

Project Delivery Methods

What are best methods for delivering the projects?

Kostas Tzanakakis



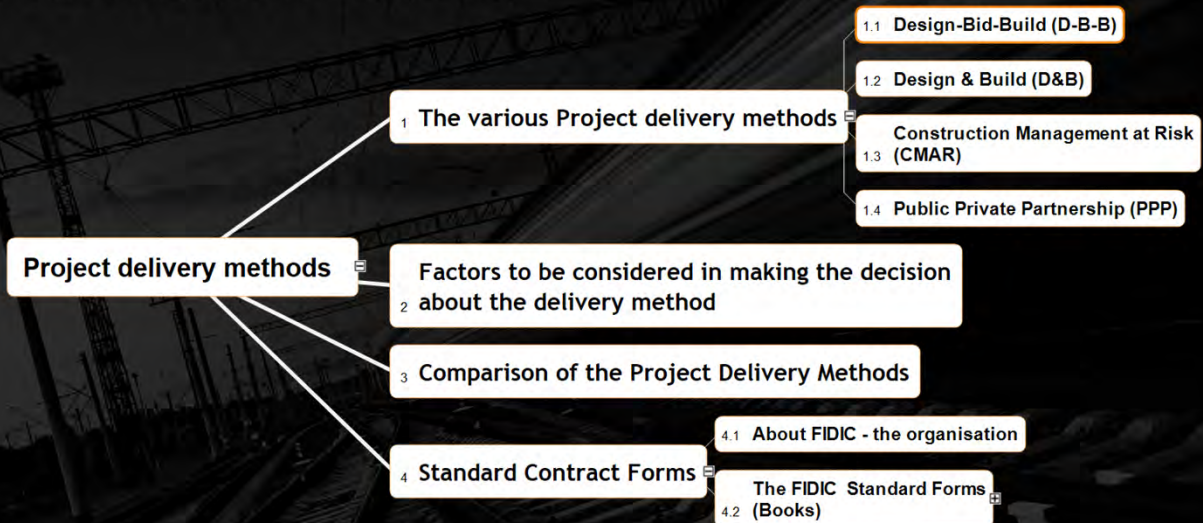
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Foreword

- There are various project delivery methods. But, what are the best methods for delivering the projects?
- This presentation is discussing the factors to be considered for the selection of the best project delivery method.
- FIDIC and the three major contract forms which are usually known as Red Book, Yellow Book and Silver Book will be presented also.
- You can download also our study "**Project Delivery Methods For The Transport Infrastructure**" <https://railhow.com/resources/project-delivery-methods-for-the-transport-infrastructure/>

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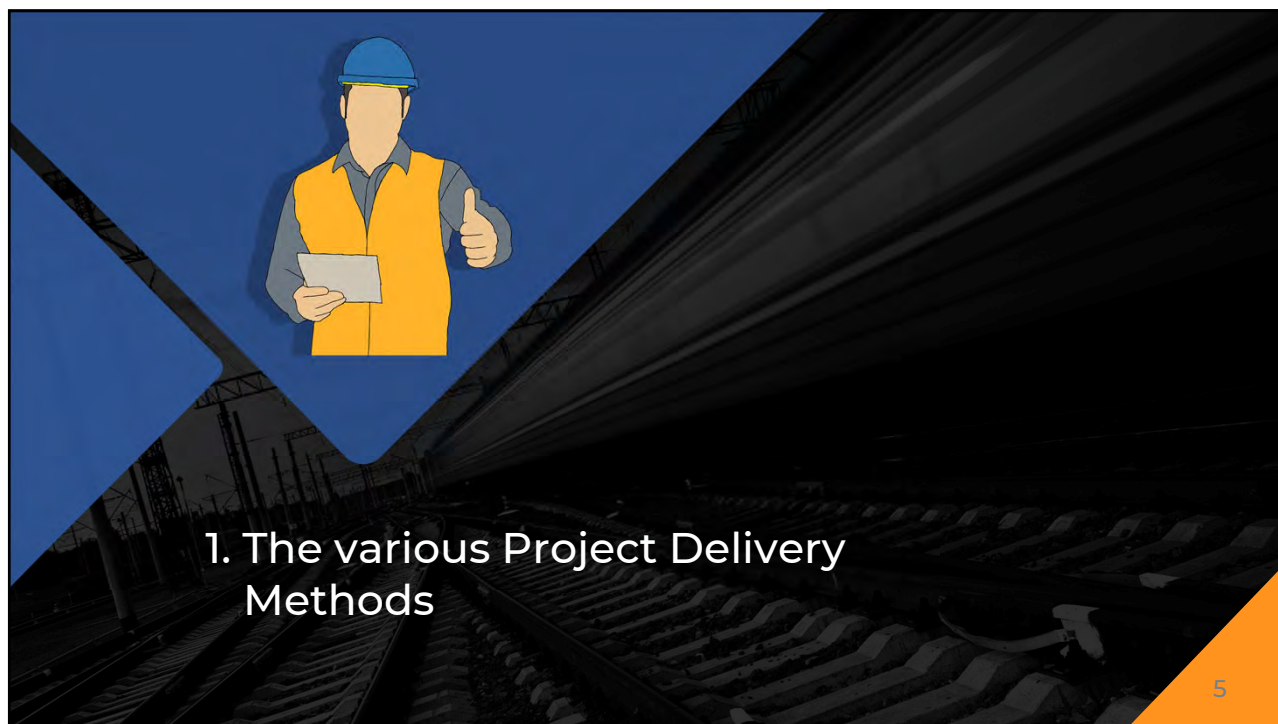
Presentation Structure



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- Project Delivery is a process including **planning, design and construction** required to execute and complete any type of project.
- One of the most important decisions made by any Owner getting on a construction project is the choice of the project delivery method – **how the project will be designed and constructed**.
- There are many options for delivery methods and many variations within those options.

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1. The various Project Delivery Methods

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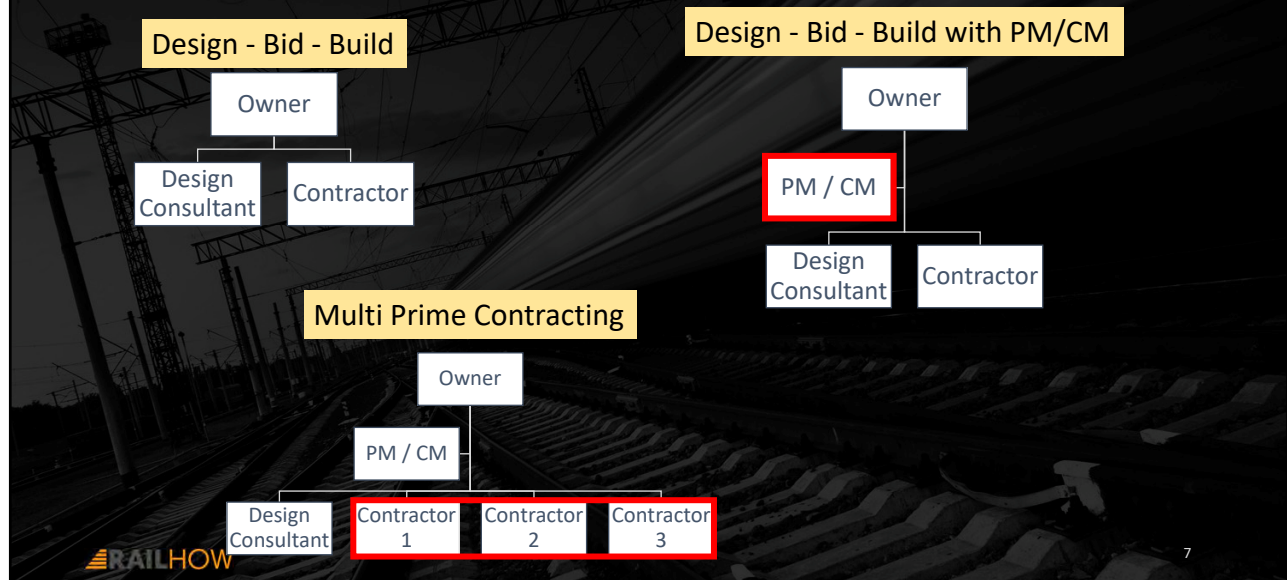
Project delivery methods

- The project delivery methods examined here are:
 - **Design-Bid-Build (D-B-B)** – The traditional project delivery method, which involves three sequential project phases: **design, procurement, and construction**.
 - **Design & Build (D&B)** – A project delivery method that combines architectural and engineering design services with construction performance under one contract.
 - **Construction Management At Risk (CMAR)** – A project delivery method in which the Construction Manager acts as a Consultant to the Owner in the development and design phases, but acts as a general contractor during construction.
 - **Public Private Partnership (PPP)** - a delivery method whereby a Public Entity partners with a Private Entity for delivering public infrastructure.

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1.1 Design-Bid-Build (D-B-B)



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- The Design-Bid-Build system remains **the most frequently used delivery method for construction projects**.
- The Owner engages a **Design Consultant** to prepare the design of the project, including construction drawings, and specifications.
The Design Consultant may also provide additional services including environmental investigation, permitting, right-of-way purchase documents, Stakeholder Management, and submissions for project funding.
- Once completed the tender documents, tender is floated, so interested Contractors can prepare and submit their bids for the work.
- The Owner will select a **Contractor**, usually based on the lowest bid, or some hybrid of price and technical merit. The selected general Contractor will then execute contracts with sub-Contractors to construct various specialty items.
- The **awarded Contractor** is responsible for constructing the project in accordance with the contract documents. The **Design Consultant** typically maintains limited oversight of the work and responds to questions about the design on behalf of the Owner.

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The role of the Project Manager / Construction Manager (PM/CM)

- In the past, most Owners relied on the experience of the Design Consultant to provide a complete and responsible set of contract documents.
- Recently, more and more Owners have found the value in **utilizing the advice and expertise of those with overall process, program and construction management knowledge during the design phase.**
- The PM/CM should be engaged in the project **as early as possible** to guide and assist the Owner through all phases of delivering the project.

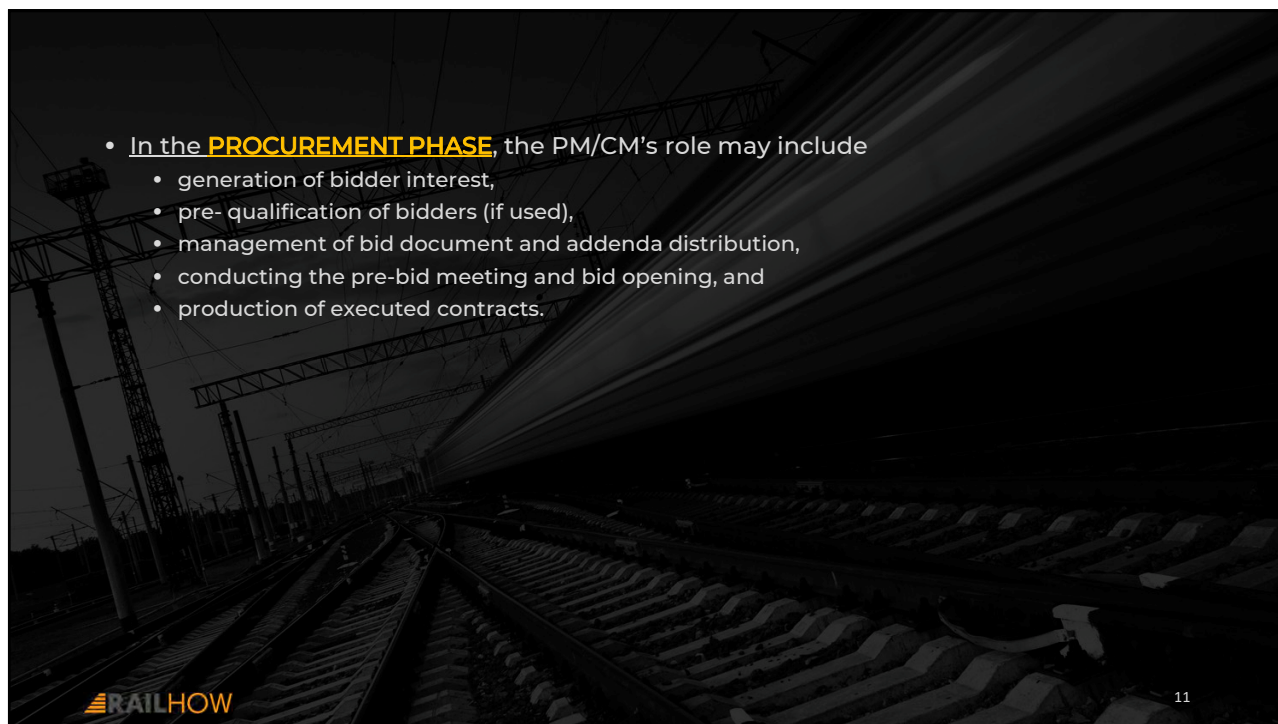
The PM/CM may also act as the **Owner's representative** with the other members of the project team, being the point of contact for the Design Consultant, Contractor, and any other specialty Consultants engaged in the project by the Owner.

- In a Design-Bid-Build delivery method, in addition to overall management expertise, the PM/CM must also provide construction expertise and advice to the project team during all pre-construction phases.

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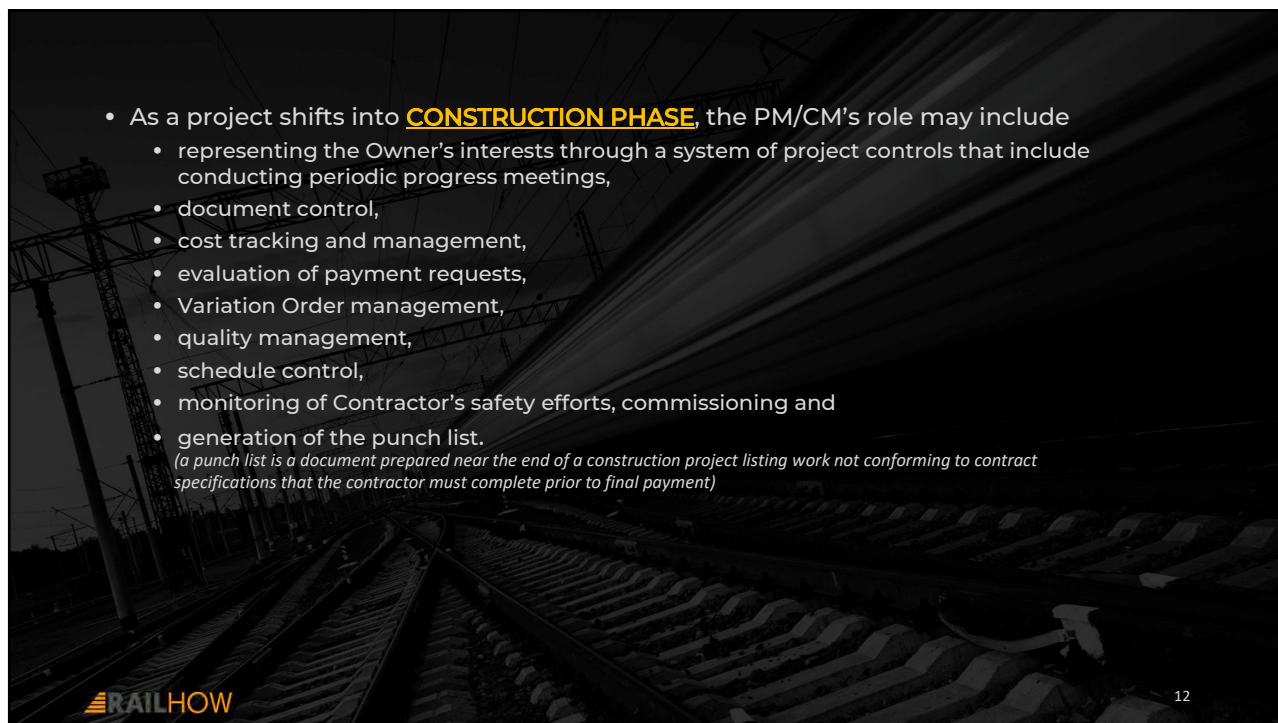
- In the **PRE-DESIGN PHASE**, the PM/CM's role may include
 - development and evaluation of the project,
 - defining the overall program and scope of work,
 - development of project budgets and schedules,
 - evaluation of project delivery methods,
 - procurement of the Design Consultant, and
 - development of project procedures and standards.
- During the **DESIGN PHASE**, the PM/CM's role
 - will continue to include tasks started in the pre-design phase,
 - may include oversight of the Design Consultant,
 - review of design documents,
 - generation of cost estimates,
 - value engineering,
 - budget and schedule management, and
 - development of overall phasing and contracting approaches.

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- In the **PROCUREMENT PHASE**, the PM/CM's role may include
 - generation of bidder interest,
 - pre-qualification of bidders (if used),
 - management of bid document and addenda distribution,
 - conducting the pre-bid meeting and bid opening, and
 - production of executed contracts.

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- As a project shifts into **CONSTRUCTION PHASE**, the PM/CM's role may include
 - representing the Owner's interests through a system of project controls that include conducting periodic progress meetings,
 - document control,
 - cost tracking and management,
 - evaluation of payment requests,
 - Variation Order management,
 - quality management,
 - schedule control,
 - monitoring of Contractor's safety efforts, commissioning and
 - generation of the punch list.
(a punch list is a document prepared near the end of a construction project listing work not conforming to contract specifications that the contractor must complete prior to final payment)

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- During the **POST-CONSTRUCTION PHASE**, the PM/CM's role may include
 - commissioning,
 - coordination of occupancy procedures,
 - the assembly and review of record documents and manuals,
 - warranty management, and
 - final project close-out.

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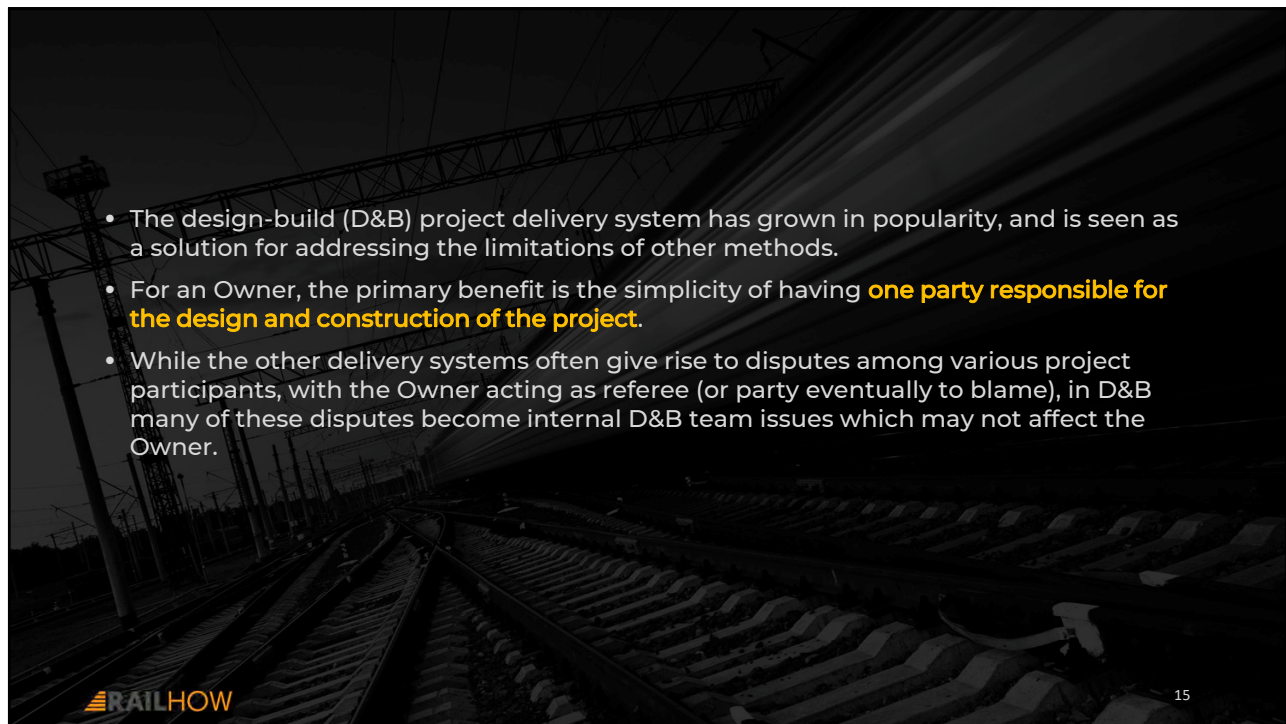
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1.2 Design & Build (D&B)

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graph TD; subgraph "Design - Build"; O1[Owner] --- DT1[Design - Build Team]; end; subgraph "Design - Build with PM/CM"; O2[Owner] --- PM[PM / CM]; PM --- DT2[Design - Build Team]; end;
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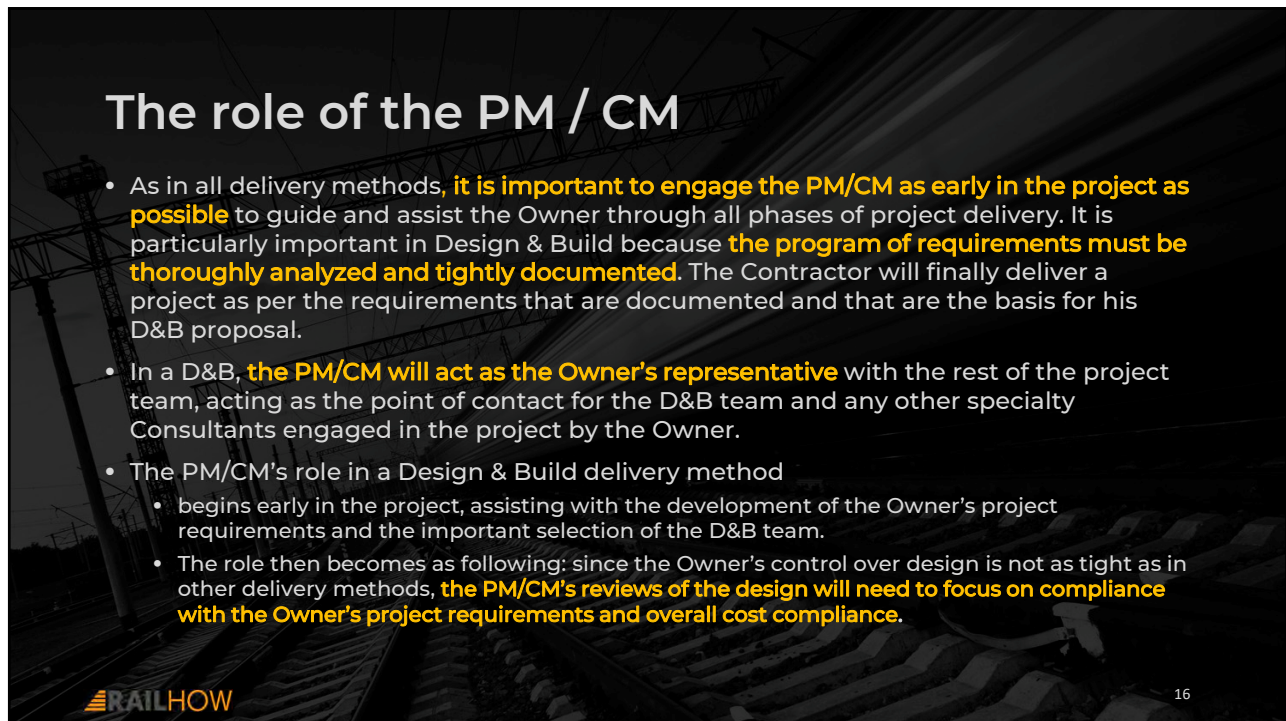


- The design-build (D&B) project delivery system has grown in popularity, and is seen as a solution for addressing the limitations of other methods.
- For an Owner, the primary benefit is the simplicity of having **one party responsible for the design and construction of the project.**
- While the other delivery systems often give rise to disputes among various project participants, with the Owner acting as referee (or party eventually to blame), in D&B many of these disputes become internal D&B team issues which may not affect the Owner.

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The role of the PM / CM



- As in all delivery methods, **it is important to engage the PM/CM as early in the project as possible** to guide and assist the Owner through all phases of project delivery. It is particularly important in Design & Build because **the program of requirements must be thoroughly analyzed and tightly documented.** The Contractor will finally deliver a project as per the requirements that are documented and that are the basis for his D&B proposal.
- In a D&B, **the PM/CM will act as the Owner's representative** with the rest of the project team, acting as the point of contact for the D&B team and any other specialty Consultants engaged in the project by the Owner.
- The PM/CM's role in a Design & Build delivery method
 - begins early in the project, assisting with the development of the Owner's project requirements and the important selection of the D&B team.
 - The role then becomes as following: since the Owner's control over design is not as tight as in other delivery methods, **the PM/CM's reviews of the design will need to focus on compliance with the Owner's project requirements and overall cost compliance.**

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1.3 Construction Management at Risk (CMAR)



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- In this scenario, instead of a traditional general Contractor, the Owner deals with a hybrid construction manager/general Contractor
 - **Prior to construction**
 - The “Construction Management at Risk” provides advisory professional management assistance to the Owner prior to construction, offering schedule, budget and constructability advice during the project planning and design phases.
 - **During construction**
 - This delivery system is similar in many ways to the Design-Bid-Build system, in that the “Construction Management at Risk” (CMAR) acts as a general Contractor during construction.
- The “Construction Management at Risk” holds the risk of construction performance and guarantees completion of the project for a negotiated price which is usually established when the design is somewhere between 50% and 90% developed.

Management Assistance to the Owner

General Contractor

Prior to Construction (planning and design)

During Construction

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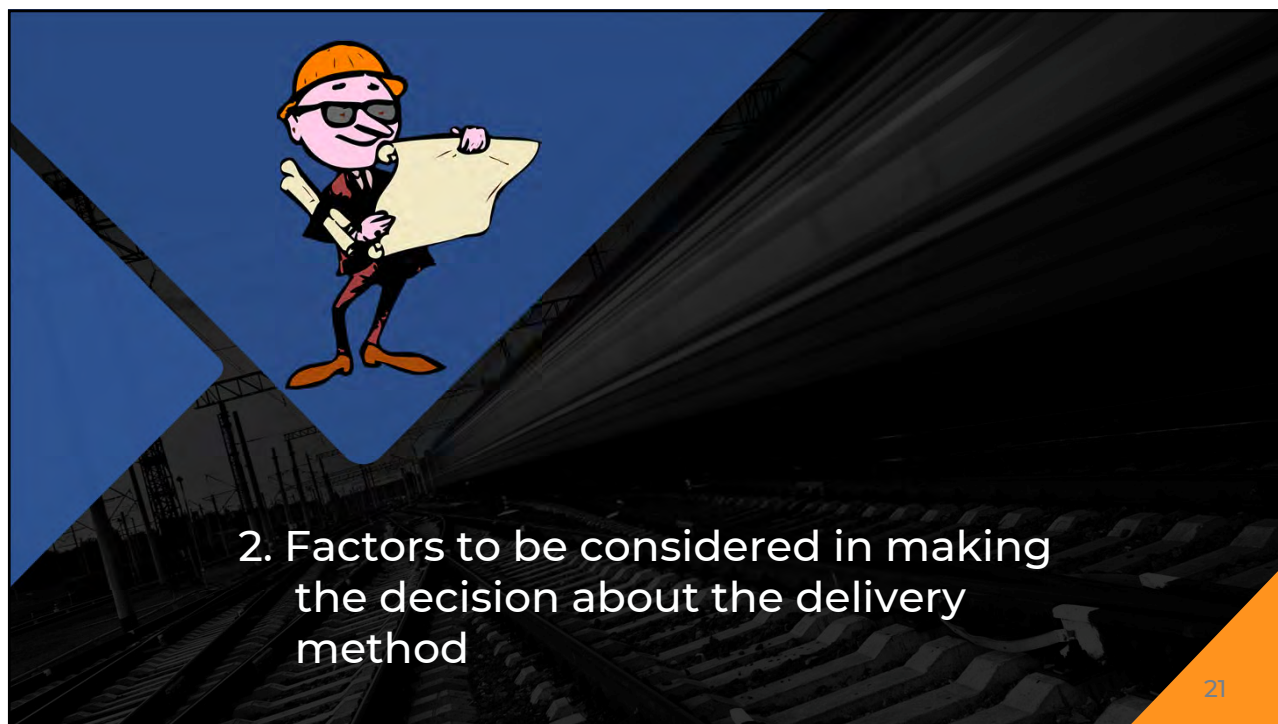
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1.4 Public Private Partnership (PPP)

- Public Private Partnership is a delivery method whereby a public entity partners with a private entity for the purpose of delivering public infrastructure.
- In the most typical of these variations, the private entity will be comprised of
 - a design-build team,
 - a maintenance company, and
 - a lending company.
- The private entity will **design, build, finance, maintain and/or operate the facility** for a set number of years, agreeing to meet **specified performance criteria** in exchange for lease payments or some other compensation. **At the end of the specified period, the facility is returned to the public entity.**
- Various **forms of PPP compensation** include a fee contract, in which the PPP firm receives its compensation through a fee charged to the Owner, and a concession contract, in which the PPP firm receives its compensation directly from the consumers rather than the Owner.

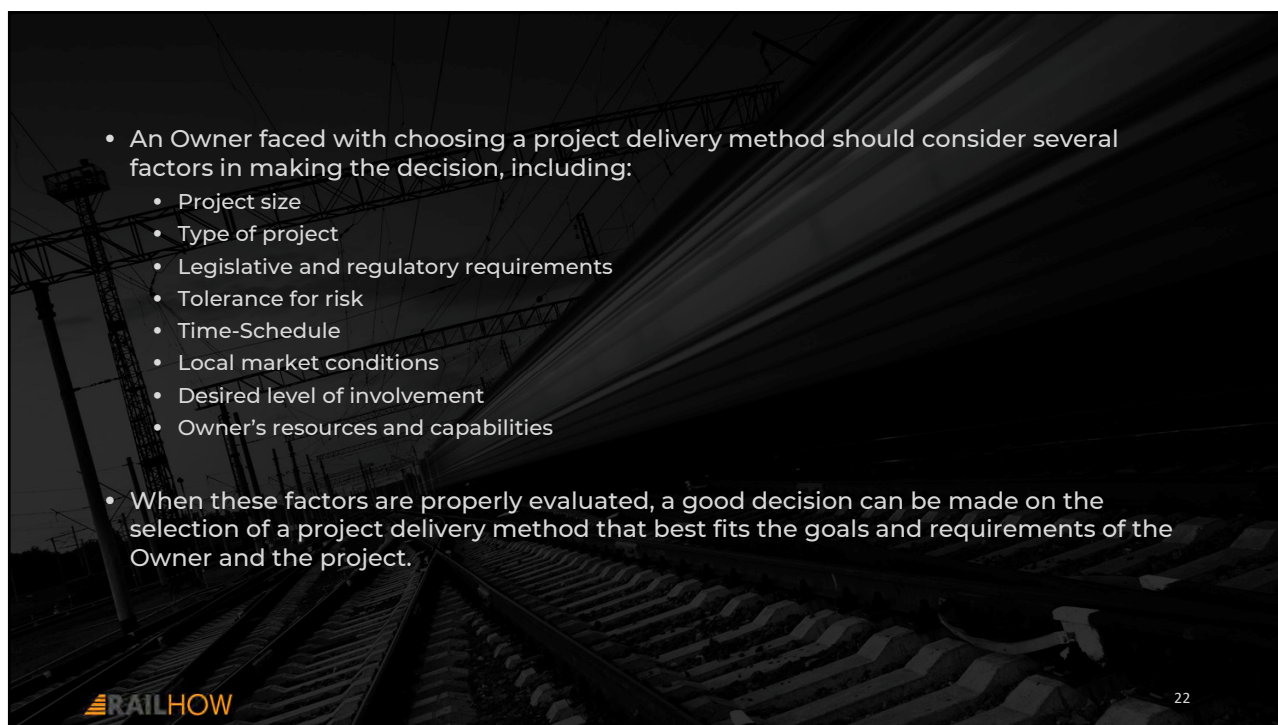
Possible schemes of PPP

Build-Finance	In build-finance projects, the private sector assumes responsibility both for financing and building the project.
Design-Build-Maintain (DBM)	In this scenario the private sector assumes responsibility for the design and construction of the project. After construction is complete, the public sector takes ownership, but the private sector entity continues to maintain the constructed facility under an ongoing maintenance agreement.
Design-Build-Finance-Maintain (DBFM)	In a Design-Build-Finance-Maintain project, in addition to design and construction of the facility, the private sector is responsible for the financing the project. As in the design-build-maintain model, once construction is complete, ownership of the facility goes to the public sector but the facility is maintained privately under an ongoing maintenance agreement.
Design-Build-Finance-Operate (DBFO)	In another variation, the Design-Build-Finance-Operate model sees the private sector, after having designed and built the facility with private financing, continue to operate and maintain it for the duration of the concession period, which may be 30 years or more. Only after the agreement has expired ownership of the facility returns to the public sector.



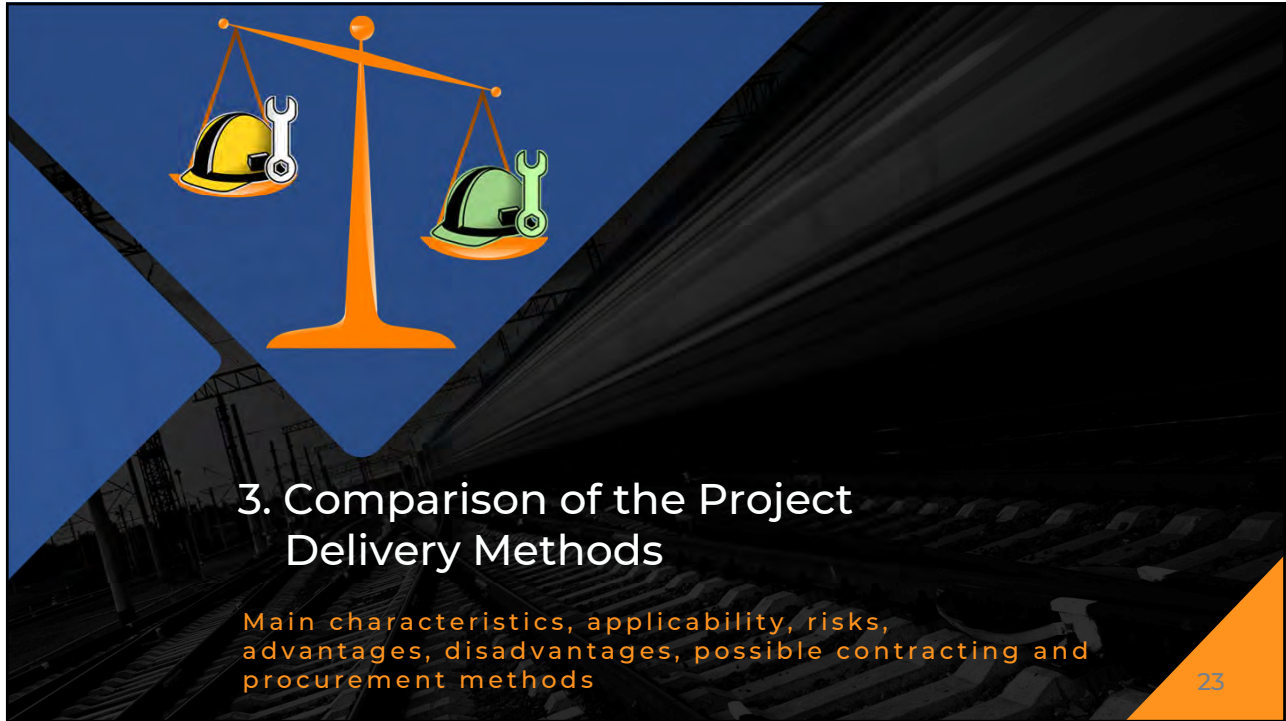
2. Factors to be considered in making the decision about the delivery method

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- An Owner faced with choosing a project delivery method should consider several factors in making the decision, including:
 - Project size
 - Type of project
 - Legislative and regulatory requirements
 - Tolerance for risk
 - Time-Schedule
 - Local market conditions
 - Desired level of involvement
 - Owner's resources and capabilities
- When these factors are properly evaluated, a good decision can be made on the selection of a project delivery method that best fits the goals and requirements of the Owner and the project.

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Main characteristics			
Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> • Traditional delivery system • Separate contracts for design and construction services (by the Owner) • Bid based on complete (100%) plans and specifications • Owner retains high level of control and risk • Traditionally a unit priced contract 	<ul style="list-style-type: none"> • Combines design and construction under a single contract • Traditionally a lump sum contract • Generally, two phase procurement <ul style="list-style-type: none"> ○ Pre-qualifications ○ Technical/price evaluation 	<ul style="list-style-type: none"> • Owner engages a Construction Manager to act as a construction advisor during the pre-construction phase and General Contractor (GC) during construction • Selection criteria include qualifications, experience, strategic approach, and cost elements 	<ul style="list-style-type: none"> • PPP is a delivery method whereby a public entity partners with a private entity for delivering public infrastructure. • In the most typical of these variations, the private entity will be comprised of <ul style="list-style-type: none"> ○ A design-build team, ○ A maintenance firm, and ○ A lending firm.

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Applicability

Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> Projects where the owner needs to completely define the scope Significant risks or third-party issues (utilities, environmental) that can be best resolved or managed by the owner. 	<ul style="list-style-type: none"> Projects that benefit from innovation in design and/or construction Well defined project scope Projects that would benefit from accelerated project delivery Projects having minimal public controversy or third party issues 	<ul style="list-style-type: none"> Projects where owner requires control of scope during design Project with multiple phases or contracts Time or funding constraints Complete or obtainable environmental documents and permits 	

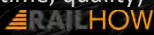


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Risks

Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> Initial low bid might not result in ultimate lowest cost or final best value Higher level of inspection/testing by the owner Owner bears risk of design adequacy Potential antagonistic relationship among the contracting parties Limited opportunity to incentivize contractors to provide enhanced performance (cost, time, quality) 	<ul style="list-style-type: none"> Less owner control over design Higher procurement costs for Bidders Potential to compromise quality Considerable time and effort in RFQ/RFP selection process 	<ul style="list-style-type: none"> Tensions over construction quality, the completeness of the design, and impacts to schedule and budget can arise 	<ul style="list-style-type: none"> While this approach is a good option as a means of bringing a project to reality, it is also a very complicated process that needs to be carefully considered.



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Advantages

Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> • Applicable to a wide range of projects • This method is widely applicable, well understood, and has well-established and clearly defined roles for the parties involved. • This method is the most common approach for public owners having to comply with local, or state procurement statutes. 	<ul style="list-style-type: none"> • D&B can produce a project more quickly than a conventional D-B-B (accelerate delivery by fast-tracking design and construction). • There is a single point responsibility for design and construction. • Cost efficiencies can be achieved since the contractor and Design Consultant are working together throughout the entire process. 	<ul style="list-style-type: none"> • Allows for innovation and constructability during design through collaboration of construction manager • Reduces error, variation orders, and materials overruns • Identifies and manages risk • Owner retains control over design 	<ul style="list-style-type: none"> • Targets alternative revenue and funding sources to close a funding gap • Transfers risk to the private sector • Accelerates construction start • Reduces construction cost and interest rate risks

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Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> • Owner controls design and construction. The owner has a significant amount of control over the end product, particularly since the project's features are fully determined and specified prior to selection of the contractor. 	<ul style="list-style-type: none"> • Variation orders would typically arise primarily from owner changes. • Potential for innovation and quality enhancement • Reduces error, variation orders, and materials overruns 	<ul style="list-style-type: none"> • Transfer of responsibility for construction, and some risk, from owner to The Construction Manager • Construction cost known and fixed during design • Construction Manager has total control of construction and all sub-contractors 	<ul style="list-style-type: none"> • Takes advantage of private-sector efficiencies and innovations in construction, scheduling, and financing

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Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> • Design changes easily accommodated prior to start of construction • Design is complete prior to construction award • Construction cost is fixed at contract award • Relative ease of implementation 	<ul style="list-style-type: none"> • Construction often starts before design completion accelerating project schedule • Construction cost known and fixed during design, price certainty • Transfer of design and construction risk from owner to the D&B entity • Emphasis on cost control • Requires less owner expertise and resources 	<ul style="list-style-type: none"> • Construction may start before design completion, reducing project schedule • The owner gains the benefit of having the opportunity to incorporate a contractor's perspective and input to planning and design decisions. 	<ul style="list-style-type: none"> • Provides efficiencies in long-term operations and maintenance • Presents an opportunity to combine public and private uses in mixed-use developments to leverage economic development

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Disadvantages

Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> • Design and construction are sequential, typically resulting in longer schedules • Can lead to a more costly final product. • Exposure to contractor variation orders and claims over design and constructability issues. • May promote more adversarial relationships rather than cooperation or coordination among the contractor, the Design Consultant and the owner. 	<ul style="list-style-type: none"> • Minimal owner control of both design and construction quality • Owner must be highly responsive in its decision making to take full advantage of the speed of D&B. • May be problematic when there is a requirement for multiple agency (many stakeholders) design approvals. • May be inappropriate if the owner is looking for an unusual or iconic design. 	<ul style="list-style-type: none"> • Reduced owner control of construction • Design changes after construction begins are costly • Potentially conflicting interests as both construction manager and contractor 	<ul style="list-style-type: none"> • The owner may experience higher total life cycle costs. • The proposal process can be very expensive for all involved. • A high level of expertise is required to execute a PPP project.

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Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> • If fixed price bidding and compensation method: the contractor may pursue a least-cost approach to completing the project and the owner may receive less scope or lesser quality than expected. • If unit price bidding and compensation method: the contractor may pursue an increased-scope approach to maximize revenue from the contract, while providing the owner more scope than expected. 	<ul style="list-style-type: none"> • Requires a comprehensive and carefully prepared performance specification • Design changes after construction begins are costly • No party responsible to represent owner's interests • High bid preparation costs/fewer bidders 	<ul style="list-style-type: none"> • While the construction manager at risk provides the owner with professional advisory management assistance during design, this same assistance is not present during the construction phase, as the construction manager at risk is in an "at-risk" position during construction. 	

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Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> • May limit the effectiveness and constructability of the design. • Requires significant owner expertise and resources • Owner at risk to contractor for design errors • Construction cost unknown until contract award • No contractor input in design, planning or value engineering (VE). 			

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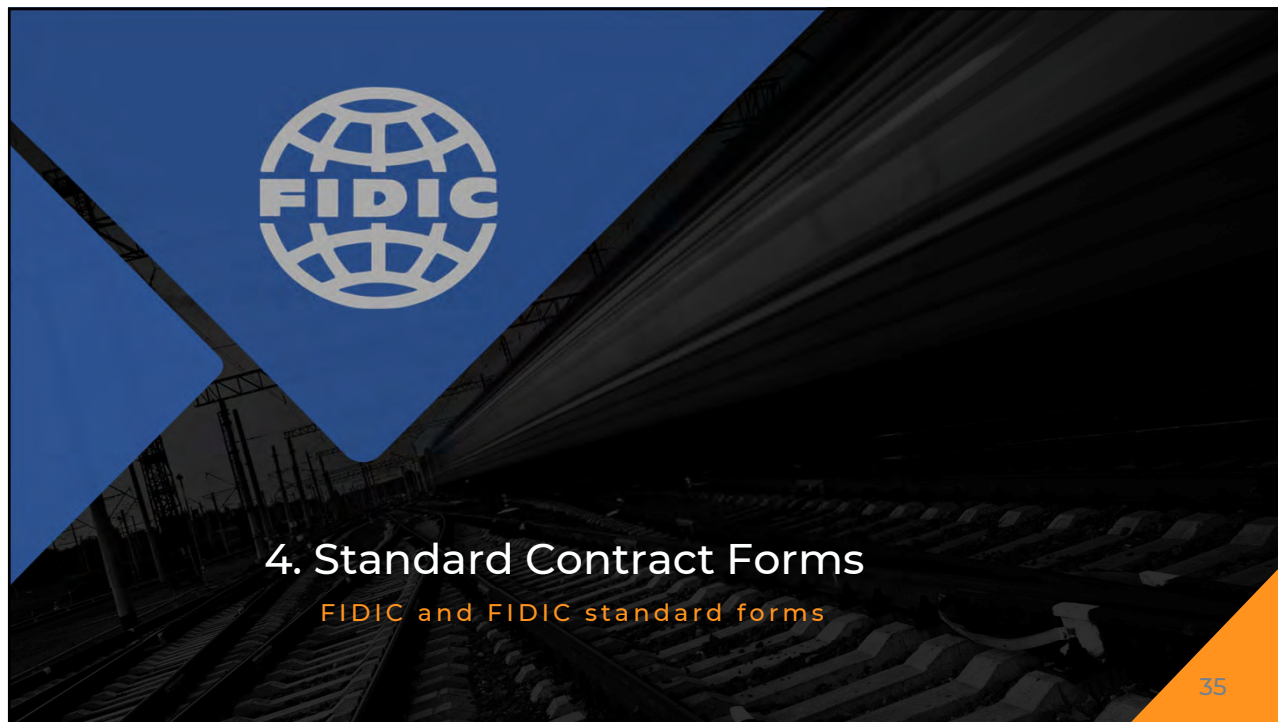
Possible Contracting and procurement methods

Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
<ul style="list-style-type: none"> In case of vertical construction (a building or treatment facility): sealed lump-sum or fixed price bid. In case of horizontal projects (as transportation): bidding is unit price. 	<ul style="list-style-type: none"> Agreement with the D&B team for <ul style="list-style-type: none"> A fixed-fee contract for design and pre-construction costs and An agreed general conditions costs and construction fee given as a percentage of total construction costs. 	<ul style="list-style-type: none"> Fixed-fee contract for pre-construction and general conditions costs, along with an agreed contractor's mark-up fee as a percentage of construction costs. Once the design has progressed to a point where a GMP can be established, the contract is converted to a GMP contract, with all remaining fixed costs rolled into the GMP. 	

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Design-bid-build (D-B-B)	Design & build (D&B)	Construction manager at risk (CMAR)	Public private partnership (PPP)
	<ul style="list-style-type: none"> Once the design has progressed to a point where a guaranteed maximum price (GMP) can be established, the contract is converted to a GMP contract, with all fixed costs rolled into the GMP. 		

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4.1 About FIDIC – the Organisation

- FIDIC: Fédération Internationale Des Ingénieurs-Conseils
- Founded in Brussels in 1913 in Europe by 3 national associations of independent consulting engineers (Belgium, France and Switzerland)
- Objectives:
 - promote common professional interests
 - disseminate information to the members of the constituent National Associations
- Now FIDIC has 97 Member Associations worldwide
- FIDIC is based in Geneva / Switzerland



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4.2 The FIDIC Standard Forms (Books)

- In the international field the most frequently used standard forms are those of the International Federation of Consulting Engineers (FIDIC).
- The FIDIC range of contract comprises three major forms which are usually known as
 - **Red Book**,
 - **Yellow Book** and
 - **Silver Book**.



*International Federation of Consulting Engineers
The Global Voice of Consulting Engineers*

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Introduction to FIDIC's **Red, Yellow** and **Silver Books**

- In any commercial contract, what are the main areas to be considered?
 - Identification of the Parties
 - Identifying the work or services to be provided
 - Ensuring that what is provided complies with the contract
 - Timing
 - Price and payments
 - Damage and injury
 - Social and environmental issues
 - Failure to perform
 - Resolution of disputes
- FIDIC contracts, address all these issues. Let's see how...

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Design responsibility

- All obligations of the Contractor are more or less dependent on DESIGN RESPONSIBILITY;
- The difference between the RED and the YELLOW BOOK lays in the extent to which design responsibilities are shifted to the Contractor;
- Under the SILVER BOOK the Contractor is responsible even where the Employer' Requirements contain errors and even where the Contractor could not reasonably have been expected to detect them, with certain very limited exceptions.

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RED BOOK – (Construction)

- The design is made by THE EMPLOYER and
- THE CONTRACTOR'S main obligation is, of course, the construction and the completion of the works.
- Traditional procurement route: DESIGN, BID and BUILD.
- The Contractor is paid on a MEASUREMENT BASIS.
- The ENGINEER is making the measurement and the Contractor is paid for the actual quantities of work he carried out.

*Since 1999, the FIDIC contract expressly recognizes the Engineer as an **agent of the Employer**. The Engineer ensures the smooth progress of work, adoption of any variations in the process, gives instructions to the contractor and decides disputes (before they are submitted to the Dispute Adjudication Body or arbitration).*



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YELLOW BOOK – PLANT AND DESIGN BUILD

- The design is carried out by the CONTRACTOR.
- The selection process under design-build contracting can be in the form of a NEGOTIATED PROCESS, or a COMPETITIVE PROCESS based on some combination of price, duration, and proposer qualifications.
- The Contractor is paid on a LUMP SUM BASIS.
- The CONTRACTOR'S OBLIGATIONS include:
 - fitness for purpose;
 - design responsibility;
 - carrying out the works in a proper and workmanlike manner with properly equipped facilities and non-hazardous materials;
 - providing those facilities and choosing those materials;
 - responsibility for method of working.



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Responsibility under Yellow Book

- Under the Yellow Book the Contractor is able to claim more time and money if the error, fault or defect in the EMPLOYER REQUIREMENTS was not one which an experienced contractor exercising due care would have discovered before submitting the Tender;
- The Contractor may also claim both additional time and money if he encounters PHYSICAL CONDITIONS which were UNFORESEEABLE.



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SILVER BOOK – EPC / TURNKEY PROJECTS

- EPC stands for Engineer, Procure and Construct, where the Contractor is responsible for engineering Design, the full range of Procurement and for Construction.
- The Contractor is paid on a LUMP SUM BASIS
- There is no Engineer to certify or determine claims; instead an Employer's Representative is appointed to act on Employer's behalf.



*Since 1999, the FIDIC contract expressly recognizes the Engineer as an **agent of the Employer**. The Engineer ensures the smooth progress of work, adoption of any variations in the process, gives instructions to the contractor and decides disputes (before they are submitted to the Dispute Adjudication Body or arbitration).*

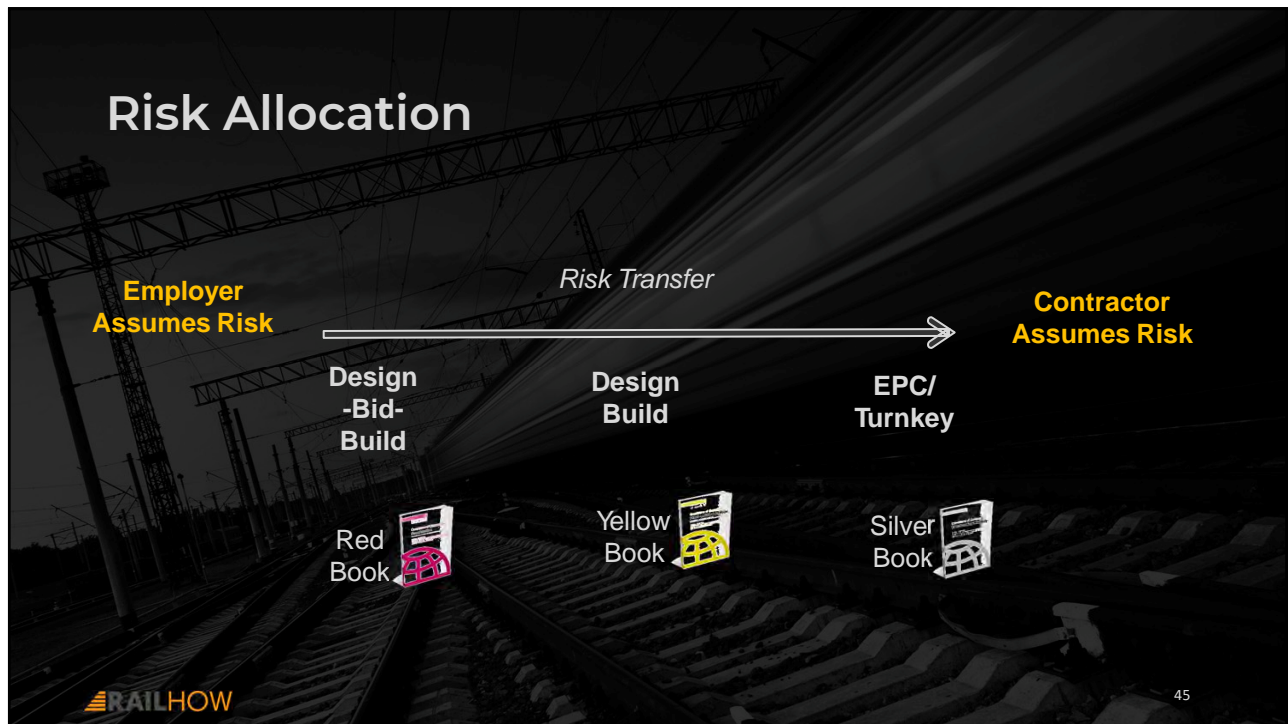
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Responsibility under Silver Book

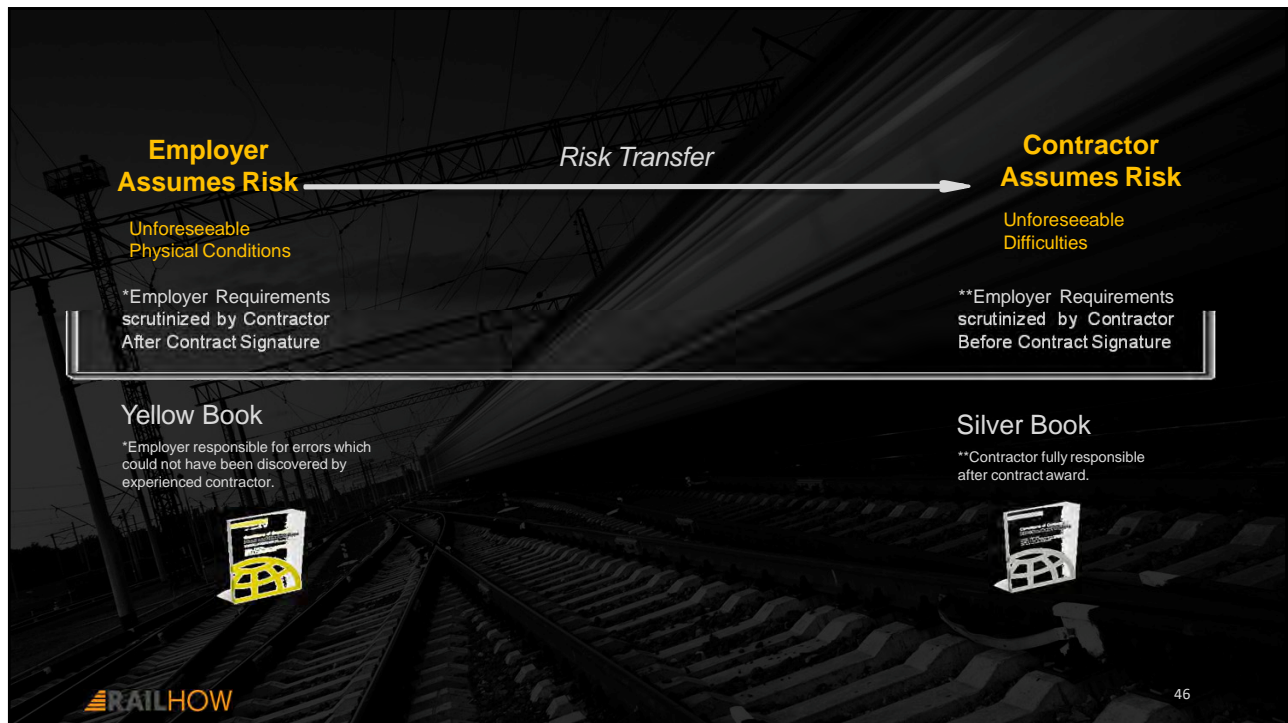
- Contractor bears risk, unless otherwise stated in the Contract, also for UNFORESEEABLE DIFFICULTIES.



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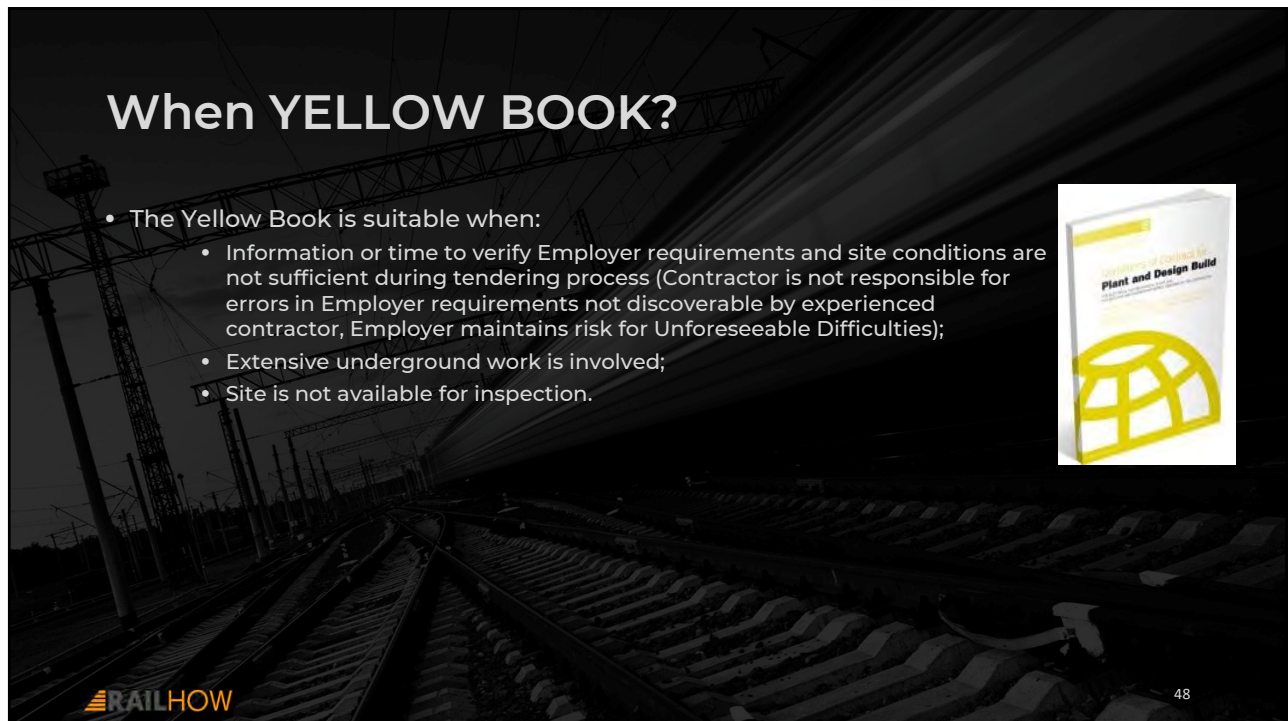
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When SILVER BOOK?

- The Silver Book is suitable when:
 - Certainty of final price and completion date are of extreme importance;
 - Employers are willing to pay a premium for this certainty;
 - Tenderers can verify all relevant data and make necessary site investigations before submitting tender (Contractor required to review Employer requirements and conduct site survey to validate pre-tender).



Thank you for your attention!



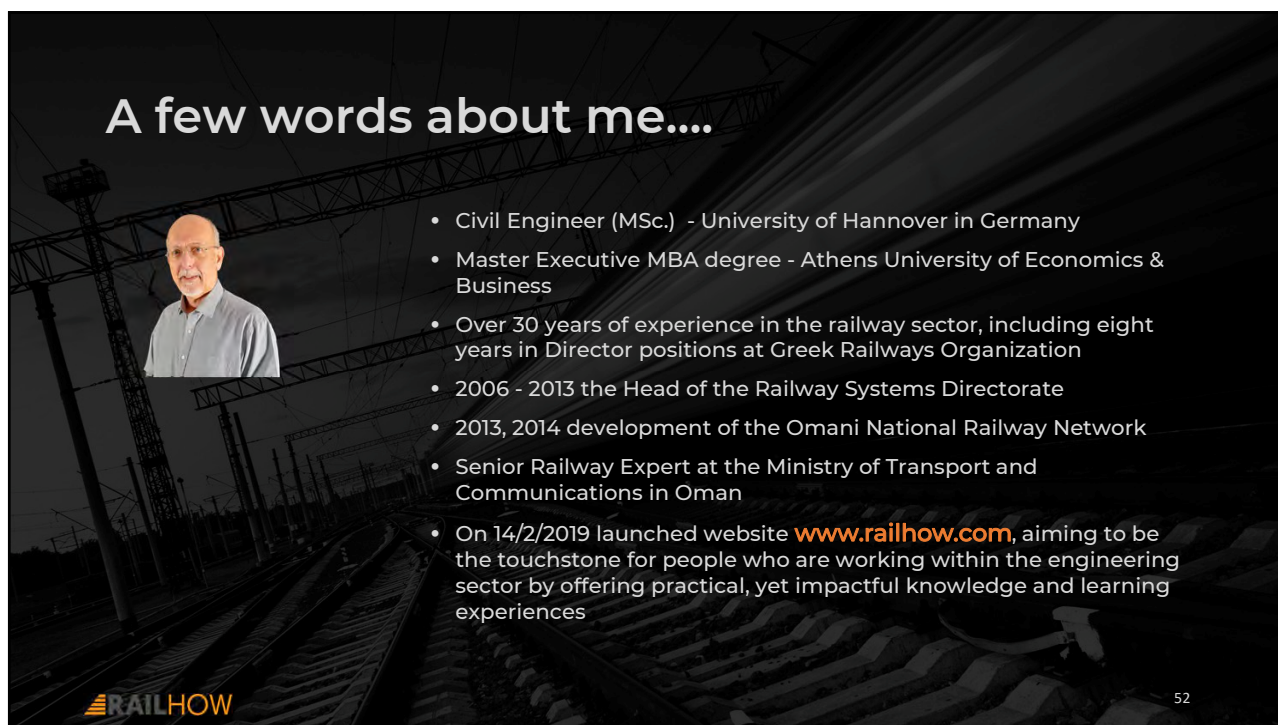
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A few words about me...



- Civil Engineer (MSc.) - University of Hannover in Germany
- Master Executive MBA degree - Athens University of Economics & Business
- Over 30 years of experience in the railway sector, including eight years in Director positions at Greek Railways Organization
- 2006 - 2013 the Head of the Railway Systems Directorate
- 2013, 2014 development of the Omani National Railway Network
- Senior Railway Expert at the Ministry of Transport and Communications in Oman
- On 14/2/2019 launched website www.railhow.com, aiming to be the touchstone for people who are working within the engineering sector by offering practical, yet impactful knowledge and learning experiences



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