.

Your input is very valuable to reach these objectives.

For any questions or concerns about the research, please contact the project investigators:

- Dr. Ghada M. Gad, Cal Poly Pomona, at gmgad@cpp.edu or (909) 869-2648
- Dr. Maria Calahorra-Jimenez, California State University, Fresno, at mcalahorrajimenez@mail.fresnostate.edu or (559) 278-8747

Question to Agency

1. Interviewee Background

1.1 What is your current position?

1.2 How long have you been in your present position and in your organization?

1.3 Briefly describe your role as it relates to the use of alternative project delivery methods such as CM/GC, DB, and PDB.

1.4 Could you describe the competencies of your organization in regard to delivering the design and construction of transportation projects?

2. Construction Manager/General Contractor (CM/GC)

2.1 Decision-Making

2.1.1 How does your agency decide whether to use CM/GC in specific projects and what influenced this decision?

2.1.2 Are there any legislative, regulatory, or staffing constraints limiting your agency's decision to use CM/GC?

2.2 Procurement

2.2.1 What key evaluation criteria are used for selecting bidders in CM/GC projects?

2.2.2 Are any legislative, regulatory, or staffing constraints limiting your agency's ability to procure CM/GC projects?

2.3 Design and Construction Phase

2.3.1 What are the primary challenges your agency faced during the design and construction phase while using CM/GC?

2.3.2 Are there specific legal and/or staffing challenges during the design and construction phases, and how were they resolved?

2.3.3 What lessons did your agency learn during the design and construction phases of CM/GC, and how are these lessons learned incorporated into future projects?

2.4 Effectiveness

2.4.1 How effective is CM/GC in meeting targeted project objectives compared to DBB?

2.4.2 What performance metrics are used to evaluate effectiveness in terms of timelines, cost, and quality?

2.4.3 Is the effectiveness of CM/GC projects evaluated by any external entity? If so, could you elaborate?

2.5 Lessons Learned and Future Recommendations

2.5.1 Could you provide three lessons learned that have helped you to improve the use of CM/GC is your projects?

2.5.2 What legislative reforms or amendments are recommended to better support CM/GC in transportation projects

3. Design-Build (DB)

3.1 Decision-Making

3.1.1 How does your agency decide whether to use DB in specific projects and what influenced this decision?

3.1.2 Are there any legislative, regulatory, or staffing constraints limiting your agency's decision to use DB?

3.2 Procurement

3.2.1 What key evaluation criteria are used for selecting bidders in DB projects?

3.2.2 Are any legislative, regulatory, or staffing constraints limiting your agency's ability to procure DB projects?

3.3 Design and Construction Phase

3.3.1 What are the primary challenges your agency faced during the design and construction phases while using DB?

3.3.2 Are there specific legal and/or staffing challenges during the design and construction phases, and how were they resolved?

3.3.3 What lessons does your agency learn during the design and construction phases of DB, and how are these lessons incorporated into future projects?

3.4 Effectiveness

3.4.1 How effective is DB in meeting targeted project objectives compared to DBB?

3.4.2 What performance metrics are used to evaluate effectiveness in terms of timelines, cost, and quality?

3.4.3 Is the effectiveness of DB projects evaluated by any external entity? If so, could you elaborate?

3.5 Lessons Learned and Future Recommendations

3.5.1 Could you provide three lessons learned that have helped you to improve the use of DB in your projects?

3.5.2 What legislative reforms or amendments are recommended to better support DB use in transportation projects?

4. Progressive Design-Build (PDB)

4.1 Decision-Making

4.1.1 How does your agency decide whether to use PDB in specific projects and what influenced this decision?

4.1.2 Are there any legislative, regulatory, or staffing constraints limiting your agency's decision to use PDB?

4.2 Procurement

4.2.1 What key evaluation criteria are used for selecting bidders in PDB projects?

4.2.2 Are any legislative, regulatory, or staffing constraints limiting your agency's ability to procure PDB projects?

4.3 Design and Construction Phase

4.3.1 What are the primary challenges your agency faced during the design and construction phases while using PDB?

4.3.2 Are there specific legal and/or staffing challenges during the design and construction phases, and how were they resolved?

4.3.3 What lessons does your agency learn during the design and construction phases of PDB, and how are these lessons incorporated into future projects?

4.4 Effectiveness

4.4.1 How effective is PDB in meeting targeted project objectives compared to DBB?

4.4.2 What performance metrics are used to evaluate effectiveness in terms of timelines, cost, and quality?

4.5 Is the effectiveness of PDB projects evaluated by any external entity? If so, could you elaborate?

4.5.1 Lessons Learned and Future Recommendations

4.5.2 Could you provide three lessons that have helped you to improve the use of PDB in your projects?

4.5.3 What legislative reforms or amendments are recommended to better support PDB use in transportation projects?

Question to Contractor

1. Interviewee Background

1.1 What is your current position?

1.2 How long have you been in your present position and in your organization?

1.3 Briefly describe your role as it relates to the use of alternative project delivery methods.

2. Construction Manager/General Contractor (CM/GC)

2.1 Decision-Making

2.1.1 How does your organization decide whether to place a proposal for a CM/GC in specific projects and what influenced this decision?

2.1.2 Are there any legislative, regulatory, or staffing constraints limiting your organization& decision to use CM/GC?

2.2 Procurement

2.2.1 What key evaluation criteria have been used for selecting your company to perform CM/GC projects?

2.2.2 Are any legislative, regulatory, or staffing constraints limiting your agency's ability to place a proposal for a CM/GC projects?

2.3 Design and Construction Phase

2.3.1 What are the primary challenges your agency faced during the design and construction phases while using CM/GC?

2.3.2 Are there specific legal and/or staffing challenges during the design and construction phases, and how were they resolved?

2.3.3 What lessons does your agency learn during the design and construction phases of CM/GC, and how are these lessons incorporated into future projects?

2.4 Effectiveness

2.4.1 How effective is CNGC in meeting targeted project objectives compared to DBB?

2.4.2 What performance metrics are used to evaluate effectiveness in terms of timelines, cost, and quality?

2.4.3 Is the effectiveness of CM/GC projects evaluated by any external entity? If so, could you elaborate?

2.5 Lessons Learned and Future Recommendations

2.5.1 Could you provide three lessons learned that have helped you to improve the use of CM/GC in your projects?

2.5.2 What legislative reforms or amendments are recommended to better support CM/GC use in transportation projects?

3. Design-Build (DB)

3.1 Decision-Making

3.1.1 How does your organization decide whether to place a proposal for a DB in specific projects and what influenced this decision?

3.1.2 Are there any legislative, regulatory, or staffing constraints limiting your organization's decision to use DB?

3.2 Procurement

3.2.1 What key evaluation criteria have been used for selecting your company to perform DB projects?

3.2.2 Are any legislative, regulatory, or staffing constraints limiting your agency's ability to place a proposal for a DB projects?

3.3 Design and Construction Phase

3.3.1 What are the primary challenges your agency faced during the design and construction phases while using DB?

3.3.2 Are there specific legal and/or staffing challenges during the design and construction phases, and how were they resolved?

3.3.3 What lessons does your agency learn during the design and construction phases of DB, and how are these lessons incorporated into future projects?

3.4 Effectiveness

3.4.1 How effective is DB in meeting targeted project objectives compared to DBB?

3.4.2 What performance metrics are used to evaluate effectiveness in terms of timelines, cost, and quality?

3.4.3 Is the effectiveness of DB projects evaluated by any external entity? If so, could you elaborate?

3.5 Lessons Learned and Future Recommendations

3.5.1 Could you provide three lessons learned that have helped you to improve the use of DB in your projects?

3.5.2 What legislative reforms or amendments are recommended to better support DB use in transportation projects?

4. Progressive Design-Build (PDB)

4.1 Decision-Making

4.1.1 How does your organization decide whether to place a proposal for a PDB in specific projects and what influenced this decision?

4.1.2 Are there any legislative, regulatory, or staffing constraints limiting your organization's decision to use PDB?

4.2 Procurement

4.2.1 What key evaluation criteria have been used for selecting your company to perform PDB projects?

4.2.2 Are any legislative, regulatory, or staffing constraints limiting your agency's ability to place a proposal for a PDB projects?

4.3 Design and Construction Phase

4.3.1 What are the primary challenges your agency faced during the design and construction phases while using PDB?

4.3.2 Are there specific legal and/or staffing challenges during the design and construction phases, and how were they resolved?

4.3.3 What lessons does your agency learn during the design and construction phases of PDB, and how are these lessons incorporated into future projects?

4.4 Effectiveness

4.4.1 How effective is PDB in meeting targeted project objectives compared to DBB?

4.4.2 What performance metrics are used to evaluate effectiveness in terms of timelines, cost, and quality?

4.4.3 Is the effectiveness of PDB projects evaluated by any external entity? If so, could you elaborate?

4.5 Lessons Learned and Future Recommendations

4.5.1 Could you provide three lessons learned that have helped you to improve the use of PDB in your projects?

4.5.2 What legislative reforms or amendments are recommended to better support PDB use in transportation projects?

Question to Lobbyist

1. Interviewee Background

1.1 What is your current position?

1.2 How long have you been in your present position and in your organization?

1.3 Briefly describe your role as it relates to the support, facilitation, and use of alternative project delivery methods (APDM) such as CM/GC, DB, and PDB.

2. Enabling Legislation Process for APDMs (CM/GC, DB, PDB)

2.1 In your organization, what are the main factors that trigger the need to advocate for a new bill or bill amendment related to the use of APDM in transportation projects? If you have examples for each APDM, please elaborate on each of them.

2.2 What are the steps your organization follows to start (or to be engaged in) a process leading to a new bill or a bill amendment related to the use of APDMs in transportation projects? If you have examples for each APDM, please elaborate on each of them.

2.3 What key stakeholders play a role in the process leading to a new bill or a bill amendment related to the use of APDMs in transportation projects? If you have examples for each APDM, please elaborate on each of them.

2.4 What are the main challenges encountered in pursuing a new bill or a bill amendment related to APDMs in transportation projects? If you have examples for each APDM, please elaborate on each of them.

3. Senate/Assembly Bills

3.1 In our research, we have found 17 bills associated with the use of CM/GC, 11 bills related to the use of DB, and 6 that authorize the use of PDB. Based on your knowledge and experience, what might be the main reasons why there are so many bills associated with the use of APDM in Transportation?

3.2 In your opinion, how could the process of having enabling legislation for using APDM in transportation projects be streamlined?

3.3 Currently, is there any enabling legislation missing that is hindering the ability to use APDMs such as CM/GC, DB, or PDB? If so, please elaborate.

4. Challenges and Lessons Learned

4.1 What are some of the main challenges you have faced when advocating for a new bill or bill amendment that enables the use of APDM in transportation projects, and how could these challenges be addressed in future similar situations?

4.2 Based on your role, could you provide three lessons learned that can help legislators and decision-makers that aim to support and facilitate the use of APDM in transportation projects?

Question to ICE

1. Interviewee Background

1.1 What is your current position?

1.2 How long have you been in your present position and your organization?

1.3 Briefly describe your role as it relates to the support of alternative project delivery methods (APDM) such as CM/GC, DB, and PDB.

2. Construction Manager/General Contractor (CM/GC) (General)

2.1 Can you elaborate on how and when do you usually get involved in CM/GC projects?

2.2 In your opinion, what are the benefits of having an ICE in a CM/GC project?

2.3 Could you elaborate on the challenges you face in these types of projects?

2.4 Based on your experience, could you provide 2–3 recommendations for agencies that start using CM/GC to deliver transportation projects?

3. Construction Manager/General Contractor (CM/GC) – Yankee Jims Bridge Replacement Project

3.1 Can you elaborate on how and when you get involved in this project?

3.2 In your opinion, what are the benefits of having your expertise in this project?

3.3 Could you elaborate on the challenges you faced/are facing in this project?

3.4 Based on this project's experience, could you provide any additional recommendations to agencies in a similar situation as Placer County?

4. Design-Build (DB)

4.1 Can you elaborate on how and when do you usually get involved in DB projects?

4.2 In your opinion, what are the benefits of having an ICE in a DB project?

4.3 Could you elaborate on the challenges you face in these types of projects?

4.4 Based on your experience, could you provide 2-3 recommendations for agencies that start using DB to deliver transportation projects?

5. Progressive Design-Build (PDB)

5.1 Can you elaborate on how and when do you usually get involved in PDB projects?

5.2 In your opinion, what are the benefits of having an ICE in a PDB project?

5.3 Could you elaborate on the challenges you face in these types of projects?

5.4 Based on your experience, could you provide 2–3 recommendations for agencies that start using PDB to deliver transportation projects?

Appendix C. Case Study Interviewees' Background

Case Study 1: Caltrans Interviewee Summaries

Interviewee 1: Chief of the Office of Innovative Design & Delivery

The current chief of the Office of Innovative Design & Delivery at Caltrans has 27 years of experience with the organization and has served in the current leadership role for the past four years. With six years of involvement in alternative project delivery, responsibilities have included managing procurement, contract awards, and oversight throughout the full project lifecycle. As the sole negotiator for Caltrans, this role involves leading high-level discussions and securing critical agreements. Legislative contributions have included drafting and amending key bills related to project delivery methods, such as updates to Construction Manager/General Contractor (CM/GC) legislation and expanding Design-Build (DB) authority under SB1 to include additional projects. These efforts have played a key role in advancing innovative project delivery practices and strengthening the legislative framework within the agency.

Interviewee 2: Area Construction Engineer

The interviewee is an Area Construction Engineer at Caltrans and has served in the organization for over 33 years. They hold multiple senior-level responsibilities, including Senior Resident Engineer for a design-build project, contract manager for the same project, and various construction engineering duties. The interviewee's experience in design-build began upon transferring from the Construction Division to the Project Management Division in 2019. Despite having limited prior exposure to design-build, they quickly assumed leadership roles, managing the project through pre-procurement, RFQ, and RFP stages, and overseeing four years of construction. Their extensive experience also includes managing one of the only two design-build projects in District 3.

Interviewee 3: Acting Deputy for Project Management

The interviewee is the Acting Deputy for Project Management at Caltrans District 5, though their usual role is Office Chief of Project Management. In this position, they oversee approximately ten project managers who handle traditional project management tasks for capital improvement projects. These tasks range from preliminary planning, environmental studies, and design to construction. They have been a project manager since 2016 and assumed the Office Chief role in 2021. Their career at Caltrans began as a student assistant around 2004, giving them approximately 20 years of experience. The interviewee's role in alternative delivery methods such as CM/GC (Construction Manager/General Contractor) involves acting as a project-level executive for Caltrans, supervising project managers, and influencing design decisions.

Interviewee 4: Design Manager

The interviewee is a Design Manager at Caltrans District 5 and has been with the organization for 19 years, with the last six years in the current role. Responsibilities include leading a design branch of ten engineers, guiding them through the project development process, and overseeing consultant-led projects to ensure adherence to design standards and policies. Their experience with CM/GC (Construction Manager/General Contractor) projects includes participating in procurement, constructability reviews, and cost estimations. The interviewee has been involved in two CM/GC projects: the Santa Barbara 101 corridor expansion and a broadband middle-mile initiative, though the latter was discontinued due to funding issues.

Interviewee 5: Project Executive (Contractor)

The interviewee currently serves as a Project Executive and has been in this position for three years. This role was assumed due to the volume and scale of CM/GC projects reporting to them, which made it impractical to continue functioning as a Project Manager. Prior to this, the interviewee worked as a Project Manager for approximately 40 years. They are a registered professional civil engineer and construction manager, with a total of 44 years of industry experience.

Since joining Granite in 2006, the interviewee has focused on delivering larger and more technically complex projects. Over the past decade, while core responsibilities have remained consistent, the role has evolved to reflect the scale of the work under their leadership. The interviewee currently oversees three CM/GC projects with a combined value of $700 million. As Project Executive, responsibilities include leading project teams through procurement, pre-construction, and construction phases. The role also includes building and supporting teams, promoting collaboration with owners, contributing technical expertise, and ensuring effective problem-solving at both technical and executive levels.

Interviewee 6: Senior Project Manager (Contractor)

The interviewee has extensive experience in the construction industry, having started as a summer intern in 1986. With an undergraduate degree in history and a master's degree in civil engineering, the interviewee has worked full-time in the industry since 1992 and has spent their entire career at a major construction firm. With over 36 years in the field, the interviewee has specialized in various project delivery methods, focusing primarily on collaborative delivery approaches such as CM/GC (Construction Manager/General Contractor) and Progressive Design-Build (PDB) over the past 10–12 years. As a senior project manager, the interviewee is responsible for assembling and directing teams working on CM/GC and PDB projects, ensuring seamless collaboration between owners, designers, and contractors. The role also includes business development—identifying potential projects, building client relationships, and evaluating feasibility based on project scope, resources, and company capacity. Additionally, the interviewee provides strategic

guidance and technical expertise to optimize project planning, mitigate risks, and align project objectives with budget and schedule constraints.

Interviewee 7: Area Manager (Contractor)

The interviewee is an Area Manager at Granite Construction with over 20 years of experience, including significant involvement in alternative procurement methods since around 2010. They began with design-build projects, transitioned to CM/GC as the company sought to mitigate project risk, and are now engaged in progressive design-build pursuits. Their role has spanned from pavement design and technical reviews to managing pre-construction coordinators and overseeing project startup operations across various delivery methods.

Interviewee 8: Project Manager (Contractor)

The interviewee is the Project Manager for the US 50 design-build project for Caltrans in Sacramento and has held this role for approximately 18 months. Prior to this, they served as the Project Controls Manager, having been involved in the project since its start in 2020. As Project Manager, responsibilities include managing the design team in coordination with WSP, the engineer of record, and communicating with Caltrans. The team comprises construction managers, project engineers, field engineers, and project controls staff.

The project spans approximately eight miles from I-5 in Sacramento to Watt Avenue. It aims to add a carpool lane in both directions and replace existing lanes that have reached the end of their service life. Due to the need to maintain four lanes of traffic in each direction, the project requires multiple traffic switches and seven to eight construction stages. Additionally, ten existing bridges are being expanded with new infill structures to accommodate the additional lanes. The contract was initially valued at $387 million, with a duration of 925 working days. The design phase was completed within a year and a half, and the project is now fully in the construction phase.

Case Study 2: LA Metro Interviewee Summaries

Interviewee 1: Executive Officer for Government Relations

The Executive Officer for Government Relations at LA Metro oversees federal and state advocacy efforts related to transportation legislation and funding. This role focuses primarily on legislative matters in Washington, D.C., and Sacramento. The individual has been with LA Metro for 30 years, spending approximately 25 of those in government relations and leading the department for around six to seven years.

Interviewee 2: Senior Director of Special Projects

The interviewee is the Senior Director of Special Projects within the Office of the CEO at LA Metro. They have held this position for approximately one year and three months and have been with LA Metro for three years. In this role, they lead an internal advisory team that brings together project managers and senior executives to discuss project delivery challenges and provide advisory recommendations. The team facilitates discussions on delivery methods, outlining pros and cons, but the final decision rests with project managers and department chiefs.

Interviewee 3: Executive Officer

The interviewee is Executive Officer at LA Metro. They oversee the agency's alternative delivery program, which was developed after amendments to the Public Utilities Code (PUC) removed previous barriers requiring a two-thirds board vote for alternative project delivery approvals. This change allowed LA Metro to implement progressive design-build (PDB), construction manager/general contractor (CM/GC), and other methods without seeking board approval each time.

As part of this effort, this individual played a key role in revising and streamlining LA Metro's contract structure. Previously, LA Metro's contracts had been amended reactively over time, often adding new clauses and requirements in response to specific construction claims and disputes. This resulted in a disjointed and inconsistent contract framework. To address this, the official collaborated with outside counsel to develop a comprehensive and standardized contract approach, ensuring clarity and consistency across LA Metro's alternative delivery projects. Guidance manuals were also created to support phased implementation, covering key aspects such as cost estimation, early work packages, and contract reconciliation.

This individual also serves on the board of CalInfra, an organization initially formed to advocate for public-private partnerships (P3s). Their role focuses on education and training rather than legislative advocacy. As part of the Education Subcommittee, they work on equipping agencies and contractors with the necessary skills to effectively utilize alternative delivery methods.

Case Study 3: SANDAG Interviewee Summaries

Interviewee 1: Director of Program Project Management

The interviewee is the Director of Program Project Management at SANDAG, a position they have held for four months. Primary responsibilities include assisting project delivery teams in evaluating and selecting alternative project delivery methods and ensuring projects align with funding, scheduling, and procurement strategies. The role also involves risk assessment, contract management, and project oversight to ensure smooth project execution from planning through construction.

Interviewee 2: Project Manager (Contractor)

The interviewee is a Project Manager at Stacy and Witbeck, a company specializing in transportation projects, particularly rail-related infrastructure such as streetcars, light rail, commuter rail, and heavy rail. They have extensive experience managing large-scale projects across various regions, including California, Oregon, and Utah. Their role primarily involves overseeing the execution of complex projects, including several of the company's most significant undertakings, such as a $2.5 billion LA Metro project, a $1 billion Caltrans project, and a $1.5 billion SANDAG project. Responsibilities include ensuring that projects are completed on time while staying within budget and meeting quality standards, with a focus on alternative procurement methods like CM/GC and PDB. They also foster collaboration between contractors, owners, and consultants throughout the project lifecycle.

Case Study 4: SBCAG Interviewee Summaries

Interviewee 1: Director of Project Delivery and Construction

The interviewee is the Director of Project Delivery and Construction at SBCAG, reporting directly to the Executive Director. Responsibilities include overseeing all phases of project implementation, from environmental clearance to construction, and working with Caltrans, local cities, and county agencies on regionally significant transportation projects. SBCAG, as a regional transportation planning organization and local transportation authority, manages projects funded through a local sales tax while also partnering with Caltrans on state highway projects. The interviewee has been in their current position for five years and has been with SBCAG for over 20 years, previously serving as a program manager. Prior to joining SBCAG, they spent 16 years in the private sector focusing on highway infrastructure projects. They play a key role in hiring consultants for design and permitting, coordinating community outreach, and managing integrated project teams. One of the major projects has been the 12-mile Highway 101 corridor improvement, which involves highway widening and adding carpool lanes.

Case Study 5: Placer County Interviewee Summaries

Interviewee 1: Engineering Manager

The Interviewee currently serves as an Engineering Manager at Placer County Department of Public Works (PWD) and has held their current position for approximately two and a half years. He has been with the department for a total of 25 years, spending over 20 years as a Senior Engineer before moving into his current role. As part of the responsibilities, this individual oversees major infrastructure projects, including the Yankee Jims Bridge Replacement Project, which is the county's first project utilizing the Construction Manager/General Contractor (CM/GC) method. Recognizing the complexity and risks associated with the project, the county

actively pursued legislative approval to use CM/GC, which required an additional two years to secure.

Interviewee 2: Project Manager (Contractor)

The interviewee is a Project Manager at Flatiron who has worked for over 12 years with the company, spending eight of those years overseeing various projects. Their experience with CM/GC (Construction Manager/General Contractor) includes managing the South Fork Smith River Project for the Federal Highways Central Land Division after the project entered the construction contract phase. More recently, they have been working on the Yankee Jims Bridge project with Placer County, handling the design and cost model phase (from 35% to 100%) and anticipating moving into the construction contract soon.

Interviewee 3: Estimating Director (Independent Cost Estimator)

The interviewee currently serves as the Estimating Director for a major engineering firm in the U.S., a position they have held for six months. Prior to this role, the interviewee served as Estimating Manager within the Transportation Group of the same firm and has been with the company for 14 years, contributing to a total of 26 years in the industry. The first 12 years of their career were spent on the contractor side, which was described as critical for understanding both contractor and owner perspectives. This professional has supported alternative delivery projects—CM/GC, DB, and PDB—for over a decade, typically serving as a lead or Independent Cost Estimator (ICE) to provide owners with third-party cost evaluations. These roles focus on reconciling estimates between owner and contractor to ensure fair pricing. The interviewee is always hired by the owner and acts as a neutral party during the cost reconciliation process.

Case Study 6: Sonoma County Interviewee Summaries

Interviewee 1: Airport Manager

The interviewee is the Airport Manager for Charles M. Schultz Sonoma County Airport, a division within Sonoma County Public Infrastructure. He has served in this role for nearly 23 years. The airport operates as an enterprise fund, sustaining itself through rates and charges from airport users. It has a relatively small staff of approximately 30 employees and lacks an internal engineering team. Hence, they frequently collaborate with external engineering firms, notably Mead & Hunt for engineering and CNS Companies for construction management.

Interviewee 2: Department Manager Designer (Designer)

The interviewee is the Department Manager of the Civil Engineering team at a consulting firm, which focuses exclusively on aviation projects. With 12 years at the firm, beginning as an entry-level engineer after graduation, the interviewee has served in their current management role

for about two years. Responsibilities include overseeing aviation civil design projects and managing client relationships with local agencies. The interviewee is currently involved in the Sonoma County Airport Apron Reconstruction Project, a complex airfield initiative requiring careful phasing and coordination. The design team led the design and worked collaboratively with the contractor, starting at the 60% design phase.

Interviewee 3: Construction Manager (Contractor)

The interviewee is a construction manager at Granite and oversees construction operations in the North Coast area, which includes offices in Santa Rosa, Ukiah, and Eureka. This individual has been with Granite for 15 years and has served in their current role for approximately five years. On the CM/GC project for the County of Sonoma, they act as the project manager, providing high-level direction and coordination with the owner. Another project manager is assigned to manage the day-to-day operations and construction. In this role, the individual describes themselves as serving in more of a project executive capacity.

Case Study 7: City of Santa Cruz Interviewee Summaries

Interviewee 1: Project Executive (Contractor)

This interviewee is a Project Executive at Granite Construction and has held that role for three years. They bring extensive experience to the position, having been with the company for a total of 35 years. Over this tenure, the individual has taken on a wide range of project roles, including serving as a project manager and leading an estimating team for a decade. Their background includes working with various alternative delivery methods, including CM/GC, design-build, and private market projects. Their first exposure to CM/GC came during a complex private sector project with Google on the Downtown West development in San José, California. In that role, they were responsible for leading the pursuit and supporting early project development, particularly in a highly constrained and dynamic environment involving multiple city blocks and active venues such as an arena. The project required significant coordination with ongoing events and concurrent construction activities by vertical builders. Typically, they become involved at the pre-construction phase, bringing together estimators, schedulers, and other technical experts.

This individual provides continuity through the lifecycle of long-duration projects—bridging pre-construction, construction, and closeout phases—to ensure smoother transitions and consistent oversight. Following the Google project, they worked on a broadband project with Caltrans, which they led for about a year before the program was ultimately canceled. More recently, they were involved in an emergency project with the City of Santa Cruz. Although the design was already 85% complete, they identified constructability issues and suggested a CM/GC-like approach. Granite was selected for the project, and the team completed the design in five months. The construction was ultimately delivered ahead of schedule and under budget by approximately $1.5 million. This collaboration with Santa Cruz was particularly successful due to

the city's progressive project selection policies and the increased flexibility granted under the emergency declaration. Through these projects, this individual has consistently applied deep expertise to support constructability, cost-efficiency, and collaborative project delivery across both public and private sectors.

Case Study 8: FCTA Interviewee Summaries

Interviewee 1: Executive Director

The interviewee is the Executive Director of the Fresno County Transportation Authority (FCTA), a position that they have held for approximately 14 months. In this capacity, they oversee the authority's operations, which include managing Measure C funds and planning for transportation projects in the region. The FCTA has a small team of about three staff members, so part of the role involves coordinating with consultants and partner agencies to advance transportation initiatives. The interviewee is a registered civil engineer in the state of California and has a career spanning over 26 years with Caltrans. Their previous roles at Caltrans included resident engineer, project manager, and design office chief.

Following Caltrans, they worked with the California High-Speed Rail Authority for about five years, serving as Director of Design and Construction and gaining initial experience with the design-build delivery method. They also worked with contractors as a project manager for a design-build project on Interstate 10 in San Bernardino County, where responsibilities included interacting with the contractor and handling post-design construction issues. They later returned to the High-Speed Rail project as a project director on Construction Package 4. Across these roles, the interviewee has accumulated 7–8 years of experience with alternative delivery methods, particularly design-build and CM/GC.

Case Study 9: CalInfra Interviewee Summaries

Interviewee 1: Executive Director

The interviewee is the Executive Director of CalInfra, the California Infrastructure Delivery Coalition, and has held this position since the coalition's inception in 2022. Responsibilities include managing day-to-day operations and overseeing CalInfra's involvement in education, outreach, policy, and state of practice programs. This individual is deeply familiar with the organization's positions and efforts related to APDMs, such as CM/GC, DB, and PDB.

Appendix D. Index of Abbreviations

Abbreviation	Term
AB	Assembly Bill
APDM	Alternative Project Delivery Method
BV	Best Value
CalCOG	California Association of Councils of Governments
Caltrans	California Department of Transportation
CM/GC	Construction Manager/General Contractor
CMR	Construction Manager at Risk
COG	Council of Governments
CSAC	California State Association of Counties
CTC	California Transportation Commission
DB	Design-Build
DBB	Design-Bid-Build
DBIA	Design-Build Institute of America
DOT	Department of Transportation
DSCs	Differing Site Conditions
DWR	Department of Water Resources
FCTA	Fresno County Transportation Authority
FCTC	Fresno County Transportation Commission
FHWA	Federal Highway Administration
GMP	Guaranteed Maximum Price
JPAs	Joint Powers Authorities
LA Metro	Los Angeles County Metropolitan Transportation Authority
LADWP	Los Angeles Department of Water and Power
MPO	Metropolitan Planning Organization
MTI	Mineta Transportation Institute
OWP	Overall Work Program
PCC	Public Contract Code
PDB	Progressive Design-Build
PDM	Project Delivery Method
QBS	Qualifications-Based Selection
RFP	Request for Proposals
RFQ	Request for Qualifications
RTA	Regional Transportation Agency
RTP	Regional Transportation Plan
RTPA	Regional Transportation Planning Agency

SANDAG	San Diego Association of Governments
SB	Senate Bill
SBCAG	Santa Barbara County Association of Governments
SHCC	Self-Help Counties Coalition
SHS	State Highway System
TIP	Transportation Improvement Program

Bibliography

Adamtey, S. (2019). Current practices of construction manager/general contractor delivery method in the transportation industry. 402–413. https://doi.org/10.1061/9780784482575.038

AGC & NAFSA. (2020). *Construction management at risk benefits, criteria and justification*. https://www.agc.org/system/files/resources/AGC-NASFA%20CM%40Risk%20-%20FINAL%20-%20June%202020.pdf

Alameri, R., & Esmaeili, B. (2023). Progressive design-build delivery method: Assessment of project performance. *International Journal of Construction Education and Research*, *19*(1), 22–41. https://doi.org/10.1080/15578771.2021.1950242

Alleman, D., & Tran, D. (2020). Challenges of implementing progressive design-build in highway construction projects. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *12*(1), 04519036. https://doi.org/10.1061/(ASCE)LA.1943-4170.0000327

Alleman, D., & Tran, D. (2021). Exploring a progressive design-build Best-Value delivery method in highway construction. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *13*(1), 05020018. https://doi.org/10.1061/(ASCE)LA.1943-4170.0000443

Anderson, L. D. (2022). An examination of an alternate project delivery method: Progressive Design Build.

Ashuri, B., Mostaan, K., & Hannon, D. (n.d.). How can innovative project delivery systems improve the overall efficiency of GDOT in transportation project delivery?

Brogan, E., Clevenger, C. M., & VanDemark, L. (2023). Evaluating design-level designation of owner-provided data for transportation design-build projects based on case studies. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *15*(2), 05022009. https://doi.org/10.1061/JLADAH.LADR-901

California Legislative Information. (2025). Home. https://leginfo.legislature.ca.gov/

Calinfra. (2023). Bridging the gap: Unlocking the potential of Alternative Project Delivery for California's infrastructure future.

Caltrans. (2008). *Alternative Procur*ement Guide. Innovative Contracting Techniques https://dot.ca.gov/-/media/dot-media/programs/design/documents/alternativeprocurementguide-a11y.pdf

Caltrans. (2017). *Regional planning handbook 2017*. https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/final-2017-rph-11-9-17.pdf

Caltrans. (2021a). Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Agencies (RTPAs) contact list. https://www.ca-ilg.org/sites/main/files/file-attachments/mpo-rtpa_1-10_0.pdf?1402610911

Caltrans. (2021b) *Caltrans CM/GC procedures*. Construction Manage/General Contractor (CM/GC) Program. https://dot.ca.gov/-/media/dot-media/programs/design/documents/caltrans-cmgc-procedures_7-19-21-ada-compliant-a11y.pdf

Caltrans (2022). *MPO & RTPA contact lists and planning maps* (February 2022 update). https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/mpo-rtpa-tc-contact-lists-0222.pdf

Caltrans. (2025). *Caltrans*. https://dot.ca.gov/about-caltrans

Castro-Nova, I., Gad, G. M., & Gransberg, D. D. (2017). Assessment of state agencies' practices in managing geotechnical risk in design–build projects. *Transportation Research Record: Journal of the Transportation Research Board*, *2630*(1), 9–14. https://doi.org/10.3141/2630-02

Chenault, D. J. (2021). Innovative contracting best practices.

City of San Diego. (2003). *Construction Manager (CM) at risk project delivery method*. https://docs.sandiego.gov/reportstocouncil/2003/03-209.pdf

Clawson, B. L., & Dickinson, M. D. (n.d.). Removing the risk from Construction Manager At-Risk Project Delivery: The benefits of CMa services.

CTC. (2017). *California Transportation Commission*. https://catc.ca.gov/-/media/ctc-media/documents/fs-ctc-overview-031017-a11y.pdf

CTC. (2024a). *2024 Regional transportation plan guidelines for metropolitan planning Agencies*. https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/division-transportation-planning/regional-and-community-planning/sustainable-transportation-planning-grants/adopted-2024-rtp-guidelines-for-mpos-2-a11y.pdf

CTC. (2024b). *2024 Regional transportation plan guidelines for regional transportation Planning Agencies*. https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/division-transportation-planning/regional-and-community-

planning/sustainable-transportation-planning-grants/adopted-2024-rtp-guidelines-for-rtpas-2-a11y.pdf

Dang, H., & Shane, J. (2018). Construction Manager General Contractor (CM/GC) characteristics and effective practices in transportation sector. 744–754. https://doi.org/10.1061/9780784481271.072

Diab, M., & Ii, R. J. G. (n.d.). Risk management in alternative project delivery scenarios: A Construction Manager/General Contractor case study. https://doi.org/doi.org/10.1061/(ASCE)CO.1943-7862.0000059

Elkind, E., Segal, K., & Lam, T. (2022). Getting back on track: Policy solutions to improve California rail transit projects. Berkeley, CA.

Ellis, R. D., Herbsman, Z. and Kumar, A. (1991). "Evaluation of the FDOT design/build program." Final Report, Submitted to Florida Dept. of Transportation, State Project No. 997007543-010, Department of Civil Engineering, University of Florida, Gainesville. https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/construction/altcontract/general/pdf/dbprogrameval1991.pdf?sfvrsn=81967648_0

Ernzen, J. J., & Schexnayder, C. (2000). One company's experience with design/build: Labor cost risk and profit potential. *Journal for Construction Engineering and Management*, *126*(1), 10.

Ernzen, J., & Feeney, T. (2002). Contractor-led quality control and quality assurance plus Design—Build: Who is watching the quality? *Transportation Research Record: Journal of the Transportation Research Board*, *1813*(1), 253–259. https://doi.org/10.3141/1813-31

FHWA. (2006). *Design-Build Effectiveness.* 1307(January).

FHWA. (2025). *FHWA—Center for Innovative Finance Support—Alternative project delivery defined: New build facilities.* https://www.fhwa.dot.gov/ipd/alternative_project_delivery/defined/new_build_facilities/design_build.aspx

Gad, G. M., Davis, B., Shrestha, P. P., & Harder, P. (2019). Lessons learned from progressive design-build implementation on airport projects. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 11*(4). https://doi.org/10.1061/(ASCE)LA.1943-4170.0000320

Gad, G. M., Esmaeili, B., Momoh, A. K., & Gransberg, D. D. (2015) The impact of Project Delivery Method on dispute occurrence in public highway projects. P*roceedings of the Annual Conference of the Canadian Society of Civil Engineering, Canada*

Gad, G. M., Ryan, C., de la Peña, P. Caplicki, E., & Minchin, E. (2022) *NCHRP 20-06/ Topic 25-03- Managing enhanced risk in the mega project era*. Transportation Research Board of the National Academies, Washington, DC. https://doi.org/10.17226/26713

Gaikwad, S. V., Calahorra-Jimenez, M., Molenaar, K. R., & Torres-Machi, C. (2021). Challenges in engineering estimates for Best Value design–build highway projects. *Journal of Construction Engineering and Management*, *147*(7), 04021065. https://doi.org/10.1061/(ASCE)CO.1943-7862.0002104

Gatti, U. C., Migliaccio, G. C., & Laird, L. (2014). Design management in design-build megaprojects: SR 99 Bored Tunnel case study. *Practice Periodical on Structural Design and Construction*, *19*(1), 148–158. https://doi.org/10.1061/(ASCE)SC.1943-5576.0000182

Ghavamifar, K., & Touran, A. (2008). Alternative project delivery systems: Applications and legal limits in transportation projects. *Journal of Professional Issues in Engineering Education and Practice*, *134*(1), 106–111. https://doi.org/10.1061/(ASCE)1052-3928(2008)134:1(106)

Gransberg, D. D., Koch, J. E., & Molennar, K. R. (2006). *Preparing for design-build projects: A primer for owners, engineers, and contractors*. American Society of Civil Engineers. https://doi.org/10.1061/9780784408285

Gransberg, D. D., & Molenaar, K. R. (2008). Does design-build project delivery affect the future of the public engineer? *Transportation Research Record: Journal of the Transportation Research Board*, *2081*(1), 3–8. https://doi.org/10.3141/2081-01

Gransberg, D. D., & Molenaar, K. R. (2019). Critical comparison of progressive design-build and Construction Manager/General Contractor project delivery methods. *Transportation Research Record: Journal of the Transportation Research Board*, *2673*(1), 261–268. https://doi.org/10.1177/0361198118822315

Gransberg, D. D., & Senadheera, S. P. (1999). Design-build contract award methods for transportation projects. *Journal of Transportation Engineering*, *125*(6), 565–567. https://doi.org/10.1061/(ASCE)0733-947X(1999)125:6(565)

Gransberg, D. D., Shane, J. S., Transportation Research Board, National Cooperative Highway Research Program Synthesis Program, & Transportation Research Board. (2010). *Construction manager-at-Risk project delivery for highway programs* (p. 14350). National Academies Press. https://doi.org/10.17226/14350

Gransberg, N. J., & Gransberg, D. D. (2020). Public project construction manager-at-risk contracts: Lessons learned from a comparison of commercial and infrastructure projects.

Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, *12*(1), 04519039. https://doi.org/10.1061/(ASCE)LA.1943-4170.0000339

Hannon, D., Mostaan, K., & Ashuri, B. (2014). Challenges and opportunities for expediting environmental analysis in transportation design-build projects. *Construction Research Congress 2014*, 1319–1328. https://doi.org/10.1061/9780784413517.135

Hashem Mehany, M., Bashettiyavar, G., Esmaeili, B., & Gad G. M. (2018). Claims and project performance between traditional and alternative project delivery methods. A*SCE Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 10*(3).

Migliaccio, G. C., Minchin, R. E., Gatti, U. C., Ptschelinzew, L., Atkins, K. E., & Hostetler, G. A. (2019). Best practices for the design process for the horizontal design-builder. In Proceedings of the 10th International Structural Engineering and Construction Conference (ISEC-10). ISEC Press. https://www.isec-society.org/ISEC_PRESS/ISEC_10/pdf/CON-18.pdf?utm_source=chatgpt.com

Minchin, R. E. (2009). Fall and rise of the largest construction manager-at-risk transportation construction project ever. *Journal of Construction Engineering and Management*, *135*(9), 930–938. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000059

Minchin, R. E., Li, X., Issa, R. R., & Vargas, G. G. (2013). Comparison of cost and time performance of design-build and design-bid-build delivery systems in Florida. *Journal of CEM*, *139*(10), 1–5.

Minchin, E., Ptschelinzew, L., Migliaccio, G. C., Gatti, U., Atkins, K., Warn, T., Hostetler, G., Asiamah, S., National Cooperative Highway Research Program, Transportation Research Board, & National Academies of Sciences, Engineering, and Medicine. (2014). *Guide for design management on design-build and Construction Manager/General Contractor projects* (p. 22273). Transportation Research Board. https://doi.org/10.17226/22273

Mitchell, W. D., & Chen, C.-R. (2022). A comparison of Georgia DOT's design-build legislation and project expenditures with those of bordering states. http://digital.library.wisc.edu/1793/83707

Molenaar, K. R., Sobin, N., & Antillón, E. I. (2010). A synthesis of Best-Value procurement practices for sustainable design-build projects in the public sector. *Journal of Green Building*, *5*(4), 148–157. https://doi.org/10.3992/jgb.5.4.148

Okere, G. (2018). Comparison of DB to DBB on highway projects in Washington State, USA. *International Journal of Construction Supply Chain Management*, *8*(2), 73–86. https://doi.org/10.14424/ijcscm802018-73-86

Park, J., & Kwak, Y. H. (2017). Design-Bid-Build (DBB) vs. Design-Build (DB) in the U.S. public transportation projects: The choice and consequences. *International Journal of Project Management*, *35*(3), 280–295. https://doi.org/10.1016/j.ijproman.2016.10.013

Patterson, D. A., Farnsworth, C. B., Hutchings, D. M., Eggett, D. L., & Weidman, J. E. (2023). Comparing cost, schedule, and quality of CM/GC and DBB project delivery for repetitive commercial construction. *International Journal of Construction Education and Research*, *19*(2), 166–186. https://doi.org/10.1080/15578771.2021.2013998

Senate Publications. (1991). *The legislative process: A citizen's guide to participation*. California State Senate. https://www.senate.ca.gov/sites/senate.ca.gov/files/legislative%20process%20booklet.pdf

Sanboskani, H., Papajohn, D., Cosentino, D., & El Asmar, M. (2024). Implementation of post-award contract administration tools in D-B and CM-GC highway projects: The state of practice in the design phase. 113–123. https://doi.org/10.1061/9780784485286.012

Scarlett, K. (2023). Procurement framework for Progressive Design-Build implementation: A case scenario of the California [Master's project, California State Polytechnic University, Pomona]. https://scholarworks.calstate.edu/downloads/5x21tp54z

SHCC. (2024). *Self Help Counties Coalition*. https://selfhelpcounties.org/

Shrestha, P. P., Davis, B., & Gad, G. M. (2020). Investigation of legal issues in construction-manager-at-risk projects: Case study of airport projects. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *12*(3), 04520022. https://doi.org/10.1061/(ASCE)LA.1943-4170.0000404

Sullivan, J., Asmar, M. E., Chalhoub, J., & Obeid, H. (2017). Two decades of performance comparisons for design-build, construction manager at risk, and design-bid-build: Quantitative analysis of the state of knowledge on project cost, schedule, and quality. *Journal of Construction Engineering and Management*, *143*(6), 04017009. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001282

Taylor, M. (2018). *California's transportation system*. https://lao.ca.gov/reports/2018/3860/californias-transportation-060418.pdf

Tran, D., Molenaar, K. R., & Gransberg, D. D. (2016). Implementing Best-Value procurement for design–bid–build highway projects. *Transportation Research Record: Journal of the Transportation Research Board*, *2573*(1), 26–33. https://doi.org/10.3141/2573-04

Warne, T. R. (2005). DB contracting for highway projects: A performance assessment. South Jordan, UT.

WSDOT. (2016). *PDM-Attribute-Comparison*. https://wsdot.wa.gov/sites/default/files/2021-10/PDM-Attribute-Comparison.pdf

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