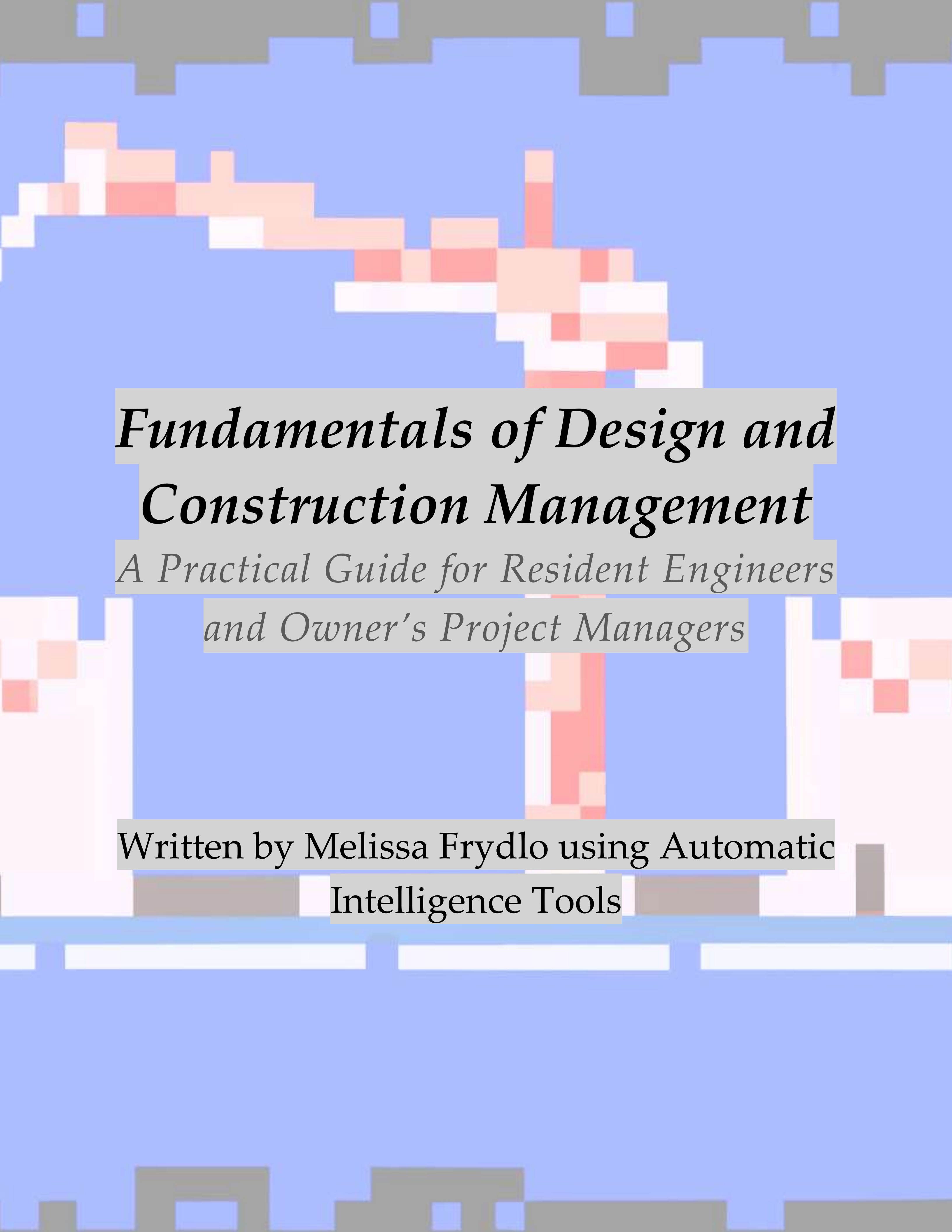

Fundamentals of Design and Construction Management

A Practical Guide for Resident Engineers and Owner's Project Managers

Written by Melissa Frydlo using Automatic Intelligence Tools

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Preamble

The greatest thing about management is the fact that, the application of management can be applied to all personal and professional aspects of your life.

In 2018, I mentioned to my colleague-friends that I am seeing everything repeat in my work. One responded, "well it is time to write then." I reflect on that day for motivation and every workday as I always have, I focus on developing a way to communicate this objective knowledge. How can I organize and disseminate the knowledge? How can I be efficient in my decision-making for the client? How can I communicate precisely? How can I be an effective teammate? How can I provide the best service as a professional? How can I work and build relationships so they will want to work with me again? How can ethics and codes of conduct be incorporated into the future of the industry? How can I make my professional practice as a Resident Engineer and Owner's Project Manager a purely enjoyable experience for myself and those I work with?

With over thirty years of working for the four main stakeholders, the designer, the owner, the owner's project manager, the general contractor / construction manager, it is safe to say that I have a unique outlook on the industry. Schooling and the degrees are an additional five and a half years which is just starting to be effective in my work. Through all this I am constantly questioning on how to improve. I constantly plan on how to develop the best work approach for clients, employers, programmers and my consulting business. The best I could come up with is software development, content creation, writing e-books, project proposals, on line products, develop courses to teach or train others to work as a Resident Engineer or an Owner's Project Manager through all phases of a design and construction project…here in lies the current question; how do I package all this that makes sense to others? Where do I begin and how do I bring the most value and above all how do we all transform together? I see the transformation-part and some of the new rules to the game but how do I maintain the patience to better the game? I need to convey the existing system so the reader can be bold enough so they too can transform, invent, create and to assist in industry evolution. I know the reader knows exactly what I am talking about because I have heard your desires to change and grow. Every question or nontransparent issue that is observed is the gateway to the industry transformation which everyone can be a part of. There is no shortage of work despite the current age of artificial intelligence or what I like to call it Automated Intelligence. The technology rolled out on the markets enhance the possibilities. So let me try to explain the existing AECO system the way I learned so we can build off that.

Introduction

When people ask me what I do for work. I would answer, "I "do" construction". This response never seemed descriptive or engaging. When I say that I work in construction, it will generally be perceived by others as working in the trades such as a carpenter, iron worker, plumber, laborer, electrician, glazier or even painter.

MAIN STAKEHOLDERS – OWNER, OWNER'S PROJECT MANAGER, DESIGNER, GENERAL CONTRACTOR OR CONSTRUCTION MANAGER, END USER

The word "management" and the different types recently popped into my mind which is a clearly much better way to describe my work. The word management gave me this idea for this book, videos, lessons, other subjects and even for business proposals and use cases. I could even revamp my web page. This comprehensive management approach can be used to write second, third and infinite editions which hopefully will make sense to others. This new professional approach is broken down into ten management categories from each main stakeholder's point of view which also gives the reader an outline of what construction management is all about through each of the main stakeholders. This book will lead with the Owner's, Facility Manager, and Owner's Project Manager point of view because they work on the project from beginning to end. The objective of this approach is to provide an impression to help the reader remember the various aspects of design and construction management, implement the practice as well as generate curiosity and questions.

The goal of this book is to describe management from all the stakeholder's point of view involved in a commercial construction project and share the one percent of management strategies that no one is talking about on line, in the meetings or on the job site. Whether your project is in the public or private sector, we will focus on commercial facility construction. Facilities such as K-12 schools, courthouses, long-term facilities, public safety facilities, higher education, municipal administrative buildings, university housing for both public and private facilities. If you have any questions on the concepts in this book, I suggest you inquire with Claude, Google or ChatGPT. The free version is all you need.

Not all designers, Construction Managers or Owner's Project Managers have worked with and directly for the facility. This information you will glean from this book will provide you a perspective that less than a fraction of the people involved in the industry is unaware. This information has the potential to bridge the communication and decision-making gap between design and construction. If you grasp these concepts, they will assist your career in being part of the rare 1% in the industry.

The 11 Types of Project Management

Facility Management

Feasibility Management

Procurement Management

Program Management

Contract Management

Design Management

Construction Management

Change Management

Move Management

Closeout Management

Public Relations Management

The subject of this book are ten types of management types for facility design and construction projects. It is important to remember, that this book is focusing on commercial design and construction with companies that are willing to play this game. I suspect there is a whole host of small contractors, subcontractors, OPMs who are not open to communication, document control, cost control and the management game simple because they are simply not aware of these levels. So, if you ever could play in this upper-echelon game, I suggest you be grateful, by learning from and working well with the team. In other words, stay in your lane and do your job to the best of your ability. If you are a manager for an employer, your work will be menial and will continue to be do until you have your own business. Even as a business owner, you need to be humble and serve your clients to the best of your ability with a positive mental attitude.

The team

The Resident Engineer typically is brought onto the project during the sixth level of management. Depending on the PDM and if there is funding and foresight, it is highly recommended bringing on a Resident Engineer, Value Engineer, Commissioning Agent, subcontractors, cost estimators and or the Construction Manager as well as variations early on during the feasibility and design phases to assist in the design management. Their reviews can be indicated in the total project schedule. Otherwise, the team is traditionally made up of a building committee and the feasibility design team.

1% ProTip

Identifying stakeholders and Supplemental Conditions.

There are a few Owners and Awarding Authorities that are so sophisticated that they have developed their own design guidelines such several Commonwealth of Massachusetts facilities, the University of Massachusetts Planning, Design and Construction as well as Smith College. These organizations have licensed architects and engineers on their staff who collect and develop standards for their campuses for various reasons. Purchasing, Contractual requirements and for efficiency are among many others. We will dive deeper later.

1% ProTip

The OPM can add this to the qualifications interview with the CM on how much knowledge they know about the facility management aspect of building.

If decisions are not acted upon in a timely fashion, hierarchies and unethical behaviors can affect macroeconomics and inhibit growth of an industry as much if not more than long lead times, so called unforeseen conditions and acts of God.

Large public construction projects are influenced by thousands of decisions made over many years by owners, designers, consultants, contractors, regulators, politicians, end users, and the public. The quality of those decisions — and whether teams operate collaboratively or in isolated "silos" — can dramatically affect project cost, schedule, public trust, long-term operations, and even regional economic conditions.

1% Pro Tip. The OPM can add this to the qualifications interview with the CM on how much knowledge they know about the facility management aspect of building. If decisions are not acted upon in a timely fashion hierarchies and behaviors can affect macroeconomics and inhibit growth of an industry as much if not more than other factors such as long lead times and acts of God. Conversely, flat hierarchies, collaboration, "inclusive design" and open communication can create the most successful project and stable economies for centuries to come.

CHAPTER 1 FEASIBILITY MANAGEMENT

The Initiation Process

The feasibility phase and feasibility management are initiated by and entity called the Owner. The Owner will become the owner of the building and property which is called an asset.

For Example, the idea for a new school building is typically initiated by a local school board and district administration in response to identified, long-term facility needs, rather than a sudden desire for a new structure. It often starts with a Statement of Interest (SOI) or a, which identifies issues with current capacity, age, or functionality.

Here is how the process is generally initiated and driven:

1. Key Triggers (The "Why") The catalyst is usually one of several, or a combination of, the following: Capacity Overload: Rapid housing growth or population influx leaves current schools overpopulated.
2. Aging Infrastructure: The cost of repairs on old buildings exceeds the cost of a new build, or the infrastructure is deemed unsafe (e.g., HVAC failure, hazardous materials).
3. Educational Advancements: Existing schools lack the specialized spaces required for modern curriculum demands, such as STEM labs, large spaces for performing arts, or adequate special education facilities. Sustainability
4. Goals: The district seeks to reduce its carbon footprint and operational costs through modern, energy-efficient construction.

Architecture and engineering (A&E) teams for school feasibility studies are hired by school districts through a structured, competitive procurement process, often starting with the selection of an Owner's Project Manager (OPM). The district issues a Request for Qualifications (RFQ) or Proposal (RFP) to solicit specialized firms, evaluating them on experience with educational projects, site analysis, and cost modeling. Key Steps in Hiring the Feasibility Team Hiring an Owner's Project Manager (OPM): For many public projects, the district first hires an OPM to lead the procurement of the designer and manage the feasibility phase. Request for Proposal (RFP/RFQ): The district issues an RFP/RFQ, which acts as a call for, or invitation to, firms to submit their qualifications and proposals. Selection Process: A selection committee evaluates firms based on specialized educational design experience, proposed project team members, and the ability to evaluate site constraints, traffic, and educational program needs. Contracting: Once a firm is selected (often via a selection panel, especially if state funding is involved), the school committee formally hires them to develop the Preliminary Design Program and Preferred Schematic Report. Hiring Sequence: Best practice often involves hiring the lead architect first, who then helps assemble or coordinate with required specialized consultants, such as civil engineers or environmental experts.

During the feasibility stage before the OPM and Designer is hired it is important to decide on the Project Delivery Method for both public and private facility projects. There are three types accepted for Massachusetts Public Sector Construction Projects and others that are highly recommended by the author of this book but the pros are not yet realized because they are not yet accepted by the Commonwealth or by Private Institutions. These three Project Delivery Methods determine which AIA documents are used for the front-end of the contract and how the schedule of values and payment requisitions will be set up. These project delivery methods as well as the Massachusetts Building code are promulgated in the Massachusetts General Laws.

Three Project Delivery Methods used in Massachusetts

Design-Bid-Build (D-B-B) M.G.L. 149

Design-Build (D-B)

Construction Management at Risk (CM@R) M.G.L. 149A

The front-end of the contract (construction documents or CDs) are the stipulations between the Owner and General Contractor (GC) or the Owner and the Construction Manager (CM).

Total Project Schedule

A Gantt Chart is one of the most important management and communication tools used in preconstruction, construction, facility development, engineering, software development, manufacturing, and operations management. It visually displays activities over time, allowing teams to understand the sequence, duration, overlap, and status of work.

Key Advantages of a Gantt Chart

1. Visualizes the Entire Project

A Gantt Chart provides a high-level and detailed visual roadmap of the project from beginning to end. Team members can quickly understand:

- Start and finish dates
- Activity durations
- Milestones
- Sequencing
- Dependencies
- Concurrent operations

This allows the Owner, OPM, A/E team, Construction Manager, subcontractors, and stakeholders to see how the project fits together as one integrated system.

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2. Improves Construction Sequencing

For construction projects, sequencing is critical. A Gantt Chart helps teams understand:

- Structural sequencing
- Procurement lead times
- Inspection requirements
- Utility coordination
- Phasing and occupancy constraints
- Temporary conditions and logistics

It becomes easier to coordinate activities such as:

- Sitework before foundations
- Foundations before steel
- Steel before enclosure
- Enclosure before interior finishes
- Ceiling installation after MEP rough-ins and inspections

This reduces trade stacking, conflicts, and inefficiencies.

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3. Identifies Critical Path Activities

A major advantage is the ability to identify the "critical path," meaning activities that directly impact the project completion date.

If a critical activity slips:

- The entire project completion may be delayed.
- Liquidated damages may occur.
- Occupancy dates may shift.
- Financing and public relations impacts may arise.

Understanding the critical path helps management focus attention and resources where they matter most.

4. Enhances Coordination Between Trades

Gantt Charts improve communication among:

- General Contractors
- Construction Managers
- Designers
- Engineers
- Subcontractors
- Vendors
- Inspectors
- Owners

Each trade can see:

- When they mobilize
- What predecessor work must be complete
- How long they have to perform their scope
- When follow-on trades arrive

This improves accountability and reduces finger-pointing.

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5. Supports Procurement and Long Lead Tracking

Many projects fail due to delayed materials rather than delayed labor.

A Gantt Chart can track:

- Shop drawing submissions
- Review durations
- Fabrication
- Shipping
- Delivery
- Installation

Examples of long-lead items:

- Switchgear
- Air handling units
- Elevators

- Curtainwall systems
- Generators
- Custom millwork
- Medical equipment

This allows procurement teams to proactively manage risk.

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6. Improves Cash Flow Planning

Owners and contractors use Gantt Charts to forecast:

- Monthly billing
- Payment requisitions
- Labor loading
- Financing draw schedules
- Retainage exposure

Public projects especially rely on accurate schedule forecasting for:

- Bond funding
- Debt exclusion planning
- Appropriations
- Fiscal-year budgeting

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7. Helps Detect Delays Early

When updated regularly, the Gantt Chart becomes an early-warning system.

Project teams can quickly identify:

- Slipping milestones
- Delayed approvals
- Labor shortages
- Weather impacts
- Design conflicts
- Inspection failures

Early detection allows corrective action before problems compound.

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8. Improves Decision-Making

Management teams can evaluate:

- Recovery strategies
- Acceleration options
- Overtime impacts
- Shift work feasibility
- Trade resequencing
- Cost vs. schedule tradeoffs

The chart allows leadership to simulate scenarios before making expensive decisions.

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9. Provides Documentation and Accountability

A well-maintained Gantt Chart creates a historical record of:

- Planned progress
- Actual progress
- Delays
- Owner impacts
- Contractor impacts
- Change order effects

This becomes important during:

- Claims analysis
- Delay disputes
- Audits
- Mediation
- Arbitration
- Legal proceedings

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10. Enhances Public and Stakeholder Communication

On public projects, schedules are often presented to:

- Building committees
- School boards
- Municipal leadership

- User agencies
- Public stakeholders
- Funding authorities

A Gantt Chart simplifies complex project information into a format non-technical stakeholders can understand.

This improves:

- Transparency
- Public trust
- Confidence in leadership
- Expectation management

Additional Strategic Advantages

Resource Management

Teams can manage:

- Workforce loading
- Equipment usage
- Crane scheduling
- Temporary power
- Inspection staffing
- Safety oversight

BIM and Digital Twin Integration

Modern scheduling systems can integrate with:

- 3D BIM models
- 4D sequencing simulations
- Reality capture
- AI-driven analytics
- Facility management systems

This helps teams visualize not only *what* is being built, but *when* and *how* it is being built.

Encourages Proactive Leadership

Without a schedule, teams often operate reactively.

A Gantt Chart encourages:

- Strategic thinking
- Forward planning
- Risk anticipation
- Interdisciplinary coordination
- Continuous monitoring

It transforms management from "putting out fires" into proactive project leadership.

Common Software Used for Gantt Charts

Some widely used platforms include:

- Oracle Primavera P6
- Microsoft Project
- Procore
- Smartsheet
- Autodesk Construction Cloud

Final Perspective

A Gantt Chart is far more than a scheduling graphic. In sophisticated construction and facility development projects, it becomes:

- A planning tool
- A coordination framework
- A risk management system
- A communication platform
- A financial forecasting tool
- A legal record
- A strategic leadership instrument

When developed correctly and updated consistently, it helps align the Owner's vision, the design intent, procurement strategy, construction sequencing, commissioning requirements, and operational turnover into one coordinated roadmap toward successful project delivery.

CHAPTER 2 PROCUREMENT MANAGEMENT

The Owner's Project Manager can assist in the development of the designer agreement because through their past experiences the OPM can guide the owner by gathering other Owner's expectations. The procurement management in essence are the development of Request for Services (RFS) and contracting with these independent contractors. Below is a list which are essential at this phase for budgeting purposes and to keep on track with the total project schedule.

Procurement Management Tasks

- Determine Project Delivery Method
- Advertising
  Stakeholder Identification
- Owner/OPM Contract Agreements
  Owner/A/E Contract Agreements
- OPM RFS
- Designer Team RFS
- Structural Peer Review RFS
- Testing and Inspections Agency RFP
- Commissioning RFP
- Cost estimating RFP
- Value engineering RFP
- Discussions on Basis of Design and Delegated Design

The Division of Capital Asset Management and Maintenance (DCAMM) and other Commonwealth of Massachusetts public agencies such as UMBA, MSCBA and MSBA use several project delivery methods authorized under:

- M.G.L. Chapter 149,
- Chapter 149A,
- Chapter 30,
- and Chapter 25A.

Each delivery method requires a different procurement strategy, risk allocation approach, and management structure. The best procurement practices focus on:

- transparency,
- fairness,
- competition,
- constructability,

- lifecycle value,
- schedule efficiency,
- and minimizing claims and change orders.

Authentic ProTip.

There are more unique project delivery methods that may suit private Owner's needs, transparency preferences, teambuilding, preferences and modernization.

- Integrated Project Delivery Method (accepted in New York and Brown University).
- Building Assist
- Design Assist
- Delegated Design – Basis of Design

Authentic Pro Tip

On Owner Agreements

The designer agreement and Owner's Project Manager needs to align with the owner's expectations.

Design Assist Project Delivery Method

The **Design-Assist Project Delivery Method** is a collaborative construction approach where key trade contractors, specialty contractors, fabricators, and suppliers are brought into the project during the design phase to assist the architect, engineers, owner, and construction manager with real-world construction expertise before final construction documents are completed.

It is often considered a "middle ground" between traditional **Design-Bid-Build** and full **Integrated Project Delivery (IPD)**.

What Occurs During Design-Assist

1. Early Team Formation

The owner selects major participants early, often including:

- Architect
- Engineers
- Owner's Project Manager (OPM)

- Construction Manager (CM)
- Mechanical contractor
- Electrical contractor
- Plumbing contractor
- Fire protection contractor
- Structural steel fabricator
- Curtain wall contractor
- Technology/AV/security vendors

These specialty contractors become part of the design conversation before bidding is finalized.

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2. Constructability Reviews

Trade partners review the evolving design documents and provide feedback on:

- Feasibility
- Sequencing
- Installation methods
- Site logistics
- Material compatibility
- Access for maintenance
- Code concerns
- Long-lead procurement risks

Example:
A ductwork contractor may advise:

- ceiling spaces are too tight,
- equipment cannot fit through access paths,
- maintenance clearances are insufficient,
- or prefabrication opportunities exist.

This reduces redesign later.

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3. Clash Detection & Coordination

One of the biggest advantages.

Using BIM/VDC platforms such as:

- Autodesk Revit
- Navisworks
- BIM 360

the team performs:

- 3D coordination
- clash detection
- system routing reviews
- spatial validation

This identifies conflicts before construction.

Examples:

- duct hitting steel,
- sprinkler piping conflicting with lighting,
- insufficient plenum depth,
- inaccessible valves,
- overcrowded risers.

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4. Cost Estimating During Design

Trade contractors continuously price:

- systems,
- materials,
- alternates,
- value engineering options,
- escalation risks.

This creates:

- real-time budgeting,
- early GMP development,
- reduced bid surprises,
- and fewer overruns.

Instead of pricing at the end, pricing evolves with the design.

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5. Value Engineering (VE)

The team studies ways to improve:

- cost,
- constructability,
- durability,
- maintenance,
- schedule,
- energy performance.

Examples:

- prefabricated bathroom pods,
- alternate structural systems,
- modular MEP racks,
- alternate façade systems,
- equipment substitutions,
- sequencing changes.

Good Design-Assist VE focuses on lifecycle value — not simply reducing first cost.

---

6. Schedule Development

The construction manager and trades help build:

- milestone schedules,
- phasing plans,
- logistics plans,
- procurement schedules,
- shutdown schedules,
- occupancy sequencing.

Long-lead items are identified early:

- switchgear,

- generators,
- elevators,
- air handlers,
- transformers,
- curtain wall systems.

This helps avoid delays.

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7. Prefabrication & Modularization Planning

Trade contractors identify opportunities for:

- off-site fabrication,
- modular assembly,
- pre-tested systems,
- rack assemblies,
- corridor modules.

Benefits:

- improved quality,
- faster installation,
- reduced labor congestion,
- safer work environments,
- fewer field conflicts.

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8. Procurement Assistance

Design-Assist teams often help:

- evaluate manufacturers,
- compare lead times,
- review substitutions,
- assess supply chain risks,
- recommend equivalent systems.

This became especially important after COVID-era supply chain disruptions.

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9. Risk Reduction

The method reduces:

- RFIs,
- change orders,
- claims,
- redesign,
- schedule conflicts,
- coordination failures.

It also improves:

- transparency,
- communication,
- accountability.

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10. Transition Into Construction

After design progresses sufficiently:

- trade packages may convert into GMP contracts,
- subcontractors may become awarded builders,
- coordinated BIM models become construction models,
- fabrication can begin earlier.

Some projects:

- competitively bid after assist,
- while others use qualifications-based selection.

Common Project Types Using Design-Assist

Design-Assist is extremely effective for:

- Hospitals

- Laboratories
- High-rise buildings
- Data centers
- Universities
- Airports
- Complex renovations
- Mission critical facilities
- Large public buildings
- Central utility plants

These projects benefit from heavy MEP coordination.

Advantages

Major Benefits

- Reduced change orders
- Better coordination
- Earlier cost certainty
- Faster schedules
- Better constructability
- Improved quality
- Reduced claims
- Better owner involvement
- Improved transparency
- Better lifecycle decisions

Potential Challenges

Risks if Poorly Managed

- Scope overlap confusion
- Premature contractor influence
- Design liability concerns
- Incomplete documentation
- Uneven participation
- Proprietary system bias
- Reduced competitive tension

A strong OPM and clear contracts are critical.

Typical Design-Assist Workflow

Owner Defines Project Goals

↓

Designer Selected

↓

CM/OPM Selected

↓

Key Trades Selected Early

↓

Collaborative Design Phase

↓

BIM Coordination / Clash Detection

↓

Constructability & Cost Reviews

↓

Value Engineering

↓

Progressive Estimating

↓

Final Documents

↓

Construction / GMP

↓

Fabrication & Installation

Difference Between Design-Assist and Design-Build

Design-Assist

- Architect typically works directly for owner.
- Contractors advise during design.
- Design responsibility stays with designer.
- More collaborative than Design-Bid-Build.

Design-Build

- Single entity responsible for both design and construction.
- Contractor leads the team.
- Greater transfer of risk to design-builder.

Difference Between Design-Assist and IPD

Integrated Project Delivery (IPD)

Usually includes:

- shared risk/reward,
- multi-party agreements,
- deeper financial integration,
- joint decision-making.

Design-Assist

- collaboration focused,
- but contracts remain more traditional.

Primary Project Delivery Methods Used in Massachusetts

Delivery Method	Massachusetts Statute	Common Use
Design-Bid-Build (DBB)	Chapter 149	Traditional public construction
Construction Manager at Risk (CMAR)	Chapter 149A	Complex vertical projects
Design-Build (DB)	Chapter 149A / Special Legislation	Fast-track and infrastructure
Energy / Decarbonization Design-Build	Chapter 25A	Energy upgrades
Horizontal Construction	Chapter 30	Civil/infrastructure projects

1. Design-Bid-Build (DBB) Procurement Best Practices

Design-Bid-Build remains the traditional Massachusetts public procurement model.

Under DBB:

1. Design is completed first.
2. The project is publicly bid.
3. The lowest eligible and responsible bidder is selected.

Best Procurement Practices for DBB

A. Complete and Coordinated Construction Documents

The single most important procurement strategy in DBB is:

“Bid complete documents.”

Incomplete documents create:

- RFIs,
- change orders,

- claims,
- and bid gaps.

B. Extensive Design Reviews Before Bidding

Massachusetts public projects often benefit from reviews at:

- Concept,
- Schematic Design,
- Design Development,
- 50% CD,
- and 95–100% CD.

Best practice includes:

- owner reviews,
- OPM reviews,
- constructability reviews,
- facility operations reviews,
- and independent cost estimating.

C. Prequalification of Filed Subcontractors

Massachusetts Chapter 149 procurement includes:
Filed Subcontractor requirements.

Best practices include:

- reviewing DCAMM certifications,
- evaluating subcontractor capacity,
- checking safety records,
- and validating relevant project experience.

D. Uniformat Cost Reconciliation Before Bid

Best practice is to reconcile:

- design estimates,
- escalation assumptions,
- alternates,
- and contingencies before bidding.

This helps avoid:

- budget overruns,
- redesign,
- and rebidding.

E. Early Existing Conditions Investigation

Many public change orders originate from:

- hidden utilities,
- hazardous materials,
- undocumented conditions,
- and poor existing-condition documentation.

Best practice includes:

- laser scanning,
- exploratory demolition,
- utility mapping,
- and subsurface investigation.

DBB Procurement Strengths

Strength	Benefit
Competitive bidding	Transparent pricing
Clear legal structure	Well-understood process
Strong owner design control	Detailed design oversight
Public accountability	Open procurement

DBB Procurement Risks

Risk	Mitigation
Contractor not involved during design	Conduct constructability reviews
Higher change order exposure	Improve coordination
Longer schedules	Early planning
Bid gaps	Better document quality

2. CM at Risk (CMAR) Procurement Best Practices

Construction Manager at Risk (CMAR) is heavily used in Massachusetts for large and complex vertical projects over $5 million.

Under CMAR:

- the CM is hired early,
- provides preconstruction services,
- then becomes the general contractor under a:
  Guaranteed Maximum Price (GMP).

Best Procurement Practices for CMAR

A. Hire the CM Early (Preferably During SD)

One of the best Massachusetts CMAR practices is:

Early CM involvement during schematic design.

This allows:

- constructability reviews
- logistics planning
- sequencing input,
- cost modeling,
- and trade coordination early.

B. Qualifications-Based Selection

Massachusetts CMAR procurement uses a:

- two-phase RFQ/RFP process.

Best practices evaluate:

- team experience,
- healthcare/lab/high-rise experience,
- BIM capability,
- Lean experience,
- safety record,
- staffing,
- and past performance.

C. Open Book Estimating

Elite CMAR projects use:

"Transparent open-book procurement."

This includes:

- detailed estimate breakdowns,
- subcontractor bid tabulations,
- contingency tracking,
- and shared escalation assumptions.

D. Early Trade Partner Procurement

Best practice includes bringing in:

- mechanical,
- electrical,
- plumbing,
- facade,
- steel,
- and fire protection trades early.

This reduces:

- coordination conflicts,
- schedule risk,
- and procurement delays.

E. BIM and Clash Detection Requirements

DCAMM strongly supports BIM and Lean integration for complex projects.

Best procurement practice requires:

- BIM execution plans,
- clash detection meetings,

- model coordination standards,
- and digital turnover requirements.

F. GMP Validation

Before establishing the GMP:

- reconcile estimates,
- review allowances,
- validate contingencies,
- and confirm scope completeness.

CMAR Strengths

Strength	Benefit
Early contractor involvement	Better constructability
Faster delivery	Overlapping phases
Collaborative procurement	Reduced claims
GMP structure	Budget predictability

CMAR Risks

Risk	Mitigation
Scope creep	Strict change management
Reduced competitive pressure	Transparent buyout
Incomplete design at GMP	Detailed reconciliation
Poor owner engagement	Strong OPM leadership

3. Design-Build Procurement Best Practices

Design-Build combines:

- design,
- engineering,
- and construction
  under one contract.

Massachusetts uses DB selectively for:

- infrastructure,
- transportation,
- and fast-track projects.

Best Procurement Practices for Design-Build

A. Develop Clear Owner Performance Criteria

The owner must clearly define:

- operational requirements,
- performance standards,
- technical criteria,
- and quality expectations.

Poor bridging documents create major risk.

B. Best-Value Procurement

Best practice evaluates:

- technical approach,
- staffing,
- schedule,
- innovation,
- lifecycle cost,
- and qualifications —
  not just price.

C. Bridging Documents

Many successful DB projects use:
Bridging Documents

These establish:

- minimum standards,
- basis of design,
- operational requirements,
- and owner expectations.

D. Progressive Design Reviews

Even in DB, the owner should require:

- SD,

- DD,
- and CD reviews.

This protects:

- quality,
- maintainability,
- and operational functionality.

E. Operational Stakeholder Reviews

Because the contractor controls design,
owners must ensure:

- facility managers,
- maintenance teams,
- security,
- IT,
- and end users
  remain engaged throughout design.

Design-Build Strengths

Strength	Benefit
Fast delivery	Overlapping design/construction
Single-point responsibility	Reduced disputes
Innovation	Contractor-driven solutions
Fewer redesign cycles	Integrated execution

Design-Build Risks

Risk	Mitigation
Reduced owner control	Strong bridging documents
Quality drift	Detailed review process
Performance gaps	Clear specifications
Operational oversights	Strong user engagement

4. Energy / Decarbonization Procurement (Chapter 25A)

Energy Design-Build projects focus on:

- energy savings,
- sustainability,
- decarbonization,
- and operational efficiency.

Best Practices

Performance-Based Procurement

Select teams based on:

- energy modeling,
- technical capability,
- and long-term operational performance.

Lifecycle Cost Analysis

Evaluate:

- energy savings,
- maintenance costs,
- and payback periods —
  not just first cost.

Commissioning Requirements

Require enhanced:

- commissioning,
- TAB,
- controls integration,
- and measurement & verification.

Best Procurement Practices Across ALL Massachusetts Delivery Methods

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1. Early OPM Involvement

The best Commonwealth projects involve:
Owner's Project Manager teams early.

Strong OPM leadership improves:

- decision-making,
- scope control,
- and procurement coordination.

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2. Early Stakeholder Engagement

Include:

- maintenance,
- janitorial,
- security,
- IT,
- facility operations,
- and end users early.

This significantly reduces late changes.

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3. Lean and BIM Integration

DCAMM strongly encourages:

- Lean planning,
- BIM coordination,
- digital collaboration,
- and lifecycle asset integration.

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4. Constructability Reviews

The best projects require:

- phased constructability reviews,
- trade participation,
- logistics reviews,
- and sequencing analysis.

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5. Transparent Change Management

Elite projects maintain:

- live change logs,
- contingency tracking,
- trend forecasting,
- and open reconciliation processes.

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6. Procurement Packaging Strategy

Best practice involves strategic:

- bid package sequencing,
- early release packages,
- long-lead procurement,
- and phased permitting.

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7. Digital Turnover Requirements

Modern Massachusetts public projects increasingly require:

- BIM turnover,
- digital asset tagging,
- O&M integration,
- and lifecycle-ready facility data.

Emerging Massachusetts Procurement Trends

Massachusetts agencies are increasingly moving toward:

- collaborative delivery methods
- early contractor involvement
- BIM-based coordination
- Lean construction
- prefabrication
- and lifecycle-focused procurement strategies.

Best Overall Procurement Philosophy

The most successful Commonwealth projects treat procurement as:

"A lifecycle risk-management and collaboration strategy — not simply a bidding process."

That mindset helps produce:

- better buildings,
- fewer change orders
- stronger cost control
- improved constructability
- and better long-term operational performance.

CHAPTER 3 PROGRAM MANAGEMENT

PROGRAM management Team

A PROGRAM Management Team serves as the strategic leadership and coordination body that aligns the Owner's long-term vision, operational goals, financial objectives, stakeholder interests, and project delivery execution into a unified framework. Unlike a traditional project management team focused primarily on schedule, cost, and construction administration, a PROGRAM Management Team operates at a much broader systems-thinking level. Their responsibility is to ensure that every planning, design, engineering, procurement, and construction decision supports the Owner's mission, operational functionality, sustainability goals, and long-term return on investment.

In the earliest stages of planning, the PROGRAM Management Team would guide the Owner, Building Committee, User Groups, and Stakeholders through the development of comprehensive Design Criteria. This becomes the foundational "Basis of Design" document that informs all future decision-making. For example, in a school project, the team would help establish projected enrollment growth, educational programming requirements, classroom utilization models, technology integration needs, security standards, transportation logistics, food service demands, athletic requirements, and future expansion capabilities. In a healthcare facility, the team would analyze projected population growth, patient acuity trends, staffing requirements, workflow efficiencies, infection control standards, specialized treatment spaces, and adaptability for evolving medical technologies. For affordable housing developments, the team would evaluate demographic trends, accessibility requirements, community integration, lifecycle maintenance costs, energy efficiency targets, social impact objectives, and long-term operational affordability.

The PROGRAM Management Team would also perform extensive data collection and forecasting to validate that the facility size, infrastructure systems, and operational models support future demand rather than only current conditions. This includes coordinating feasibility studies, demographic analysis, traffic studies, utility assessments, environmental reviews, economic modeling, and lifecycle cost analysis. Their role is to prevent underbuilding, overbuilding, or designing facilities that become functionally obsolete prematurely.

An essential responsibility of the PROGRAM Management Team is continuously revisiting and validating the Project Charter throughout the life of the program. The Project Charter serves as the governing strategic document defining the project's mission, purpose, authority structure, financial constraints, stakeholder expectations, success metrics, and guiding philosophy. As projects evolve, scope pressures, budget limitations, political influences, and stakeholder conflicts can gradually pull the project away from its original intent. The PROGRAM Management Team acts as the steward of the charter, ensuring that all decisions remain aligned with the Owner's core vision and approved objectives.

The team would facilitate recurring strategic workshops, Charrettes, critical path and milestone reviews with the Owner and stakeholders to reassess whether the project remains aligned with established Goals and Objectives. Goals may include operational efficiency, sustainability targets, public image, occupant wellness, educational outcomes, community impact, affordability, resiliency, or economic development initiatives. Objectives would convert these broader goals into measurable deliverables such as energy use intensity targets, occupancy capacities, budget thresholds, schedule milestones, carbon reduction goals, or patient throughput efficiencies.

Design Principles are another critical component managed by the PROGRAM Management Team. These principles serve as the philosophical and operational framework guiding architects, engineers, consultants, and constructors. Examples may include flexibility and adaptability, human-centered design, biophilic integration, daylight optimization, universal accessibility, adaptive reuse, durability, maintainability, low operational cost, resilience, code requirements or community connectivity. By clearly defining these principles early, the PROGRAM Management Team ensures that all disciplines are designing toward a common vision rather than operating independently in fragmented silos.

A highly advanced PROGRAM Management Team would also establish and maintain a Design Decision Repository. This repository functions as a centralized institutional memory documenting why major decisions were made, what alternatives were considered, who approved them, associated risks, lifecycle implications, cost impacts, and supporting data. This becomes invaluable during long-duration projects where personnel turnover occurs or when disputes arise regarding previous approvals. Instead of relying on fragmented meeting minutes or individual recollections, the repository provides a transparent decision-making history that improves accountability and continuity.

Similarly, the PROGRAM Management Team would maintain an Owner's Wants and Needs Repository. This living database captures operational preferences, stakeholder concerns, functional requirements, lessons learned, future aspirations, and user feedback throughout planning and execution. Often, Owners communicate important operational insights informally during workshops, walkthroughs, or meetings that may otherwise become lost during the technical progression of design documents. The repository ensures that these insights are preserved, categorized, prioritized, and incorporated into the evolving design and construction process.

From a leadership perspective, the PROGRAM Management Team acts as the integrator between executive vision and technical execution. They bridge communication gaps between the Owner, finance teams, user groups, architects, engineers, contractors, code officials, commissioning authorities, and facility operators. Their role is not simply managing tasks, but orchestrating alignment between human needs, economics, infrastructure, sustainability, operational performance, and long-term societal value.

On large public or institutional projects, effective PROGRAM Management can significantly reduce costly redesigns, change orders, operational inefficiencies, and stakeholder conflicts by ensuring that the project remains rooted in clearly documented goals, measurable performance criteria, and transparent decision-making processes from concept through occupancy and facility operations.

Ultimately, a sophisticated PROGRAM Management Team transforms a construction project from merely “building a facility” into creating a high-performing, future-oriented operational ecosystem designed to deliver measurable value to occupants, owners, and the broader community for decades.

What is programming?

Programming in facility design is the **planning and information-gathering phase** that happens before actual design begins. It defines **what the building or facility must do, who will use it, how spaces should function, and what requirements the design team must satisfy**.

In architecture, engineering, and construction, “programming” does **not** mean computer coding. It means developing a **facility program** or **building program**.

A facility programming process typically answers questions like:

- What is the purpose of the facility?
- How many people will use it?
- What departments or functions are needed?
- How much space is required?
- What equipment or systems are needed?
- What are the operational workflows?
- What are the safety, accessibility, and code requirements?
- What is the budget and schedule?

- What are the owner's long-term goals?

For example, if a hospital is being planned, programming would determine:

- Number of patient rooms
- Operating room requirements
- Nurse station locations
- Adjacency needs between departments
- Medical equipment needs
- Future expansion capability

In a school project, programming may include:

- Number of classrooms
- STEM labs
- Security requirements
- Student circulation patterns
- Gymnasium and cafeteria capacities

The programming phase often includes:

- Interviews with stakeholders
- Surveys and workshops
- Existing condition analysis
- Space needs assessments
- Operational workflow studies
- Adjacency diagrams ("bubble diagrams")
- Preliminary budgets and schedules

Common deliverables include:

- A written Program Report
- Space Program tables
- Area calculations
- Functional relationship diagrams
- Performance criteria
- Project goals, objectives and priorities
- Presentations
- Response to Request for Information (RRFI) during design reviews

Redundancy between the Owner / OPM and Owner/Designer agreement a complimentary. The designer will provide the deliverables and the OPM will manage the designer.

Programming is extremely important because many project problems originate from:

- unclear owner expectations
- missing operational input
- poor stakeholder coordination
- or incomplete understanding of facility operations

Strong programming can:

- reduce change orders
- improve constructability
- support better user experience
- improve lifecycle operations,
- and reduce costly redesign later in the project.

Programming is becoming more collaborative by involving:

- architects
- engineers
- facility managers
- contractors
- subcontractors
- maintenance staff
- and end users earlier in the process

This early collaboration helps align:

- design intent
- operations
- budget
- schedule
- and constructability before drawings are fully developed

CHAPTER 4 CONTRACT MANAGEMENT / DEVELOPMENT

Contract Management / Development

Contract Management and Contract Development are among the most important functions in the successful delivery of a capital construction project. The contract documents establish the legal, financial, administrative, and technical framework that governs the relationship between the Owner, Designer, Contractor, Construction Manager, consultants, and third-party vendors throughout the life of the project. Well-developed agreements help reduce disputes, clarify expectations, allocate risk appropriately, establish accountability, and ensure compliance with public procurement laws and funding requirements.

On large municipal, state, or institutional projects, contract development is rarely performed by one individual. Instead, it is developed collaboratively by a team consisting of the Owner's legal department, procurement officials, Owner's project representatives, the Owner's Project Manager (OPM), finance personnel, risk managers, and often external legal counsel or consultants specializing in construction law and public procurement.

Contract Development Team

The legal department plays a central role in developing and reviewing agreements. Legal counsel ensures that the contract language complies with applicable laws, procurement statutes, labor regulations, insurance requirements, indemnification standards, and risk management objectives. Legal teams also review dispute resolution procedures, termination clauses, liquidated damages provisions, delegated design responsibilities, intellectual property rights, audit language, and compliance requirements associated with public funding sources.

Procurement personnel are responsible for ensuring the procurement process complies with state and municipal regulations, including advertisement requirements, bidder qualifications, prequalification procedures, minority and disadvantaged business participation goals, public bid openings, and award procedures. Procurement teams help structure the Request for Services (RFS), Request for Qualifications (RFQ), Request for Proposals (RFP), or Invitation for Bids (IFB) in accordance with the chosen Project Delivery Method.

The Owner's point person or internal project representative acts as the operational liaison between the institution and the project team. This individual communicates the Owner's goals, operational concerns, facility standards, user expectations, maintenance considerations, sustainability objectives, and long-term operational needs. They ensure the contract reflects the practical expectations of the organization that will ultimately occupy, maintain, and operate the facility.

The OPM assists in coordinating all contract development activities and typically serves as the technical advisor to the Owner throughout procurement, design, and construction. The OPM often helps draft scopes of work, establish deliverable requirements, define review procedures, recommend contract language based on lessons learned, and align project controls with contractual obligations. OPMs also assist in developing schedules for submissions, cost control procedures, change management protocols, payment requisition procedures, and document control standards.

Incorporating the Owner’s Expectations into the RFS and Agreements

One of the primary objectives of contract development is translating the Owner’s expectations into enforceable contractual requirements. This process begins during development of the RFS or procurement documents. The selected Project Delivery Method significantly influences how responsibilities, risks, and expectations are allocated among the parties.

For example:

- In a traditional Design-Bid-Build delivery method, the Owner contracts separately with the Designer and General Contractor.
- In Construction Manager at Risk (CM at Risk), the Construction Manager may provide preconstruction services and collaborate during design.
- In Design-Build delivery, design and construction responsibilities are integrated under one entity.
- In Design-Assist approaches, trade contractors contribute technical expertise during design development.

The RFS and subsequent agreements may include:

- Design standards and performance criteria
- Sustainability and energy-efficiency goals
- BIM and digital coordination requirements
- Review and approval milestones
- Schedule expectations and milestone dates
- Cost estimating and value engineering requirements
- Constructability review obligations
- Life-cycle cost analysis requirements
- Quality assurance and quality control procedures
- Commissioning requirements
- User group coordination responsibilities
- Public communication and stakeholder engagement procedures

The Owner may also require specific review services by the A/E team and OPM, including:

- Drawing and specification reviews
- Cost estimate validation
- Constructability analysis
- Schedule analysis
- Code compliance reviews
- Phasing and logistics evaluations
- FF&E coordination
- Permit tracking
- Risk assessment reporting
- Claims analysis support

Audit Requirements, Insurance, Certifications, and Licenses

Public construction contracts frequently contain extensive audit and compliance requirements. Contractors, consultants, and subcontractors may be required to maintain records for several years after project completion and provide access to financial records upon request by the Owner, auditors, or state oversight agencies. These provisions are especially important for publicly funded projects subject to state reimbursement or federal grant requirements.

Insurance requirements are also carefully structured to protect the Owner and manage project risk. Typical requirements may include:

- General Liability Insurance
- Professional Liability Insurance
- Workers' Compensation
- Builder's Risk Insurance
- Automobile Liability
- Umbrella or Excess Liability coverage
- Pollution Liability where applicable

Contracts may also require specific business certifications and licensing requirements, including:

- DCAMM certification
- Minority Business Enterprise (MBE) participation
- Women Business Enterprise (WBE) participation
- Service-Disabled Veteran-Owned Business certifications
- Trade licenses
- Professional registrations
- OSHA training certifications
- Surety bonding capacity

These requirements are typically verified during procurement and monitored throughout the duration of the project.

Approval Thresholds and Procurement Requirements under Chapter 149 and 149A

Massachusetts public construction procurement laws under Massachusetts General Laws Chapter 149 and Massachusetts General Laws Chapter 149A establish strict procurement procedures and financial thresholds intended to protect public funds and ensure fair competition.

Chapter 149 generally governs traditional public building construction procurement, while Chapter 149A governs Construction Manager at Risk delivery methods for eligible public projects.

One critical concept associated with these statutes is the prohibition against "bid stacking." Bid stacking occurs when a project is intentionally divided into smaller contracts, or excessive change orders are issued, to circumvent statutory bidding thresholds or avoid public procurement requirements. This practice undermines fair competition and can expose municipalities and public agencies to legal challenges, audit findings, and potential violations of procurement law.

To prevent this, contracts typically establish approval thresholds and controls for:

- Change orders
- Contingency usage
- Allowance expenditures
- Scope modifications
- Time extensions
- Contract amendments

Once cumulative changes exceed certain thresholds, additional approvals may be required from municipal boards, procurement officials, legal counsel, or funding authorities.

Municipal Warrants and Approval Processes

Municipal projects, particularly school projects and large public facilities, often require formal approvals through municipal warrant processes. Payment requisitions, contract amendments, appropriation transfers, and change orders may require review and authorization by:

- School Committees
- Town Meetings
- City Councils

- Select Boards
- Finance Committees
- Building Committees

These public approval processes help maintain transparency and accountability for taxpayer-funded projects. For example, payment requisitions are often reviewed by the OPM and Designer before certification by the Owner. The requisition may then be routed through municipal accounting departments and ultimately approved through warrant authorization before payment is released.

Similarly, contract amendments involving additional funding or scope modifications may require public votes or formal authorization depending on the value and funding source of the change.

Role of Legal, OPM, and Owner's Representative During Construction

Contract management continues long after agreements are executed. During construction, the legal department may become involved in:

- Claims management
- Contract interpretation
- Dispute resolution
- Default proceedings
- Insurance disputes
- Delay claims
- Mediation or litigation support

The OPM plays a daily role in administering the contract by tracking compliance, reviewing schedules, evaluating change requests, coordinating communications, monitoring risk, reviewing payment applications, and documenting project activities. The OPM also assists the Owner in maintaining consistency between the contract requirements and actual project execution.

The Owner's point person remains essential throughout the project by coordinating user input, operational concerns, occupancy planning, budget considerations, and institutional priorities. This individual often becomes the bridge between executive leadership, end users, consultants, and contractors.

Ultimately, successful contract development and management establish the foundation for effective project execution. Clear agreements, collaborative communication, regulatory compliance, and disciplined contract administration help public and private Owners deliver projects that meet budget, schedule, operational, and long-term performance objectives.

General Contractor / Construction Manager Responsibilities in Capital Construction

The role of the General Contractor (GC) or Construction Manager (CM) has evolved far beyond simply "building the project." On modern public and private construction programs, the GC/CM becomes the operational leader responsible for transforming the design documents, owner expectations, budget constraints, procurement requirements, safety obligations, and construction sequencing into a coordinated and constructible reality. The contractor becomes the central hub connecting the Owner, Architect/Engineer (A/E), consultants, subcontractors, suppliers, testing agencies, commissioning authorities, permitting officials, and end users.

In both traditional Design-Bid-Build and collaborative delivery methods such as CM at Risk (CM@Risk), Design-Assist, and Integrated Project Delivery (IPD), the contractor's effectiveness often determines whether a project succeeds or struggles.

Contract Administration

One of the primary responsibilities of the GC/CM is contract administration. This involves managing and enforcing the requirements of the prime contract, subcontract agreements, specifications, general conditions, supplementary conditions, and regulatory obligations.

The contractor must understand:

- Scope requirements
- Milestone dates
- Insurance requirements
- Safety obligations
- Labor compliance
- Quality standards
- Allowances and contingencies
- Change order procedures
- Payment procedures
- Reporting requirements
- Audit requirements
- Closeout obligations

A sophisticated contractor develops internal management systems to ensure all contractual requirements flow down properly to subcontractors and suppliers. This is critical because subcontractors often perform the majority of the physical work on large projects.

The GC/CM must ensure that subcontractors receive the complete contract documentation — not merely isolated specification sections. Many coordination failures occur when subcontractors only review their trade specifications and fail to understand:

- General conditions
- Temporary protection requirements
- Logistics limitations
- Working hour restrictions
- BIM coordination obligations
- Testing and inspection requirements
- Minority participation goals
- Safety standards
- Cleaning responsibilities
- Punch list obligations
- Commissioning support requirements

Providing complete transparency in the contract documents reduces claims, scope gaps, and adversarial relationships.

Construction Scheduling

The construction schedule becomes one of the most important management tools on the project. The GC/CM develops, updates, monitors, and communicates the master schedule throughout the life of the project.

The schedule typically includes:

- Procurement durations
- Long-lead material tracking
- Design deliverables
- Permitting milestones
- Utility coordination
- Phased turnover requirements
- Inspection durations
- Testing activities
- Commissioning activities
- Owner occupancy milestones
- Furniture, Furnishings & Equipment (FF&E) installation
- Seasonal constraints
- Weather impacts
- Substantial completion and final completion dates

An experienced contractor understands that scheduling is not merely software manipulation. It requires understanding:

- Means and methods
- Labor productivity
- Trade stacking limitations
- Site logistics
- Sequencing dependencies
- Supply chain risks
- Workforce availability
- Inspection hold points
- Safety constraints

The best schedulers mentally construct the building in four dimensions — visualizing not only the 3D assembly of the building systems, but also the time-based sequence of installation.

The schedule also becomes a communication tool between all stakeholders. Weekly look-ahead schedules, pull-planning sessions, milestone recovery plans, and subcontractor coordination meetings help maintain alignment and accountability.

Bid Leveling and Procurement

During procurement, the GC/CM performs bid solicitation, bid leveling, and subcontractor evaluations.

Bid leveling involves comparing subcontractor proposals to ensure:

- Scope completeness
- Specification compliance
- Inclusion of alternates
- Clarification of exclusions
- Labor assumptions
- Escalation assumptions
- Unit pricing
- Schedule durations
- Staffing levels
- Material inclusions
- Temporary work responsibilities

A low number does not necessarily represent the best value. Contractors must evaluate whether subcontractors:

- Understand the project
- Possess sufficient manpower
- Have experience with similar projects
- Maintain financial stability
- Can support aggressive schedules
- Have strong safety records
- Can participate effectively in BIM coordination and collaborative planning

Bid leveling becomes especially important in CM@Risk delivery because early trade procurement often occurs while portions of the design are still evolving. Thorough scoping sessions help prevent scope gaps and future disputes.

Scoping Sessions and Scope Validation

Scoping sessions are among the most important preconstruction activities.

These meetings allow the GC/CM and subcontractors to review:

- Included scope
- Excluded scope
- Delegated design responsibilities
- Temporary protection
- Firestopping
- Hoisting responsibilities
- Access requirements
- BIM participation
- Layout requirements
- Testing support
- Startup requirements
- Overtime assumptions
- Warranty obligations
- Coordination drawings
- Material lead times

For CM@Risk projects, this process is critical because early Guaranteed Maximum Price (GMP) packages may contain evolving design details. Without detailed scope validation, multiple trades may assume another contractor is carrying specific responsibilities.

Effective scoping reduces:

- Change orders

- Claims
- Coordination conflicts
- Delays
- Finger-pointing between trades

Coordination and Trade Management

The GC/CM coordinates all trades and disciplines to ensure systems fit spatially and operationally.

Coordination responsibilities include:

- Structural coordination
- Mechanical/electrical/plumbing (MEP) coordination
- Ceiling coordination
- Equipment clearances
- Shaft coordination
- Utility routing
- Access panel verification
- Fire protection coordination
- Acoustical ceiling coordination
- Above-ceiling congestion analysis

Modern projects increasingly rely on BIM coordination; however, experienced field teams still mentally visualize constructability beyond what software may reveal.

For example, reflected ceiling plans may not fully communicate:

- Ceiling depth transitions
- Access requirements above ceilings
- Actual duct elevations
- Structural conflicts
- Hanger spacing
- Equipment maintenance clearances

The contractor often becomes the practical interpreter between the digital model and physical construction reality.

Payment Requisitions and Financial Controls

The GC/CM manages monthly payment requisitions and financial reporting processes.

Payment applications generally require:

- Schedule of values updates
- Percent complete verification
- Stored material documentation
- Conditional and unconditional lien waivers
- Certified payroll submissions
- Minority participation reporting
- Insurance verification
- Change order tracking
- Contingency reporting
- Cost-to-complete forecasting

For public projects, especially under Massachusetts public procurement laws such as Chapter 149 and Chapter 149A, contractors must comply with prevailing wage laws and certified payroll reporting requirements.

The contractor also tracks:

- Retainage
- Allowance usage
- Cash flow projections
- Pending change orders
- Claims exposure
- Labor productivity trends

Financial transparency is critical to maintaining owner trust and lender confidence.

Certified Payroll, Labor Compliance, and Workforce Participation

Publicly funded projects often require strict labor compliance procedures.

The GC/CM monitors:

- Certified payroll submissions
- Prevailing wage compliance
- Apprenticeship participation

- Workforce diversity participation
- Minority Business Enterprise (MBE) goals
- Women Business Enterprise (WBE) goals
- Veteran business participation
- Local hiring requirements

The contractor must verify subcontractor compliance and maintain auditable records for owner agencies and regulatory authorities.

Strong contractors proactively support workforce participation goals by:

- Outreach to diverse subcontractors
- Early procurement notifications
- Mentorship opportunities
- Workforce development partnerships
- Trade training initiatives

These goals are not simply administrative requirements; they contribute to expanding economic opportunity within the construction industry.

Insurance and Risk Management

The GC/CM manages project risk through insurance compliance and safety oversight.

Requirements may include:

- General liability insurance
- Builder's risk insurance
- Professional liability coverage
- Workers compensation
- Umbrella policies
- Pollution liability
- Railroad protective liability
- Owner-controlled insurance programs (OCIPs)
- Contractor-controlled insurance programs (CCIPs)

The contractor must ensure all subcontractors maintain proper coverage throughout the project duration.

Risk management also includes:

- Site safety planning
- Emergency response procedures
- Hazard communication
- Fall protection
- Utility protection
- Public protection measures
- Environmental controls

Permitting and Regulatory Coordination

Construction cannot proceed without permits, inspections, and regulatory approvals.

The GC/CM coordinates:

- Building permits
- Trade permits
- Utility permits
- Fire department approvals
- Elevator inspections
- Environmental permits
- Street occupancy permits
- Crane permits
- Health department approvals
- Temporary occupancy permits

The contractor must also coordinate inspection sequencing to avoid delays that impact the critical path schedule.

Document Control and Information Management

Modern projects generate enormous volumes of information.

The GC/CM manages:

- Requests for Information (RFIs)
- Submittals
- Shop drawings
- Meeting minutes
- ASIs
- Bulletins

- Change directives
- Daily reports
- Progress photos
- Inspection reports
- Commissioning documentation
- Closeout manuals

Document control systems become essential to maintaining accountability and historical project records.

Accurate documentation protects all parties and provides clarity when disputes or scope questions arise.

Resource Verification and Availability

One of the most overlooked responsibilities of the GC/CM is verifying whether labor, equipment, and materials are actually available to execute the work.

The contractor must evaluate:

- Trade manpower availability
- Union labor conditions
- Fabrication capacity
- Material lead times
- Equipment availability
- Crane scheduling
- Specialized installer availability
- Startup technician scheduling
- Seasonal workforce fluctuations

A project schedule is only realistic if the resources exist to support it.

Many project failures occur not because of poor design, but because the industry overcommits limited skilled labor and supply chain capacity.

Conclusion

The General Contractor and Construction Manager serve as the integrators of construction reality. They bridge the gap between design intent, owner expectations, regulatory compliance, trade coordination, financial management, and physical execution.

The best contractors combine:

- Technical expertise
- Communication skills
- Leadership
- Scheduling intelligence
- Financial discipline
- Constructability knowledge
- Risk awareness
- Collaborative problem-solving

As construction projects become increasingly complex, technology-driven, and schedule-sensitive, the GC/CM role continues evolving into a highly sophisticated management profession requiring both macro-level strategic thinking and micro-level technical awareness.

CHAPTER 5 DESIGN MANAGEMENT

Facility Design Management is the **structured process of planning, coordinating, reviewing, controlling, and guiding the design of a facility** from early concept through construction documents and construction administration to ensure the project meets the owner's:

- operational goals,
- budget,
- schedule,
- quality expectations,
- code requirements,
- and long-term lifecycle needs.

It acts as the bridge between:

- the owner,
- designers,
- engineers,
- construction managers,
- contractors,
- facility operators,
- and stakeholders.

Facility design management is especially important on:

- healthcare projects,
- higher education facilities,
- laboratories,
- public buildings,
- high-rise buildings,
- infrastructure projects,
- and technically complex facilities.

Core Responsibilities of Facility Design Management

A Facility Design Manager or Owner's Project Manager typically oversees:

Strategic Planning

- Owner goals and vision
- Facility programming
- Budget development
- Schedule management
- Risk identification

Design Coordination

- Architectural coordination
- MEP/FP systems coordination
- Interdisciplinary reviews
- Clash detection participation
- Constructability integration

Quality Control

- Design reviews
- Code compliance
- Accessibility compliance
- Value management
- Scope verification

Cost Management

- Estimate reconciliation
- Uniformat tracking
- Escalation analysis
- Scope alignment
- Contingency management

Stakeholder Management

- User group meetings
- Facility operations coordination
- Executive reporting
- Decision tracking

Procurement Support

- CM@R coordination
- Bid package sequencing
- Prequalification review
- Early trade involvement

Typical Design Phases and Recommended Review Percentages

The design management process typically includes formal review milestones at increasing levels of detail.

Phase	Approximate Completion	Primary Focus
Concept / Pre-Design	0–15%	Vision, feasibility, massing, budget validation
Schematic Design (SD)	15–30%	| Major systems, layout, relationships
Design Development (DD)	30–60%	Detailed coordination and system definition
Construction Documents (CD)	60–100%	Final drawings/specifications for bidding and construction

1. Concept Phase (0–15%)

Objectives

- Define owner requirements
- Validate feasibility
- Establish project scope
- Confirm site strategy
- Develop preliminary budget

Design Management Activities

- Facility programming
- Site analysis
- Preliminary code review
- High-level phasing strategy
- Sustainability goals

- Early risk assessment

Deliverables

- Concept narratives
- Site studies
- Preliminary massing
- High-level systems concepts
- Rough order-of-magnitude estimates

Cost Reconciliation

At this stage, estimates are often organized by:

- gross square foot costs
- benchmarking
- conceptual Uniformat systems
- or historical cost databases.

2. Schematic Design (15–30%)

Objectives

- Define building organization
- Establish primary engineering systems
- Develop floor plans and circulation
- Confirm structural concepts

Design Management Focus

This phase is critical because major cost and operational decisions are being locked in.

The design manager coordinates:

- user group reviews
- constructability feedback
- preliminary clash avoidance
- AHJ coordination
- and schedule alignment.

Typical SD Review Items

- Space adjacencies
- Building systems selection
- Vertical transportation
- Envelope concepts
- Structural grid
- Mechanical room sizing
- Site logistics

Recommended Review Participants

- Owner
- Architect
- Engineers
- CM/GC
- Major subcontractors (if early involvement exists)
- Facility maintenance staff
- IT/security representatives

3. Design Development (30–60%)

This is often the most important phase for Facility Design Management.

Objectives

- Fully coordinate systems
- Resolve conflicts
- Finalize equipment selections
- Refine details
- Reconcile budget accurately

Key Management Activities

- BIM coordination
    - Consider incorporating ceiling height, lifting ceiling tiles and access to equipment not only pipe and structural member clashes.
- Clash detection meetings
- Constructability reviews
- Detailed estimate reconciliation
- Scope verification

- Long-lead procurement identification
- Plan and Specification Reviews

Typical Design Development / DD Reviews

- Ceiling coordination
- Structural penetrations
- Mechanical routing
- Electrical capacity
- Equipment access
- Maintenance clearances
- Envelope detailing
- Acoustics
- Energy performance

4. Construction Document Reviews (60–100%)

Objectives

- Produce complete bid-ready documents
- Finalize specifications
- Eliminate ambiguity
- Reduce RFIs and change orders

Facility Design Management Focus

The design manager helps ensure:

- document consistency
- coordinated specifications
- accurate details
- constructable solutions
- and bidding clarity

Final Reviews Often Include

- Quality assurance / quality control
- Biddability review
- Constructability review
- Final code review

- ADA compliance review
- Specification coordination
- Final cost reconciliation

Uniformat Cost Reconciliation

Uniformat is a standardized system for organizing building costs by:

- systems
- assemblies
- and functional elements

Unlike MasterFormat (trade/specification based), Uniformat helps owners and design managers track:

- budget impacts
- system changes
- and design evolution more effectively.

Examples include:

- Substructure
- Shell
- Interiors
- Services
- Equipment
- Sitework

Why Uniformat Cost Reconciliation Is Important in Facility Design Management

Uniformat Cost Reconciliation allows:

- estimate comparison
- phase-to-phase reconciliation
- better value engineering
- clearer owner decision-making
- and improved scope control.

Uniformat cost reconciliation methodology is especially useful during:

- Schematic Design (SDs)

- Design Development (DDs)
- and early Construction Document (CD) phases.

Suggested Uniformat Reconciliation Strategy
For Projects with Substantial Budgets

Examples:

- hospitals,
- laboratories,
- civic buildings,
- airports,
- universities,
- high-rise towers.

Recommended Approach

Perform formal reconciliation at:

- Concept
- End of SD
- 50% DD
- 95% CD

Suggested Process

1. Independent estimator develops Uniformat estimate.
2. CM/GC develops parallel estimate.
3. Design manager leads reconciliation workshop.
4. Variances are categorized:
    - quantity differences
    - escalation assumptions
    - scope gaps
    - contingency differences
    - constructability impacts
5. Decisions are documented in a reconciliation log

Benefits

- Early budget transparency

- Reduced redesign
- Improved executive confidence
- Better procurement timing
- Reduced claims exposure

For Projects with Tight Budgets

Examples:

- schools
- municipal buildings
- affordable housing
- renovations
- small public projects

Recommended Strategy

Use “continuous lightweight reconciliation.”

Instead of large formal reconciliation sessions:

- track Uniformat systems monthly,
- monitor cost drift continuously,
- maintain live estimate dashboards,
- and perform focused scope reviews.

Key Focus Areas

- Envelope costs
- MEP systems
- Structural complexity
- Finish levels
- Sitework escalation

Best Practice

Maintain a:

- “Design-to-Budget Matrix”
  that identifies:

- target values,
- current estimates,
- variances,
- and mitigation strategies.

This helps prevent late-stage redesign.

Best Practice Recommendation

Modern Facility Design Management works best when:

- CM@R teams are hired during Design Development or earlier
- major trades participate in coordination
- BIM is integrated early
- and Uniformat reconciliation is performed continuously

This creates:

- transparency
- accountability
- better constructability
- improved lifecycle operations
- and fewer change orders during construction

For complex facilities, the most successful teams treat design management as:

"Continuous integration between operations, design, cost, schedule, and construction."

CHAPTER 6 CONSTRUCTION MANAGEMENT

The thoughts and minds of a design and construction team including the owner's project manager, architect and engineer of record, resident engineer, superintendents, construction manager and subcontractors' engineer, and foremen on a large to jumbo scale project often must operate like several systems running simultaneously. It is part technical, part logistical, part psychological, and part strategic. The role is translating abstract information into physical reality while coordinating hundreds or thousands of moving parts under cost, schedule, safety, legal, and political constraints.

A high-level construction professional is continuously switching between macro and micro thinking.

At the macro level, they are asking:

- What sequence makes the entire project flow efficiently?
- Where are the bottlenecks?
- Which trade controls the critical path?
- What decisions today affect commissioning six months from now?
- What procurement items have long lead times?
- How do weather, labor availability, inspections, permits, and owner decisions affect momentum?

At the micro level, they are simultaneously asking:

- Will this sleeve interfere with structural reinforcing?
- Can the electrician physically access this conduit route?
- Is the delegated design compatible with the architectural intent?
- Will the waterproofing fail at this transition detail?
- Can this material actually be installed safely and ergonomically in the field?

The mind becomes a constantly updating simulation engine.

A strong engineer or construction manager is mentally constructing the building long before the trades physically build it. The 2D drawings from the A/E team become spatial models in the imagination. Plans, sections, elevations, specifications, RFIs, shop drawings, and submittals are mentally merged into a living 3D sequence of events.

For experienced professionals, looking at drawings often triggers an internal visualization process automatically:

- “This beam gets erected before this curtain wall.”
- “The crane swing radius conflicts with pedestrian protection.”
- “This mechanical room will become inaccessible once overhead piping is installed.”
- “The drywall contractor will struggle because the MEP rough-in tolerances are too tight.”
- “The commissioning agent will need access here later.”

This is why experienced builders can walk into partially completed spaces and “see” future problems that are invisible to others.

Construction sequencing itself is a form of applied systems engineering. Every activity affects another activity:

- Structure affects enclosure.
- Enclosure affects temporary conditioning.
- Conditioning affects finishes.
- Finishes affect occupancy dates.
- Occupancy dates affect owner operations and financing.

A good builder understands interdependency rather than isolated tasks.

Means and methods require another layer of thinking entirely. The contract documents may show *what* must be built, but field leadership determines *how* it can safely and efficiently happen:

- crane picks,
- temporary shoring,
- access routes,
- material staging,
- worker flow,
- scaffold systems,
- hoisting logistics,
- prefabrication opportunities,
- safety sequencing,
- temporary utilities,
- shutdown coordination.

This requires practical imagination combined with real-world experience.

Delegated design adds another cognitive dimension. The engineer or construction manager must understand where design responsibility transfers between parties:

- structural steel connections,
- curtain wall engineering,
- fire stopping systems,
- truss calculations,
- specialty equipment supports,
- temporary works,
- HVAC controls integration.

They must constantly ensure that delegated systems still preserve the design intent, code compliance, constructability, and coordination with adjacent systems. This requires understanding not only the design itself, but the contractual boundaries of responsibility.

Communication protocol is equally critical because construction failure is often not caused by lack of intelligence, but by fragmented information flow.

A project can fail when:

- RFIs are delayed,
- submittals are incomplete,
- field directives bypass formal channels,
- assumptions are undocumented,
- meeting minutes are unclear,
- trades work from outdated drawings,
- decisions are verbal rather than traceable.

The construction manager's mind therefore becomes a communication router:

- Who needs this information?
- When do they need it?
- Is it documented?
- Is it contractual?
- Does it affect cost or schedule?
- Does it require owner approval?
- Does it create downstream liability?

In many ways, construction management is organized anticipation.

The pressure component changes everything further. Under schedule pressure, the brain must prioritize rapidly without losing situational awareness. The best professionals develop the ability to:

- filter noise,
- identify critical issues,
- remain calm during conflict,
- maintain decision velocity,
- avoid emotional reactions,
- preserve documentation discipline,
- think several weeks ahead while solving today's emergency.

This is mentally exhausting because the brain is continuously balancing:

- technical accuracy,
- labor productivity,
- safety,
- politics,
- contracts,
- personalities,
- budget,
- sequencing,
- owner expectations,
- public perception,
- risk exposure.

Large projects especially become exercises in controlled chaos management.

Over time, experienced professionals begin developing what could almost be called "construction intuition." This intuition is not magic; it is pattern recognition built from thousands of observations:

- noticing recurring failure points,
- understanding trade behavior,
- predicting coordination conflicts,
- sensing unrealistic schedules,
- identifying weak details,
- recognizing procurement risks,
- understanding how human behavior affects productivity.

The best builders combine:

1. Technical intelligence
2. Spatial visualization
3. Systems thinking
4. Emotional discipline
5. Communication clarity
6. Risk management
7. Leadership under uncertainty
8. Practical field knowledge
9. Contractual awareness
10. Long-range anticipation

Ultimately, the role is a bridge between imagination and physical reality.

The architect and engineers conceive the design. The construction team converts symbols, specifications, and intent into actual matter assembled in time and space by human beings under real-world constraints.

That transformation is one of the most cognitively demanding coordination exercises in modern industry.

On a jumbo construction project, the "Owner" is not just one person. The owner side is usually an entire organization made up of:

- executives,
- facility operators,
- maintenance personnel,
- safety staff,
- security teams,
- finance personnel,
- consultants,
- user groups,
- and governing committees.

Their role is to ensure the facility is designed, constructed, operated, and maintained in a way that supports the organization's long-term mission.

On highly successful projects, the owner team is deeply integrated into:

- programming,
- design reviews,
- constructability discussions,
- commissioning,
- operational planning,
- and turnover.

The Owner's Role on a Jumbo Project

The Owner is ultimately responsible for:

- defining project goals,
- funding the project,
- approving decisions,
- managing risk,
- and accepting the final facility.

The owner organization typically focuses on:

- operational continuity,
- lifecycle costs,
- occupant experience,
- safety,
- maintainability,
- and long-term asset value.

Owner Organizational Structure on Large Projects

A jumbo project owner team may include:

Owner Role	Primary Focus
Executive Leadership	Funding, strategy, approvals
Owner's Project Manager (OPM)	Daily owner representation
Facility Manager	Long-term operations
Maintenance Team	Serviceability and access

Owner Role	Primary Focus
Janitorial/Custodial Team	Cleaning and operational practicality
Security Team	Physical security and access control
Safety Team	Occupant and operational safety
Visitor Experience Manager	Public flow and user experience
IT/Technology Team	Systems integration
Building Committee	Governance and approvals
User Groups	Functional operational needs

Facility Manager

The Facility Manager is one of the most important owner representatives on a major project.

They are responsible for:

- long-term building operations,
- maintenance strategy,
- system reliability,
- and operational efficiency after turnover.

Their Main Focus

“Can this building realistically be operated and maintained for the next 30–50 years?”

Facility Manager Responsibilities During Design

Review of:

- Mechanical rooms
- Equipment access
- Roof access
- Service clearances
- Filter replacement access

- Valve locations
- Maintenance pathways
- Storage areas
- Utility metering
- Control systems

They Help Prevent:

- inaccessible equipment,
- unsafe maintenance conditions,
- oversized operational costs,
- and future shutdown issues.

During Construction

Facility managers often participate in:

- coordination meetings,
- mockups,
- equipment demonstrations,
- startup planning,
- commissioning reviews,
- and turnover preparation.

During Turnover

They verify:

- O&M manuals,
- training completion,
- spare parts,
- warranties,
- asset tagging,
- and digital turnover information.

Janitorial / Custodial Services

Custodial teams are frequently overlooked but provide extremely valuable operational insight.

Their role is to help ensure the building can be:

- cleaned efficiently,
- maintained safely,
- and operated practically.

What Custodial Teams Review

Materials & Finishes

- Flooring durability
- Wall protection
- Ceiling accessibility
- Restroom finishes
- Stain resistance
- Cleaning compatibility

Operational Concerns

- Trash flow
- Cleaning closets
- Floor drain locations
- Equipment storage
- Elevator protection
- Cleaning routes

Why This Matters

Poor custodial planning can create:

- higher operational costs,
- labor inefficiencies,
- damaged finishes,
- and occupant complaints for decades.

Visitor Experience Manager

On hospitals, universities, airports, stadiums, civic buildings, and large campuses, visitor experience becomes a major operational component.

This role focuses on:

- user navigation,
- public comfort,
- accessibility,
- and first impressions.

Responsibilities

Review:

- Entrances
- Wayfinding
- Lobby flow
- Waiting areas
- Signage
- Accessibility
- Parking circulation
- Elevator traffic
- Reception areas

They Consider:

- emotional experience,
- confusion points,
- congestion,
- and operational bottlenecks.

Security Team

Security teams play a massive role in modern facilities.

They help design systems that protect:

- people,
- assets,
- operations,
- and critical infrastructure.

Security Responsibilities During Design

Review of:

- Access control systems
- Card readers
- Cameras
- Security desk locations
- Visitor screening
- Emergency lockdown systems
- Loading dock security
- Parking security
- Keying systems
- Perimeter protection

During Construction

Security teams coordinate:

- temporary access control,
- badging,
- site security,
- and operational continuity if the facility remains occupied.

On Sensitive Facilities

Security involvement becomes extremely detailed on:

- hospitals,
- laboratories,

- data centers,
- government buildings,
- research facilities,
- and military projects.

Safety Team

The owner's safety department focuses on:

- occupant safety,
- operational safety,
- emergency preparedness,
- and regulatory compliance.

Safety Reviews Include

Life Safety

- Egress paths
- Fire alarm systems
- Smoke control
- Emergency lighting
- Refuge areas

Operational Safety

- Roof safety systems
- Ladder access
- Fall protection
- Lockout/tagout access
- Hazardous material handling
- Slip resistance
- Emergency response routes

During Construction

Owner safety teams may:

- monitor contractor compliance,
- coordinate occupied-building safety,
- review shutdown procedures,
- and protect ongoing operations.

Building Committee

The Building Committee is usually a governance and decision-making body.

They may include:

- executives,
- trustees,
- finance leaders,
- community representatives,
- department heads,
- or public officials.

Their Role

Oversight Of:

- Budget approvals
- Major design decisions
- Scope changes
- Public accountability
- Schedule milestones
- Strategic alignment

Typical Responsibilities

- Reviewing presentations
- Approving milestones
- Authorizing expenditures
- Managing political/public concerns
- Supporting funding decisions

User Groups

User groups include:

- doctors,
- teachers,
- researchers,
- operations staff,
- administrators,
- maintenance personnel,
- and frontline workers.

These groups help validate:

- workflows,
- equipment needs,
- functionality,
- and operational efficiency.

Why Owner Involvement Is Critical

Many project failures happen because operational staff are brought in too late.

Examples:

- Equipment cannot be serviced
- Security coverage has blind spots
- Janitorial closets are undersized
- Public circulation fails
- Maintenance access is unsafe
- Utility shutdowns become impossible
- Operational staffing costs increase dramatically

Best Practice on Jumbo Projects

The best jumbo projects integrate owner operations teams:

- during programming,
- throughout design,
- during BIM coordination,
- during mockups,
- and throughout commissioning.

This creates:

- better lifecycle performance,
- reduced operational costs,
- improved occupant satisfaction,
- safer facilities,
- and fewer post-occupancy modifications.

Modern Integrated Owner Approach

Leading projects now use:

- Integrated Project Delivery (IPD),
- Lean planning,
- BIM-based facility management,
- digital twins,
- and lifecycle asset integration.

The owner team is no longer passive.

On advanced projects, the owner acts as:

"An active operational partner guiding the facility from concept through long-term operations."

The Owner's Project Manager

On a jumbo construction project, the Owner's Project Manager (OPM) represents the owner's interests throughout construction and acts as the owner's:

- technical advisor,
- operational coordinator,
- risk manager,

- quality observer,
- schedule monitor,
- and communication bridge between all parties.

The OPM's mission during construction is to help ensure the project is:

- built according to the contract documents,
- aligned with the owner's goals,
- delivered safely,
- financially controlled,
- operationally coordinated,
- and substantially complete on time.

On large projects, the OPM organization is often structured similarly to a construction management team with:

- Directors,
- Senior Project Managers,
- Project Managers,
- Resident Engineers,
- Clerks of the Works,
- commissioning specialists,
- schedulers,
- estimators,
- and document controls staff.

OPM Organizational Structure During Construction

OPM Role	Primary Focus
Director	Executive oversight and owner strategy
Senior PM / PM	Daily project management and coordination
Resident Engineer	Technical field oversight
Clerk of the Works	Continuous field observation and documentation

1. OPM Director

The OPM Director oversees the project at the executive and strategic level.

They are responsible for protecting the owner's:

- budget,
- schedule,
- public accountability,
- operational goals,
- and contractual interests.

Primary Responsibilities

Executive Oversight

- Monitor overall project health
- Advise owner leadership
- Support executive decision-making
- Oversee major risks

Financial Oversight

- Budget monitoring
- Change order review
- Contingency management
- Forecast analysis

Strategic Coordination

- Coordinate with executives
- Manage political/public concerns
- Support board or building committee reporting
- Align project with institutional goals

High-Level Issue Resolution

- Escalated disputes
- Schedule recovery strategy
- Claims avoidance
- Major operational conflicts

Typical Activities

- Executive OAC meetings
- Board presentations
- High-level risk reviews
- Major change negotiations
- Public stakeholder coordination

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2. OPM Project Manager

The OPM Project Manager manages the owner-side day-to-day administration and coordination during construction.

They are heavily involved in:

- communication,
- issue tracking,
- schedule review,
- field coordination,
- and documentation management.

Primary Responsibilities

Construction Coordination

- Coordinate between owner, architect, CM/GC, and users
- Monitor construction progress
- Review sequencing impacts
- Track milestone completion

Schedule Oversight

- Review CPM schedules
- Analyze delays
- Monitor critical path activities
- Verify recovery plans

Cost Monitoring

- Review pay applications
- Evaluate change orders
- Track allowances and contingencies
- Monitor budget exposure

Documentation

- Meeting minutes
- Action-item tracking
- Decision logs
- Executive reporting

Owner Coordination

- Occupancy planning
- Utility shutdown coordination
- User group communication
- Operational continuity planning

Typical Daily Tasks

- OAC meetings
- Reviewing RFIs and ASIs
- Monitoring construction activities
- Coordinating inspections
- Following up on unresolved issues
- Reviewing logistics plans
- Tracking procurement status

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3. Resident Engineer (RE)

The Resident Engineer is one of the most important technical field representatives for the owner.

They are typically stationed onsite full-time.

The RE acts as the owner's technical eyes and ears in the field.

Primary Responsibilities

Field Observation

- Observe construction progress
- Monitor compliance with drawings/specifications
- Verify workmanship quality
- Identify deficiencies

Technical Coordination

- Review installations
- Coordinate inspections
- Verify testing procedures
- Observe mockups and demonstrations

Documentation

- Daily reports
- Photo documentation
- Field observations
- Deficiency logs
- Progress tracking

Quality Oversight

The RE helps identify:

- non-conforming work,
- coordination conflicts,
- incomplete installations,
- unsafe practices,
- and workmanship concerns.

Schedule Monitoring

They monitor:

- manpower levels,
- productivity,
- sequencing,
- and milestone progress.

Coordination with Design Team

The RE often communicates directly with:

- architects,
- engineers,
- testing agencies,
- and inspectors.

What Resident Engineers Commonly Review

Structural Work

- Reinforcing steel
- Concrete placement
- Structural connections

Building Envelope

- Waterproofing
- Curtainwall installation
- Roofing

Interior Work

- Framing
- Finishes
- Above-ceiling coordination

MEP Systems

- Equipment installation
- Ductwork routing
- Piping coordination
- Electrical rough-in

---

4. Clerk of the Works (COW)

The Clerk of the Works is a field observer focused on:

- continuous site presence,
- workmanship,
- quality,
- and compliance observation.

Historically, Clerks of the Works were used extensively on:

- public projects,
- institutional projects,
- and large civic buildings.

Primary Responsibilities

Daily Site Observation

- Observe ongoing work
- Verify materials
- Monitor installation practices
- Track field conditions

Documentation

- Daily logs
- Weather reports
- Workforce counts
- Progress observations

- Deficiency documentation

Quality Monitoring

The COW helps identify:

- improper installations,
- specification deviations,
- damaged materials,
- incomplete work,
- high visibility
- and coordination issues.

Safety Awareness

While usually the contractor's safety officer's responsibilities, they may document:

- unsafe conditions,
- access concerns,
- and operational hazards.

Reporting

The Clerk reports observations to:

- the RE
- OPM PM
- architect
- and owner

Difference Between Resident Engineer and Clerk of the Works

Role	Primary Focus
Resident Engineer	Technical oversight and coordination
Clerk of the Works	Continuous observation and documentation

Modern Jumbo Project OPM Responsibilities

On modern mega-projects, OPM teams may also manage:

Digital Oversight

- BIM coordination review
- Digital turnover tracking
- Asset management integration
- Drone progress monitoring

Operational Readiness

- Move Management and Planning
- Phased occupancy
- Training coordination
- Commissioning oversight

Risk Management

- Claims mitigation
- Delay analysis
- Constructability issue tracking
- Escalation forecasting

OPM Role During Key Construction Activities

Activity	OPM Involvement
Concrete pours	Observation and documentation
Mockups	Review and approval coordination
Utility shutdowns	Owner coordination
Schedule delays	Recovery analysis
Change orders	Cost/scope review

Activity	OPM Involvement
Commissioning	Witnessing and verification
Turnover	Training and closeout oversight

What Makes a Strong OPM Team

The best OPM teams:

- communicate clearly
- document thoroughly
- understand construction sequencing
- anticipate operational impacts
- and maintain neutrality while protecting the owner

Strong OPM teams reduce:

- claims
- rework
- operational disruptions
- schedule overruns
- and lifecycle problems

Best Practice on Jumbo Projects

The most successful jumbo projects treat the OPM as:

“An integrated extension of the owner’s operational and strategic leadership.”

Rather than only reviewing paperwork, advanced OPM teams actively participate in:

- field coordination,
- constructability reviews,
- BIM meetings,
- commissioning,
- turnover planning,
- and operational readiness throughout construction.

The Designer and their Consultants

During the construction phase of a jumbo construction project, the Architect of Record (AOR) and their consultants serve as the design team responsible for:

- interpreting the design intent,
- administering the construction contract,
- reviewing contractor submissions,
- responding to field conditions,
- and helping ensure the project is constructed in accordance with the contract documents.

Their work during construction is commonly called:

"Construction Administration" (CA)

On complex projects, Construction Administration becomes a full-time professional operation involving:

- architects,
- engineers,
- specification writers,
- BIM coordinators,
- specialty consultants,
- envelope consultants,
- acousticians,
- lighting designers,
- code consultants,
- commissioning agents,
- and delegated design reviewers.

Role of the Architect of Record (AOR)

The AOR is the licensed architect legally responsible for:

- the architectural design,
- code compliance,
- coordination of the contract documents,
- and maintaining the design intent.

The AOR is generally **not responsible for means and methods of construction**, which belong to the contractor.

Primary Construction Phase Responsibilities of the AOR

Responsibility	Purpose
Construction Administration	Administer owner-contractor contract
Submittal Review	Verify design intent compliance
RFI Responses	Clarify drawings/specifications
Site Observations	Observe general compliance
Change Management	Review modifications and ASIs
Coordination	Resolve interdisciplinary issues
Quality Oversight	Monitor overall conformance
Delegated Design Review	Review specialty engineer designs
Closeout Support	Punch lists and turnover

Construction Administration (CA)

Construction Administration is the process by which the architect and consultants administer the construction contract and support construction execution.

Core Construction Administration Duties

1. Submittal Review

One of the AOR's largest responsibilities.

The contractor submits:

- shop drawings,
- product data,

- samples,
- mockups,
- calculations,
- and coordination drawings.

The AOR reviews them to determine whether they generally conform to:

- design intent,
- specifications,
- code requirements,
- and aesthetic requirements.

Examples of Submittals Reviewed

Architectural

- Curtainwall systems
- Doors and hardware
- Roofing systems
- Finishes
- Waterproofing
- Casework

Structural

- Steel shop drawings
- Rebar drawings
- Connections

MEP

- Equipment selections
- Controls
- Lighting fixtures
- Diffusers
- Panelboards

Important Legal Principle

Submittal review is:

"For general conformance with design intent"

The contractor remains responsible for:

- dimensions,
- fabrication,
- means and methods,
- sequencing,
- and coordination.

---

2. RFI Responses

The AOR answers:
Request for Information (RFIs)

These clarify:

- drawing conflicts,
- missing details,
- field conditions,
- constructability concerns,
- or coordination issues.

Typical RFI Topics

- Ceiling conflicts
- Structural penetrations
- Finish transitions
- Equipment clearances
- Utility routing
- Waterproofing interfaces

Why RFIs Matter

Poor or delayed RFI responses can cause:

- delays,
- trade stacking,
- rework,
- schedule impacts,
- and claims.

On jumbo projects, thousands of RFIs may occur.

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3. Site Observation / Field Visits

The AOR and consultants perform periodic site visits to:

- observe progress,
- verify general conformance,
- review mockups,
- and identify visible deficiencies.

They Typically Observe

Architectural

- Envelope installation
- Finishes
- Waterproofing
- Firestopping

Structural

- Reinforcement
- Connections
- Concrete work

MEP

- Equipment placement
- Major routing
- Coordination

Important Distinction

The architect:

- does NOT provide continuous inspection,
- does NOT supervise construction labor,
- and does NOT control contractor means and methods.

That responsibility belongs to:

- the contractor,
- superintendent,
- and trade foremen.

---

4. Supplemental Instructions & Changes

Construction rarely proceeds exactly as originally drawn.

The AOR helps manage:

- unforeseen conditions,
- owner changes,
- code revisions,
- and coordination adjustments.

Common Change Documents

Document	Purpose
ASI	Architect's Supplemental Instruction

Document	Purpose
CCD	Construction Change Directive
Proposal Request	Pricing request
Bulletin	Clarification/change package

---

5. Coordination with Consultants

The AOR leads coordination among:

- structural engineers,
- MEP engineers,
- civil engineers,
- fire protection consultants,
- AV/IT consultants,
- landscape architects,
- lighting designers,
- and specialty consultants.

Consultant Responsibilities During Construction

Structural Engineer

Reviews:

- Steel shop drawings
- Structural calculations
- Delegated connections
- Temporary loading concerns

Observes:

- Structural framing
- Reinforcement
- Specialty installations

Mechanical Engineer

Reviews:

- HVAC equipment
- Controls
- Duct routing
- TAB procedures
- Startup procedures

Electrical Engineer

Reviews:

- Power distribution
- Lighting controls
- Generator systems
- Arc flash coordination
- Short-circuit studies

Plumbing Engineer

Reviews:

- Piping systems
- Storm drainage
- Domestic water
- Medical gas systems

Fire Protection Consultant

Reviews:

- Sprinkler layouts
- Hydraulic calculations
- Fire alarm coordination
- Standpipe systems

Delegated Design During Construction

On jumbo projects, many specialized systems are:

"Delegated Design"

This means the contractor hires specialty engineers to complete portions of the design within criteria established by the AOR/engineer.

Examples of Delegated Design Scopes

Delegated Scope	Typical Specialty Engineer
Curtainwall	Facade engineer
Steel connections	Structural steel engineer
Cold-formed framing	Specialty structural engineer
Fire sprinkler systems	FP engineer
Temporary shoring	Contractor engineer
Precast systems	Specialty engineer
Stairs	Fabricator engineer
Seismic bracing	Specialty engineer
Rigging systems	Specialty engineer

Contractor's Engineers on Delegated Design

The contractor's delegated engineers produce:

- calculations,
- stamped drawings,
- fabrication details,
- and installation criteria.

These engineers are usually retained by:

- subcontractors,
- specialty fabricators,
- or design-assist trades.

AOR’s Role in Delegated Design

The AOR and consultants review delegated design submissions for:

- compatibility with the overall design,
- adherence to performance criteria,
- coordination impacts,
- and general conformance.

Critical Legal Distinction

The delegated engineer remains responsible for:

- engineering calculations,
- detailed design,
- and specialty engineering adequacy.

The AOR remains responsible for:

- establishing the design criteria,
- coordination,
- and overall project integration.

Example: Curtainwall Delegated Design

AOR Defines:

- Performance requirements
- Thermal criteria
- Air/water requirements
- Design intent
- Aesthetic requirements

Contractor’s Facade Engineer Designs:

- Mullions
- Anchors
- Structural calculations
- Fabrication details

AOR Reviews:

- Appearance
- Compatibility
- Performance compliance
- Integration with waterproofing

BIM and Coordination During Construction

Modern jumbo projects rely heavily on:

- BIM coordination,
- clash detection,
- and digital modeling.

The AOR and consultants often participate in:

- coordination meetings,
- clash reviews,
- sequencing discussions,
- and installation planning.

Commissioning Support

The AOR and engineers also support:
Commissioning

This includes:

- witnessing testing,

- reviewing deficiencies,
- verifying performance,
- and supporting turnover readiness.

Punch List and Closeout

Near project completion, the AOR leads or participates in:

- punch list walks,
- deficiency tracking,
- substantial completion evaluations,
- and final completion reviews.

Successful Construction Administration on Jumbo Projects

The best CA teams:

- respond quickly,
- coordinate effectively,
- understand field sequencing,
- communicate clearly,
- and collaborate constructively with contractors and owners.

Strong Construction Administration helps reduce:

- RFIs,
- delays,
- rework,
- disputes,
- and operational problems after occupancy.

Modern Reality of Jumbo Project CA

On modern mega-projects, the Architect of Record is no longer just:

“The designer who produced the drawings.”

They become:

- design coordinators,
- technical integrators,
- digital collaborators,
- operational advisors,

and risk managers throughout construction.

The Construction Manager

On a jumbo construction project — such as a high-rise, hospital, laboratory, airport, stadium, mega-campus, or large public infrastructure project — the management structure becomes highly specialized because the project is too complex for one person to control effectively.

Each leadership role manages a different layer of:

- operations,
- coordination,
- risk,
- schedule,
- safety,
- quality,
- logistics,
- and stakeholder communication.

Below is a practical breakdown of what these positions typically do on a large-scale project.

Executive Leadership

Project Executive

The Project Executive oversees the project at the highest operational and financial level for the construction manager or general contractor.

Primary Responsibilities

- Executive oversight of the entire project
- Client relationship management
- Contract negotiations
- Financial performance
- Major risk management
- Dispute resolution
- Staffing strategy
- Executive reporting
- Oversight of schedule and budget health

Focus Areas

- Profitability
- Major change orders
- Claims avoidance
- Political/public relations
- High-level owner communication
- Resource allocation across projects

Typical Involvement

They usually attend:

- executive OAC meetings,
- high-level issue meetings,
- major negotiations,
- and critical milestone reviews.

They are less involved in daily field operations.

Project Management Team

Project Manager (PM)

The Project Manager runs the administrative and operational side of the project.

They are often considered the “central nervous system” of project execution.

Primary Responsibilities

- Contract administration
- Cost control
- Buyout management
- Change order management
- Procurement coordination
- Schedule oversight
- Coordination with design team
- Owner communication
- Risk tracking

Daily Activities

- Reviewing RFIs
- Reviewing submittals
- Managing subcontractors
- Tracking budgets
- Coordinating procurement
- Monitoring schedule impacts
- Leading coordination meetings

Major Deliverables

- Monthly reports
- Budget forecasts
- Change order logs
- Procurement logs
- Risk registers
- Cash flow projections

Key Goal

Keep the project:

- financially healthy,
- contractually protected,
- and operationally coordinated.

Assistant Project Manager (APM)

The Assistant Project Manager supports the PM and manages detailed coordination tasks.

On jumbo projects, APMs are often assigned by:

- area,
- building,
- phase,
- or trade package.

Typical Responsibilities

- RFI management
- Submittal tracking
- Meeting minutes
- Document control
- Procurement tracking
- Coordination support
- Daily communication with subcontractors
- Schedule updates
- Field issue tracking

Common Tasks

- Logging RFIs
- Tracking long-lead items
- Reviewing shop drawings
- Coordinating deliveries
- Updating action-item logs
- Following up on unresolved issues

Importance

Strong APMs are critical because jumbo projects generate:

- thousands of RFIs,
- submittals,
- sketches,
- revisions,

- and coordination issues.

Field Operations Team

Chief Superintendent

The Chief Superintendent is the highest-ranking field operations leader.

They oversee all field superintendents and direct day-to-day construction execution.

Primary Responsibilities

- Overall site operations
- Safety leadership
- Site logistics
- Workforce coordination
- Sequence management
- Schedule enforcement
- Field quality oversight
- Trade coordination

Major Focus

"How do we physically build this project efficiently and safely?"

Responsibilities Include

- Managing construction sequencing
- Coordinating cranes and hoists
- Workforce flow
- Material logistics
- Site access
- Inspections
- Recovery planning when behind schedule

Key Role

The Chief Superintendent transforms:

- schedules,
- drawings,
- and planning

  into actual field execution.

Superintendent

Superintendents manage specific scopes or areas of the project.

On jumbo projects, there may be:

- structural superintendents,
- interiors superintendents,
- facade superintendents,
- site superintendents,
- vertical transportation superintendents,
- or area superintendents.

Responsibilities

- Daily field coordination
- Safety monitoring
- Quality inspections
- Managing subcontractor activities
- Verifying manpower
- Tracking production
- Daily reporting

They Monitor

- Work sequencing
- Trade stacking
- Installation quality
- Inspection readiness
- Schedule progress

Assistant Superintendent

Assistant Superintendents support field execution and handle detailed operational oversight.

Typical Responsibilities

- Daily walkthroughs
- Safety inspections
- Punch list tracking
- Deliveries coordination
- Inspection preparation
- Quality verification
- Monitoring small crews or zones

Common Assignments

They may manage:

- one floor,
- one wing,
- one trade area,
- or one shift.

Importance

On large projects, Assistant Superintendents help prevent:

- overlooked issues,
- unsafe conditions,
- and schedule slippage.

MEP/FP Leadership

MEP Superintendent

(MEP = Mechanical, Electrical, Plumbing)

This role is one of the most important on modern projects because building systems are extremely complex.

Responsibilities

- Coordinate all MEP trades
- Manage ceiling coordination
- Resolve system clashes
- Sequence installations
- Support commissioning
- Verify equipment installation
- Coordinate inspections

Key Systems Managed

- HVAC
- Electrical distribution
- Plumbing
- Medical gas
- Controls
- Fire alarm
- Low voltage
- Building automation

Critical Tasks

- Shaft coordination
- Above-ceiling coordination
- Equipment access planning
- Startup sequencing
- Utility shutdown coordination

Why This Role Matters

MEP systems can represent:

- 30–60% of project cost
  on complex buildings.

Poor MEP coordination often causes:

- delays,
- rework,

- and expensive change orders.

Fire Protection (FP) Superintendent

The FP Superintendent specializes in:

- sprinkler systems,
- standpipes,
- fire pumps,
- and life safety coordination.

Responsibilities

- Coordinate sprinkler installation
- Verify code compliance
- Coordinate inspections
- Support testing and commissioning
- Coordinate with ceilings and MEP trades

Critical Coordination Areas

- Congested ceilings
- Penetrations
- Seismic bracing
- Fire stopping
- Testing procedures

How All These Roles Work Together

On jumbo projects, success depends on:

- communication,
- sequencing,
- and coordination.

A simplified workflow may look like this:

Role	Primary Focus
Project Executive	Executive strategy and client leadership
Project Manager	Budget, contracts, coordination
Assistant PM	Detailed project administration
Chief Superintendent	Overall field execution
Superintendent	Daily construction operations
Assistant Superintendent	Detailed field oversight
MEP Superintendent	Building systems coordination
FP Superintendent	Fire protection systems and inspections

Modern Jumbo Project Reality

Large projects today often include:

- BIM coordination rooms,
- digital clash detection,
- Lean pull planning,
- Last Planner System,
- 4D scheduling,
- prefabrication coordination,
- drone progress tracking,
- AI-assisted scheduling,
- and real-time field reporting.

This means leadership roles increasingly require:

- technical knowledge,
- communication skills,
- data analysis,
- and systems thinking —
  not just traditional construction experience.

On the best projects, these teams operate as:

“Integrated operational systems rather than isolated departments.”

That integration is what reduces:

- delays,
- claims,
- change orders,
- and field conflicts on mega-projects.

CHAPTER 7 CHANGE MANAGEMENT

Change Management on Jumbo Construction Projects

Change Management is the structured process used to:

- identify,
- evaluate,
- price,
- approve,
- document,
- coordinate,
- and implement changes to the project.

On jumbo construction projects, change management is one of the most critical functions because changes can significantly impact:

- budget,
- schedule,
- operations,
- sequencing,
- procurement,
- commissioning,
- and long-term facility performance.

Effective change management is not just about processing change orders.
It is about:

"Preventing unnecessary changes while managing unavoidable changes intelligently."

What Is a Change Order?

A Change Order is a formal modification to:

- scope,
- cost,
- schedule,
- design,
- or contract requirements.

Common Causes of Change Orders

Cause	Example
Incomplete design	Missing details
Owner scope changes	Additional program requirements
Existing condition conflicts	Unknown utilities
User-requested revisions	Layout changes
Code interpretation changes	AHJ comments
Coordination conflicts	MEP clashes
Procurement substitutions	Material availability
Constructability issues	Installation conflicts
Unclear specifications	Ambiguous requirements
Accelerated schedules	Out-of-sequence work

The Owner's Perspective on Change Management

The owner focuses on:

- budget protection,
- operational functionality,
- long-term value,
- and minimizing disruption.

Owner Priorities

Control Cost Growth

Owners want:

- predictable budgets,

- minimized contingency consumption,
- and fewer claims.

Protect Operational Goals

Changes should support:

- functionality,
- lifecycle operations,
- maintainability,
- and user experience.

Avoid Late Changes

Late changes are extremely expensive because they often affect:

- installed work,
- procurement,
- commissioning,
- and occupancy.

What Owners Should Do to Reduce Change Orders

1. Invest in Early Programming

Strong programming reduces:

- missing scope,
- operational oversights,
- and late user requests.

This includes involving:

- end users,
- facility staff,
- maintenance,
- security,
- IT,
- and operations teams early.

2. Make Decisions Early

Delayed owner decisions often create:

- redesign,
- resequencing,
- procurement delays,
- and premium costs.

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3. Avoid “Design During Construction”

Frequent late revisions during construction create:

- cascading coordination impacts,
- schedule delays,
- and productivity loss.

---

4. Maintain Clear Governance

A structured approval process helps prevent:

- uncontrolled scope creep,
- emotional decision-making,
- and contradictory direction.

The OPM’s Perspective on Change Management

The Owner's Project Manager (OPM) acts as the owner’s:

- risk manager,
- process coordinator,
- and change-control administrator.

OPM Responsibilities in Change Management

Change Tracking

Maintain:

- change logs,
- trend logs,
- contingency tracking,
- and forecasting reports.

Impact Analysis

Evaluate:

- cost impacts,
- schedule impacts,
- operational impacts,
- and procurement implications.

Scope Validation

The OPM helps determine:

- whether the change is legitimate,
- avoidable,
- or already included in contract scope.

Coordination

Coordinate between:

- owner,
- architect,
- engineers,
- contractor,

- and end users.

Documentation

Ensure:

- decisions are documented,
- approvals are formalized,
- and exposures are tracked.

Best OPM Practices to Reduce Changes

Conduct Regular Design Reviews

At:

- Concept
- SD
- DD
- 50% CD
- 95% CD

Maintain Decision Logs

Track:

- open questions,
- approvals,
- and unresolved scope items.

Lead Constructability Reviews

Bring in:

- contractors,
- subcontractors,

- and facility operators early.

Monitor “Scope Drift”

Small cumulative changes can become massive budget impacts.

The Designer’s Perspective on Change Management

The Architect of Record and consultants focus on:

- maintaining design integrity,
- code compliance,
- coordination,
- and technical accuracy.

Designer Responsibilities

Produce Coordinated Documents

Well-coordinated drawings reduce:

- RFIs,
- field conflicts,
- and redesign.

Clarify Design Intent

Ambiguous documents create:

- interpretation conflicts,
- disputes,
- and pricing exposure.

Coordinate Consultants Thoroughly

Many changes originate from:

- poor interdisciplinary coordination.

Especially:

- MEP conflicts,
- ceiling congestion,
- structural penetrations,
- and envelope interfaces.

Designer Best Practices to Reduce Change Orders

1. Detailed User Engagement

Engage:

- maintenance teams,
- operations,
- security,
- janitorial staff,
- and occupants.

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2. BIM Coordination

Use:
Building Information Modeling (BIM)

for:

- clash detection,
- spatial coordination,
- and installation sequencing.

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3. Perform Peer Reviews

Independent reviews identify:

- inconsistencies,
- omissions,
- and constructability concerns.

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4. Improve Drawing Clarity

Good details reduce:

- assumptions,
- RFIs,
- and interpretation disputes.

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5. Coordinate Equipment Early

Late equipment changes create:

- structural revisions,
- power revisions,
- and major schedule impacts.

The Construction Manager's Perspective

The Construction Manager or GC focuses on:

- constructability,
- procurement,
- sequencing,
- labor productivity,
- and cost exposure.

CM/GC Responsibilities in Change Management

Pricing Changes

Prepare:

- labor costs,
- material costs,
- schedule impacts,
- and general conditions impacts.

Evaluate Constructability

Identify:

- installation conflicts,
- sequencing problems,
- access concerns,
- and productivity impacts.

Procurement Coordination

Determine impacts to:

- long-lead materials,
- fabrication,
- and deliveries.

Schedule Analysis

Evaluate:

- critical path impacts,
- resequencing,
- acceleration,
- and recovery requirements.

CM/GC Best Practices to Reduce Changes

1. Early Trade Involvement

Bring in:

- MEP trades,
- facade contractors,
- steel fabricators,
- and specialty contractors early.

This is one of the most effective ways to reduce changes.

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2. Constructability Reviews

Review:

- access,
- sequencing,
- crane logistics,
- ceiling coordination,
- prefabrication opportunities,
- and installation feasibility.

---

3. Model-Based Coordination

Participate actively in:

- BIM coordination,
- clash meetings,
- and field layout validation.

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4. Procurement Planning

Identify:

- long-lead risks,
- substitutions,
- and market escalation early.

Capturing End User Needs

One of the biggest causes of change orders is:

"Late discovery of operational requirements."

Who Should Be Included Early?

Stakeholder	Why They Matter
Facility managers	Maintenance access
Janitorial staff	Cleaning practicality
Security teams	Access control
IT departments	Technology infrastructure
Maintenance personnel	Serviceability
Occupants	Workflow validation
Operations staff	Daily functionality
Safety personnel	Emergency operations

Best Practices for Capturing User Needs

User Workshops

Conduct:

- interviews,
- workflow reviews,
- and operational simulations.

Mockups

Use:

- room mockups,
- VR walkthroughs,
- and BIM visualization.

This helps users identify problems before construction.

Adjacency Reviews

Review:

- circulation,
- workflow,
- storage,
- and operational efficiency.

Lifecycle Thinking

Ask:

"How will this facility operate for the next 30 years?"

not just:

"How does it look during design?"

Most Effective Ways to Reduce Change Orders

Strategy	Benefit
Strong programming	Reduces missing scope

Strategy	Benefit
Early stakeholder involvement	Captures operational needs
Early CM/GC involvement	Improves constructability
BIM coordination	Reduces clashes
Peer reviews	Finds errors early
Uniformat reconciliation	Controls budget drift
Mockups	Validates functionality
Early procurement planning	Reduces substitutions
Clear governance	Prevents scope creep
Timely decisions	Avoids resequencing

The Reality of Jumbo Projects

Even excellent projects will still experience changes because:

- existing conditions evolve,
- owner priorities shift,
- codes change,
- and construction is inherently complex.

The goal is not:

"Zero change orders."

The goal is:

"Well-managed, justified, coordinated changes with minimal disruption."

Characteristics of Elite Change Management Systems

The best projects use:

- transparent decision logs,
- live change dashboards,
- BIM-integrated issue tracking,
- risk forecasting,
- trend analysis,
- and collaborative review meetings.

Best Practice Philosophy

The most successful jumbo projects view change management as:

“A collaborative risk-management process rather than a claims-management process.”

That mindset promotes:

- transparency,
- accountability,
- trust,
- and better long-term project outcomes.

CHAPTER 8 CLOSE OUT MANAGEMENT

During the closeout phase of a jumbo construction project, the Construction Manager (CM) or General Contractor (GC) transitions from primarily building the project to:

- completing,
- testing,
- documenting,
- training,
- commissioning,
- correcting deficiencies,
- and turning over the facility for occupancy and long-term operations.

Closeout on a jumbo project is essentially:

"The process of transforming a construction site into a fully operational facility."

On complex projects, closeout can take:

- several months,
- or even more than a year after substantial completion.

It is one of the most documentation-intensive phases of the entire project.

Primary Goals of the Closeout Phase

The CM/GC is responsible for helping ensure:

- the facility is safe,
- code compliant,
- operational,
- tested,
- documented,
- maintainable,
- and ready for occupancy.

Major Closeout Responsibilities

Closeout Activity	Purpose
Substantial Completion	Achieve occupiable status
Punch List Completion	Correct deficiencies
Commissioning	Verify system performance
Training	Educate owner staff
O&M Manuals	Provide operational documentation
Attic Stock Turnover	Deliver spare materials
Testing & Balancing	Verify HVAC performance
Permit Closeout	Final regulatory approvals
Certificate of Occupancy	Legal occupancy approval
As-Builts / Record Docs	Final facility records
Warranty Turnover	Protect owner interests
LEED Documentation	Sustainability certification
Final Cleaning	Occupancy readiness

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1. Substantial Completion

Substantial Completion is one of the most critical project milestones.

It generally means:

"The project is sufficiently complete so the owner can occupy or use the facility for its intended purpose."

CM/GC Responsibilities for Substantial Completion

The contractor coordinates:

- final inspections,
- testing,
- life safety approvals,
- temporary occupancy requirements,
- and punch list preparation.

Typical Requirements Before Substantial Completion

Life Safety Systems Operational

- Fire alarm
- Sprinklers
- Emergency lighting
- Egress systems
- Smoke control systems

Building Systems Operational

- HVAC startup
- Electrical systems energized
- Plumbing operational
- Elevators functioning

Documentation Prepared

- Preliminary O&M manuals
- Testing reports
- Inspection reports
- Startup reports

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2. Punch List Management

The contractor manages:
Punch List activities.

Punch lists identify:

- incomplete work,
- damaged finishes,
- installation deficiencies,
- and correction items.

Typical Punch List Items

Architectural

- Paint touch-up
- Ceiling tile replacement
- Hardware adjustments
- Flooring repairs

MEP

- Controls calibration
- Missing labels
- Air balance corrections
- Equipment adjustments

Site

- Landscaping deficiencies
- Pavement repairs
- Drainage corrections

Jumbo Project Reality

Large projects may contain:

- tens of thousands of punch list items.

Many contractors now use:

- BIM-integrated punch systems,
- tablets,

- QR-code tracking,
- and cloud-based closeout software.

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3. Testing and Balancing (TAB)

Testing Adjusting and Balancing (TAB) verifies HVAC systems perform as designed.

The CM/GC coordinates TAB contractors, commissioning agents, engineers, and controls vendors.

TAB Activities Include

Air Systems

- Airflow measurements
- Static pressure verification
- Diffuser balancing

Hydronic Systems

- Pump balancing
- Flow verification
- Valve adjustments

Controls Coordination

- Sequence verification
- Sensor calibration
- Trend analysis

Why TAB Is Critical

Improper balancing can cause:

- occupant complaints,
- humidity issues,
- energy waste,

- pressure imbalance,
- and poor comfort performance.

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4. Commissioning

Commissioning is one of the largest closeout activities on jumbo projects.

Commissioning verifies:

“The building systems operate according to the owner’s project requirements.”

CM/GC Responsibilities During Commissioning

Coordinate:

- Vendors
- Subcontractors
- Controls contractors
- TAB contractors
- Engineers
- Facility staff

Support:

- Functional performance testing
- Startup procedures
- Deficiency correction
- Retesting
- Seasonal testing

Systems Commonly Commissioned

System	Examples
HVAC	Chillers, AHUs, VAVs
Electrical	Generators, ATS, UPS

System	Examples
Plumbing	Pumps, domestic water
Fire Alarm	Detection and notification
Security	Access control
Lighting Controls	Occupancy systems
Building Automation	Integrated controls

Deficiency Commissioning Items

Commissioning deficiencies are extremely common.

Examples include:

- incorrect control sequences
- unstable temperatures
- sensor calibration problems
- communication failures
- improper valve operation
- vibration issues,
- and startup failures.

The CM/GC must:

- track
- correct
- retest
- and close these items systematically

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5. O&M Manuals

Operations and Maintenance Manual (O&M Manual) turnover is a major contractor responsibility.

These manuals help the owner operate and maintain the building long after construction.

Typical O&M Contents

Equipment Information

- Product data
- Shop drawings
- Cut sheets
- Serial numbers

Maintenance Requirements

- Filter schedules
- Lubrication procedures
- Preventive maintenance intervals

Warranty Information

- Start/end dates
- Contact information
- Coverage requirements

Troubleshooting Information

- Alarm descriptions
- Diagnostic procedures
- Replacement parts

Modern Best Practice

Many projects now require:

- digital O&M platforms
- BIM-linked asset data
- QR-coded equipment
- and computerized maintenance management system (CMMS) integration

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6. Training

Training is one of the most overlooked but most important closeout activities.

The CM/GC coordinates training sessions for:

- facility managers
- maintenance staff
- operators
- security teams
- and custodial personnel

Typical Training Topics

HVAC Systems

- BAS operation
- Alarm management
- Seasonal adjustments

Electrical Systems

- Emergency power operation
- Switchgear procedures
- Arc flash safety

Security Systems

- Card access
- Camera systems
- Emergency lockdown procedures

Specialty Equipment

- Elevators
- Kitchen systems
- Medical equipment
- Laboratory systems

Good Training Includes

- Video recordings
- Hands-on demonstrations
- Written guides
- Emergency procedures
- Seasonal operation guidance

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7. Attic Stock

Attic Stock refers to spare materials turned over to the owner.

Common Attic Stock Includes

Architectural

- Ceiling tiles
- Carpet tiles
- Paint
- Flooring materials
- Wall panels

MEP

- Filters
- Light fixtures
- Controls components
- Valves
- Belts

Why It Matters

Attic stock helps owners:

- maintain finish consistency,
- reduce downtime,

- and avoid discontinued product problems.

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8. Permit Closeout & Certificate of Occupancy

The CM/GC coordinates final inspections required by:

- building departments
- fire marshals and fire captains
- health departments
- utilities
- regulatory agencies

Final Permit Activities

Inspections

- Life safety
- Accessibility
- Elevator inspections
- Mechanical inspections
- Fire alarm acceptance

Documentation

- Signed permits
- Testing reports
- Engineer certifications
- Special inspection reports

Certificate of Occupancy

Certificate of Occupancy (CO or C of O) is the official approval allowing legal occupancy.

Without it:

- the building often cannot legally operate.

---

9. LEED Closeout Activities

For projects pursuing:
LEED certification, the contractor may coordinate sustainability closeout tasks.

Common LEED Closeout Requirements

Indoor Air Quality Measures

- Building flush-out
- Air quality testing
- MERV filtration requirements

Documentation

- Recycled material tracking
- Regional material reporting
- Waste diversion documentation
- VOC compliance tracking

Commissioning Documentation

- Enhanced commissioning reports
- Energy system verification

Building Flush-Out

A flush-out uses large volumes of outside air before occupancy to remove:

- VOCs,
- odors,
- dust,
- and contaminants.

This supports:

- indoor air quality,

- occupant health,
- and LEED credits.

---

10. Record Drawings / As-Builts

The CM/GC coordinates final:
As-Built Drawings documentation.

These reflect actual installed conditions.

Typical As-Built Information

- Routing changes
- Underground utilities
- Valve locations
- Equipment revisions
- Field modifications

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11. Warranty Management

The contractor organizes:

- warranty start dates,
- warranty logs,
- vendor contacts,
- and corrective response procedures.

Typical Warranty Periods

Item	Typical Duration
General construction	1 year
Roofing	20+ years

Item	Typical Duration
Waterproofing	5–20 years
Equipment	Manufacturer-specific

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12. Final Cleaning and Occupancy Readiness

The CM/GC coordinates:

- deep cleaning,
- dust removal,
- touch-up work,
- site restoration,
- and occupancy preparation.

Modern Closeout on Jumbo Projects

Modern closeout increasingly includes:

- BIM-integrated turnover,
- digital twins,
- cloud-based asset management,
- QR-coded equipment,
- and AI-driven maintenance systems.

Some owners now require:

- complete digital asset databases before acceptance.

The Reality of Closeout

Closeout is often the most difficult phase because:

- subcontractors are demobilizing,
- schedules are compressed,
- owner occupancy pressure is intense,

- and thousands of details remain unresolved.

The best CM/GC teams begin closeout planning:

months before substantial completion.

Best Practices

Elite contractors treat closeout as:

“The beginning of facility operations — not the end of construction.”

That mindset produces:

- smoother occupancy,
- fewer operational failures,
- better owner satisfaction,
- reduced warranty claims,
- and stronger long-term building performance

CHAPTER 9 MOVE MANAGEMENT

Move Management for Commonwealth of Massachusetts FF&E Projects

Move Management is a critical component of capital construction and renovation projects within the Commonwealth of Massachusetts. The process involves the planning, procurement, coordination, relocation, installation, tracking, and disposal of Furniture, Furnishings, and Equipment (FF&E) to support the successful occupancy and operation of a facility. Effective move management reduces operational disruptions, protects assets, supports code compliance, and ensures that the User Agency and End Users receive functional and safe spaces upon occupancy.

FF&E items may include office furniture, workstations, seating, conference room furniture, filing systems, laboratory furnishings, educational furnishings, medical equipment, appliances, shelving, artwork, and specialty operational equipment. During project development, it is important to clearly distinguish between contractor-furnished items and owner-furnished items. Contractor-furnished items are typically procured and installed by the General Contractor as part of the construction contract and are included within the construction bid documents and specifications. Owner-furnished items are purchased directly by the Owner or User Agency and may either be owner-installed or coordinated for installation by the contractor or a third-party mover/vendor.

Early coordination between the Owner's Project Manager (OPM), Designer, Construction Manager, User Agency, and End Users is essential when developing FF&E specifications. Reviewing FF&E requirements with the User Agency before the bid documents are issued is one of the most important steps in the process. This review helps verify operational needs, furniture layouts, accessibility requirements, technology integration, storage needs, finish selections, and user preferences. Failure to properly coordinate FF&E can result in costly change orders, procurement delays, improper utility connections, incompatible furniture dimensions, insufficient storage, or end-user dissatisfaction after occupancy.

The FF&E review process should also evaluate existing furniture and equipment to determine whether items will be reused, relocated, refurbished, auctioned, sold, donated, recycled, or disposed of. Proper inventory management and tagging are important to maintain accountability throughout the move process. In many public projects, usable furniture and equipment should first be evaluated for redistribution through surplus property programs before disposal occurs. Utilizing the Commonwealth's surplus property program can provide substantial benefits, including reduced procurement costs, sustainability improvements, reduced landfill waste, and opportunities for other public agencies to reuse functional equipment and furnishings. Reuse programs also support environmental stewardship initiatives and sustainability goals.

For items that are no longer needed, disposal requirements must comply with Commonwealth regulations, environmental standards, and agency procedures. The preferred order of disposition is often:

1. Reuse within the agency or another public entity;
2. Transfer through the surplus property program;
3. Donation to qualified organizations or nonprofits;
4. Auction or public sale;
5. Recycling; and
6. Disposal.

This hierarchy promotes sustainability and responsible asset management while reducing unnecessary waste. Special attention should be given to electronic waste, appliances containing refrigerants, hazardous materials, and confidential records, all of which may require specialized disposal procedures.

Move management must also address applicable fire and life safety standards for upholstered furniture. In Massachusetts and throughout the United States, CAL 117 and CAL 133 are recognized fire safety standards commonly referenced for upholstered seating and furniture systems. CAL 117 addresses the flammability performance of upholstery materials and foam components under smolder resistance testing, while CAL 133 establishes full-scale fire testing requirements for seating furniture used in public occupancies and high-risk environments. Compliance with these standards is important in schools, healthcare facilities, dormitories, public assembly spaces, and government buildings to help reduce fire hazards and improve occupant safety. The Designer and procurement teams should verify that specified furniture products meet applicable codes, insurance requirements, and fire safety standards prior to procurement.

Packaging waste management is another important consideration during FF&E installation and occupancy transitions. Large FF&E procurements generate significant quantities of cardboard, plastic wrap, pallets, and other waste materials. Therefore, cardboard removal, recycling requirements, debris management, and waste disposal responsibilities should be explicitly written into the Request for Services (RFS) or procurement documents. Contractors and movers should be required to remove packaging materials daily, maintain clean work areas, recycle eligible materials, and comply with local waste disposal regulations. This helps maintain site safety, reduces fire hazards, supports sustainability goals, and prevents operational disruptions during phased occupancy.

The procurement of moving services is typically performed through a formal Request for Proposals (RFP) process or other public procurement method consistent with Commonwealth requirements. The mover RFP should clearly define the project scope, schedule constraints, phasing requirements, security procedures, insurance requirements, union or prevailing wage obligations if applicable, inventory tracking expectations, coordination requirements, temporary storage needs, furniture assembly/disassembly responsibilities, protection of finishes, and disposal requirements. The RFP may also require bidders to demonstrate experience with occupied renovations, healthcare facilities, laboratories, educational institutions, or large-scale public-sector relocations.

The selected mover should coordinate closely with the OPM, User Agency, IT personnel, security teams, and the construction team to develop detailed move plans, sequencing diagrams, labeling systems, and occupancy schedules. Mock moves, pilot relocations, and phased occupancy plans are often beneficial for complex projects. Successful move management ultimately supports a smooth transition from construction completion to full building operations while minimizing downtime, protecting assets, maintaining safety, and improving end-user satisfaction.

In addition to traditional furniture and equipment coordination, FF&E planning for Commonwealth of Massachusetts projects must also address computer workstations, technology integration, and wire management requirements. Modern office environments, public facilities, educational buildings, and healthcare facilities rely heavily on integrated technology systems, making early coordination between the User Agency, IT departments, Designers, and furniture vendors essential.

Computer workstations should be reviewed during the design phase to confirm operational functionality, ergonomics, accessibility compliance, monitor configurations, docking station requirements, sit-to-stand desk compatibility, power access, and data connectivity needs. Furniture layouts should be coordinated with electrical and telecommunications drawings to ensure that floor boxes, wall outlets, power poles, and data ports align with the final workstation configuration. Failure to coordinate these systems prior to bidding can result in field modifications, exposed cabling, damaged finishes, change orders, and operational inefficiencies.

Wire management requirements should be clearly identified within the contract documents and FF&E specifications. These requirements may include integrated cable trays, concealed raceways, grommets, under-desk cable management systems, power distribution modules, separation of power and low-voltage systems, and provisions for future technology expansion. Proper wire management is important not only for aesthetics, but also for safety, accessibility, cleaning, maintenance, and compliance with electrical and fire code requirements. Poorly managed wiring can create tripping hazards, obstruct accessibility clearances, interfere with custodial operations, and contribute to overheating or fire risks.

Contract documents should clearly indicate responsibility for furnishing and installing wire management components. In some cases, these items may be contractor-furnished and installed as part of the electrical or furniture package, while in other situations they may be owner-furnished through separate technology or FF&E procurement contracts. The specifications should identify coordination responsibilities between the furniture vendor, electrical contractor, IT vendor, telecommunications contractor, and mover to avoid gaps in scope.

Mock-ups and user reviews are highly recommended for workstation-intensive environments. User Agency staff and End Users should have the opportunity to review furniture layouts, monitor configurations, storage capacities, accessibility clearances, and wire management solutions prior to final procurement. This collaborative review process helps confirm that the furniture systems support operational workflows while minimizing future modifications and change orders.

During move management and occupancy phases, movers and installers should also coordinate the relocation and reconnection of computers, monitors, printers, phones, and peripheral devices. Labeling systems for technology equipment and cabling should be incorporated into the move plan to support efficient installation and minimize downtime. Coordination with IT personnel is essential to maintain data security, operational continuity, and proper activation of systems during phased occupancy transitions.

CHAPTER 10 CELEBRATIONS AND PUBLIC RELATIONS MANAGEMENT

In a capital construction project, ceremonial and commemorative events help celebrate milestones, recognize stakeholders, engage the public, support fundraising, and create a legacy for the facility. These activities are often coordinated by the Owner, Owner's Project Manager (OPM), public relations staff, architects, and construction managers.

Groundbreaking Ceremony

A groundbreaking ceremony marks the official start of construction. It is commonly held after permits, funding, and contracts are secured.

Who to Invite

Typical attendees include:

- Owner representatives and board members
- Government officials and legislators
- Donors and community leaders
- Architects, engineers, OPMs, and construction managers
- End users, staff, and students (if applicable)
- Media and local news organizations

Preparation

The project team typically prepares:

- A safe and visually appealing site area
- Hard hats, ceremonial shovels, and signage
- Podium, sound system, tenting, and seating
- Renderings, project boards, and press materials
- Parking, accessibility, and site logistics plans

The event is used to communicate the project vision, schedule, economic benefits, and community impact.

Topping Off Ceremony

A topping off ceremony occurs when the final structural beam is placed at the highest point of the building. This tradition symbolizes structural completion and recognizes the workforce.

Common elements include:

- Signing the final beam by workers and stakeholders
- Placement of an American flag and ceremonial tree on the beam
- Recognition speeches thanking contractors and trades
- Photos documenting the milestone

The construction manager coordinates crane operations, safety, and sequencing to ensure the event does not disrupt ongoing work.

Beam Raising

Beam raising is similar to a topping off ceremony but focuses specifically on erecting a major structural steel element. It highlights collaboration among the steel fabricator, erector, ironworkers, engineers, and inspectors.

Projects may incorporate:

- Permanent marker signatures on the beam
- Student or community participation
- Time-lapse photography or drone footage
- Recognition of safety achievements

This event is often integrated into public outreach and project marketing efforts.

Ribbon Cutting Ceremony

A ribbon cutting celebrates substantial completion or occupancy of the building. It formally introduces the facility to the public and recognizes all contributors.

Preparation typically includes:

- Final cleaning and staging of the facility
- Temporary certificates of occupancy or occupancy approvals
- Tours of key spaces
- Press releases and media coordination

- Commemorative scissors, ribbons, and plaques

The Owner often uses this event to highlight the project's benefits, sustainability features, and long-term community value.

Time Capsule

A time capsule preserves historical items for future generations and is often installed within a cornerstone, lobby, or wall cavity.

Items may include:

- Project drawings and photographs
- Newspapers and coins
- Letters from stakeholders or students
- Building dedication programs
- Lists of project participants

The project team must determine:

- Waterproof and durable storage materials
- Secure installation location
- Documentation of future opening instructions

Time capsules create a historical record of the project and the community at the time of construction.

Bronze Plaques

Bronze plaques provide permanent recognition and are commonly installed near entrances, lobbies, or ceremonial spaces.

Plaques may recognize:

- Donors and sponsors
- Building dedication information
- Project team participants
- Historic significance
- Sustainability certifications

The architect and Owner typically coordinate plaque size, mounting, wording, and aesthetics to match the building design.

Other Remembrances

Capital projects often include additional commemorative elements such as:

- Memorial gardens or benches
- Public art installations
- Donor walls
- Historic exhibits
- Employee recognition displays
- Cornerstones or engraved pavers

These elements strengthen community identity and provide opportunities for engagement and philanthropy.

Building and Wing Naming

Naming opportunities are frequently used in institutional and nonprofit projects to recognize major donors, public officials, historic figures, or community leaders.

Examples include:

- Entire building naming rights
- Named wings, auditoriums, classrooms, or laboratories
- Named gardens, plazas, or conference rooms

The Owner usually establishes formal naming policies addressing:

- Donation thresholds
- Approval procedures
- Ethical considerations
- Duration of naming rights

Naming strategies are often coordinated with fundraising campaigns.

Public relations management for public and private construction projects is a strategic communication function that helps build trust, maintain transparency, reduce resistance, manage expectations, and generate support throughout the planning, design, construction, occupancy, and operational phases of a project. In public-sector work especially, successful public relations management can directly influence whether a project receives funding approval, political support, community acceptance, and long-term public confidence.

In many ways, public relations management becomes the bridge between technical professionals, elected officials, stakeholders, the media, abutters, taxpayers, facility users, and the broader community.

PURPOSE OF PUBLIC RELATIONS MANAGEMENT

The objectives of public relations management in construction and facility development typically include:

- Educating the public about the purpose and value of the project
- Building trust and transparency
- Reducing misinformation and rumors
- Demonstrating responsible stewardship of public or private funds
- Managing public expectations regarding schedule, impacts, and costs
- Promoting economic, educational, environmental, and social benefits
- Coordinating communications between the Owner, OPM, A/E team, CM/GC, and stakeholders
- Supporting public votes, debt exclusions, appropriations, or bond authorizations
- Highlighting workforce participation, sustainability, and community benefits
- Preserving the reputation of the Owner and project team

For public projects, PR management often becomes just as important as technical management because perception can directly affect approvals, funding, and political momentum.

PUBLIC RELATIONS MANAGEMENT TEAM

The PR effort may include participation from:

- Owner's Project Manager (OPM)
- Public Information Officer (PIO)
- Communications consultants
- Municipal leadership
- School committees or building committees
- Economic development departments

- Legal counsel
- Design and construction leadership
- User agency leadership
- Community outreach coordinators
- Minority/Women Business Enterprise outreach specialists
- Sustainability consultants
- Media coordinators

The communication plan should establish:

- Who may speak publicly on behalf of the project
- Approval workflows for announcements
- Crisis communication procedures
- Social media protocols
- Public meeting schedules
- Documentation and media archives

COMMON PUBLIC RELATIONS MANAGEMENT ACTIVITIES

1. PROJECT ANNOUNCEMENTS

Announcements are often issued at major milestones such as:

Project Initiation

- Feasibility study announcement
- Site selection announcement
- Funding authorization
- Design team selection
- OPM procurement award
- Community visioning kickoff

Design Phase

- Conceptual design unveiling
- Public workshops
- Sustainability goals announcement
- Traffic and neighborhood impact meetings
- Educational presentations

Procurement Phase

- Bid package announcements
- Public procurement notices
- Contractor award announcements
- MWBE participation outreach events

Construction Phase

- Groundbreaking ceremonies
- Major milestone celebrations
- Structural topping-off ceremonies
- Public safety announcements
- Utility shutdown notices
- Traffic detour notices
- Community impact notifications

Closeout and Occupancy

- Ribbon-cutting ceremonies
- Grand opening celebrations
- Community tours
- Donor recognition events
- Economic impact reports
- Sustainability certification announcements

TYPES OF PUBLIC EVENTS

Groundbreaking Ceremonies

These events symbolize the official start of construction and often include:

- Elected officials
- Building committee members
- Project executives
- School or healthcare leadership
- Community representatives
- Students or residents
- Media organizations

The event may feature:

- Renderings and display boards
- Speeches
- Ceremonial shovels
- Project videos
- Drone photography
- Press interviews

These ceremonies help generate public excitement and reinforce accountability.

Public Information Sessions

These sessions educate stakeholders on:

- Project goals
- Budget
- Schedule
- Traffic impacts
- Noise mitigation
- Sustainability initiatives
- Public safety measures
- Community benefits

Visual tools often include:

- Site logistics plans
- Renderings
- BIM visualizations
- Phasing diagrams
- Flythrough animations
- Existing versus proposed comparisons

Community Outreach Meetings

These are critical when:

- Neighborhood impacts are anticipated
- Historic districts are affected
- Environmental concerns exist
- Public resistance is possible
- Eminent domain or zoning relief is required

The project team may address:

- Parking concerns
- Pedestrian circulation
- Utility disruptions
- Working hours
- Dust and noise control
- Emergency access
- Local business impacts

Strong outreach can significantly reduce opposition and litigation risk.

PUBLIC RELATIONS DURING A PROPOSED DEBT EXCLUSION

A proposed debt exclusion is one of the most sensitive and strategically managed public communication efforts in municipal construction.

In places such as the Massachusetts, a debt exclusion allows a municipality to temporarily raise taxes beyond the limits established under Proposition 2½ in order to finance a capital project such as:

- Schools
- Public safety facilities
- Libraries
- DPW facilities
- Senior centers
- Public infrastructure

Because taxpayers ultimately vote on many debt exclusions, public education and transparent communication become absolutely critical.

PUBLIC RELATIONS STRATEGIES FOR DEBT EXCLUSION CAMPAIGNS

1. EDUCATIONAL COMMUNICATIONS

The public must understand:

- Why the project is needed
- Risks of doing nothing
- Existing facility deficiencies
- Long-term operational benefits
- Energy savings
- Life-cycle cost reductions
- Safety concerns
- Educational or healthcare impacts
- Economic development impacts

Messaging must remain factual and transparent.

Typical communication tools include:

- Mailers
- Informational websites
- Public forums
- FAQ sheets
- Budget graphics
- Tax impact calculators
- Community presentations
- Social media updates
- Local cable television appearances

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2. FINANCIAL TRANSPARENCY

One of the most important PR objectives is clearly explaining:

- Total project cost
- State reimbursement opportunities
- Grant participation
- Financing structure

- Taxpayer impacts
- Debt duration
- Inflation escalation risks
- Consequences of delaying the project

Visual charts are often used to explain:

- Average household tax impacts
- Comparative municipal debt
- Operating savings
- Future maintenance avoidance

Transparency helps maintain credibility.

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3. BUILDING PUBLIC TRUST

Public trust may depend on:

- Demonstrating rigorous planning
- Showing responsible budgeting
- Independent cost estimating
- Third-party oversight
- Audit procedures
- Transparent procurement
- Schedule accountability
- Value engineering efforts

The Owner often communicates:

- "The project has been carefully vetted."
- "The costs have been independently reviewed."
- "The project meets long-term community needs."

COMMON DEBT EXCLUSION EVENTS

Town Hall Meetings

Town halls allow:

- Open public questions
- Presentation of project renderings
- Financial discussions
- Community concerns
- Stakeholder feedback

These meetings often become the defining public perception moments of the project.

Facility Tours

Existing facility tours can be extremely powerful.

The public may observe:

- Aging infrastructure
- Accessibility deficiencies
- Moisture intrusion
- Safety concerns
- Mechanical failures
- Overcrowding
- Inefficient layouts

Seeing conditions firsthand often creates stronger support than presentations alone.

Community Visioning Sessions

These workshops invite stakeholders to contribute ideas regarding:

- Educational programming
- Wellness initiatives
- Sustainability goals
- Community use spaces
- Public gathering areas
- Recreation opportunities

This helps create emotional ownership of the project.

MEDIA MANAGEMENT

Public relations management also includes media coordination.

The project team may issue:

- Press releases
- Construction updates
- Emergency notifications
- Milestone announcements
- Sustainability achievement notices
- Grant award announcements

Media strategy becomes especially important when:

- Delays occur
- Budgets change
- Community disruptions arise
- Litigation emerges
- Safety incidents occur

Strong PR management helps maintain confidence during difficult periods.

DIGITAL PUBLIC RELATIONS MANAGEMENT

Modern projects often utilize:

- Project websites
- Public dashboards
- Live webcams
- Drone progress videos
- Social media campaigns
- BIM visualization tools
- QR-code project signage
- Digital newsletters

Some Owners now provide:

- Real-time schedule milestones
- MWBE participation statistics
- Local workforce metrics
- Sustainability dashboards
- Energy modeling information

This increases transparency and public engagement.

PRIVATE FACILITY DEVELOPMENT PUBLIC RELATIONS

Private developments also require strategic PR management, especially for:

- Hospitals
- Universities
- Mixed-use developments
- Industrial campuses
- Corporate headquarters
- Affordable housing
- Sports facilities

The focus may include:

- Economic development
- Job creation
- Tax revenue
- Community partnerships
- Sustainability commitments
- Local hiring
- Infrastructure improvements

Developers often coordinate with:

- Municipal officials
- Planning boards
- Neighborhood groups
- Investors
- Media organizations

A strong public image can accelerate approvals and reduce opposition.

THE FUTURE OF CONSTRUCTION PUBLIC RELATIONS MANAGEMENT

The future of PR management in construction may become significantly more data-driven and immersive through:

- AI-assisted communication management
- Real-time public dashboards
- Digital twin visualization
- Interactive BIM presentations
- Virtual reality walkthroughs
- Predictive community impact modeling
- Automated public notifications
- Sentiment analysis from community feedback

The most successful project teams will likely combine:

- Technical excellence
- Emotional intelligence
- Radical transparency
- Community-centered leadership
- Authentic communication
- Rapid information sharing

In modern public and private development, the ability to communicate effectively with people may become just as important as the ability to design and construct the facility itself.

CHAPTER 11 THE FUTURE OF AECO INDUSTRY

THE FUTURE OF THE AECO INDUSTRY

The future of the Architecture, Engineering, Construction, and Operations (AECO) industry will not simply be defined by more advanced software, faster computers, or increasingly complex Building Information Modeling (BIM) platforms. The next evolution of the industry will be determined by the balance between authentic professional expertise, transparent collaboration, practical constructability knowledge, and the intelligent integration of artificial intelligence and automation. Technology alone will not solve the longstanding inefficiencies of the industry unless the foundational principles of communication, coordination, pattern recognition, and dimensional understanding are first strengthened.

For decades, the AECO industry has operated within fragmented silos. Architects, engineers, construction managers, facility operators, subcontractors, manufacturers, estimators, and end users have frequently worked in isolated workflows with disconnected objectives, separate software environments, and limited interdisciplinary transparency. This fragmentation has contributed to schedule delays, change orders, coordination conflicts, budget overruns, and operational inefficiencies that continue to affect both public and private sector projects worldwide.

The future of AECO will require a cultural shift just as much as a technological shift.

Authentic Professional Experience and Pattern Recognition

One of the most valuable yet least documented assets in the construction and engineering industry is authentic field experience. The ability to recognize patterns in construction sequencing, means and methods, material behavior, coordination conflicts, and operational risks is developed through years of exposure to real-world project conditions.

Experienced professionals often mentally simulate construction long before work begins in the field. They visualize:

- Structural sequencing
- Temporary supports
- Trade stacking
- Material logistics
- Equipment access
- Ceiling congestion
- Mechanical routing
- Long-lead procurement
- Safety exposures

- Facility operations after turnover

This level of pattern recognition is difficult to teach solely through textbooks or software tutorials. It is developed through observation, repetition, failure analysis, collaboration, and continuous adaptation under pressure.

The future AECO professional will need to combine:

- Technical expertise
- Construction intelligence
- Systems thinking
- Emotional intelligence
- Data literacy
- AI-assisted decision making
- Operational foresight

Artificial intelligence will increasingly automate repetitive engineering tasks, specification analysis, clash detection, quantity extraction, scheduling analysis, and document coordination. However, AI systems still rely heavily on the quality of human judgment, contextual understanding, and experiential input.

The industry must therefore preserve and capture institutional knowledge from experienced professionals before large portions of the workforce retire. The development of AI-enhanced construction knowledge systems, facility management databases, lessons-learned repositories, and intelligent construction sequencing platforms may become one of the most important initiatives of the next generation.

The Increasing Importance of Soft Skills

Despite advances in automation and BIM technologies, soft skills may become more valuable than ever.

Future project leaders will need the ability to:

- Communicate clearly across disciplines
- Resolve conflicts professionally
- Facilitate collaboration
- Manage emotional pressure
- Interpret stakeholder expectations
- Lead interdisciplinary coordination meetings
- Build trust between teams
- Translate technical complexity into understandable information

Many project failures are not caused by engineering deficiencies alone. They are often the result of:

- Poor communication
- Defensive organizational culture
- Lack of accountability
- Misaligned expectations
- Incomplete documentation
- Delayed decision-making
- Ego-driven silos
- Fear of transparency

The future AECO industry will increasingly reward leaders who can unify teams rather than control them through rigid hierarchies. Collaborative project delivery methods such as Integrated Project Delivery (IPD), Design-Assist, progressive CM at Risk, and other hybrid models demonstrate the industry's movement toward earlier contractor involvement, collective problem solving, and shared accountability.

As projects become more technically complex, human collaboration becomes even more essential.

The Need for Transparency and Industry Change

The AECO industry has historically struggled with transparency. Critical information is often distributed across disconnected emails, drawing sets, RFIs, meeting minutes, submittals, field reports, specifications, and verbal conversations. This creates informational gaps that can significantly impact project outcomes.

The future industry must move toward:

- Open information environments
- Real-time coordination platforms
- Transparent decision repositories
- Traceable design evolution
- Shared risk awareness
- Cross-disciplinary accountability
- Centralized digital documentation systems

Owners, public agencies, and facility operators are increasingly demanding lifecycle transparency rather than simply construction completion. Buildings are no longer viewed only as finished products; they are long-term operational systems requiring maintainability, adaptability, energy efficiency, and data integration.

The future "digital twin" concept will likely evolve beyond static BIM models into living operational ecosystems integrating:

- Sensors
- Building automation systems
- Maintenance histories
- Energy analytics
- Occupancy data
- Predictive maintenance
- Asset management intelligence
- AI-driven operational optimization

However, before the industry can fully realize these advanced capabilities, it must first improve its understanding of the foundational dimensions of design and construction.

The Need to Refocus on the First and Second Dimensions Before BIM

Many organizations have rapidly adopted BIM and 3D visualization technologies without fully mastering the first and second dimensions: accurate drafting, coordination clarity, constructability logic, and disciplined documentation practices.

The first dimension represents the conceptual and linear understanding of systems and relationships.
The second dimension represents the accurate translation of information into coordinated plans, sections, elevations, details, and annotations.

Without strong 2D foundations:

- 3D models inherit errors
- Clash detection becomes unreliable
- Coordination assumptions increase
- Trade conflicts multiply
- Field improvisation becomes necessary
- Project risk escalates

BIM should not replace fundamental engineering and drafting discipline. Instead, BIM should enhance already coordinated information.

The future industry must avoid over-reliance on visually impressive models that lack practical construction intelligence. A sophisticated model is only as valuable as the accuracy, completeness, and constructability of the information embedded within it.

Critical BIM Development Improvements

As BIM continues evolving, there is a growing need for more intelligent ceiling coordination and spatial awareness within design models.

One of the most common coordination problem areas in large facilities remains the ceiling plenum space. Mechanical, electrical, plumbing, fire protection, structural, lighting, audio visual, medical systems, security systems, and architectural features frequently compete for limited overhead space. Yet many BIM workflows still oversimplify ceiling systems or fail to model them with sufficient detail early enough in the design process.

Future BIM development should incorporate:

- Fully coordinated reflected ceiling plans (RCPs)
- Actual acoustical ceiling depths
- Suspension system dimensions
- Ceiling cavity clearances
- Lighting fixture depths
- Access panel requirements
- Maintenance access zones
- Finished ceiling elevations
- Structural slab-on-deck elevations
- Trade-specific installation tolerances

Ceiling heights should not merely reference generalized "finished floor" elevations. They should intelligently relate to:

- Structural slab elevations
- Floor assembly thicknesses
- Ceiling support systems
- Mechanical distribution zones
- Equipment service clearances
- Acoustical performance requirements
- Accessibility requirements
- Constructability sequencing

The future BIM environment should allow dynamic analysis of vertical spatial relationships in real time. Intelligent systems could automatically flag:

- Insufficient plenum space
- Ceiling elevation conflicts
- Access violations

- Unsafe maintenance conditions
- Code compliance risks
- Trade installation sequencing conflicts

This evolution would significantly improve coordination efficiency while reducing costly field rework and schedule impacts.

AI, Automation, and the Evolution of Engineering

The AECO industry is approaching a major transformation through AI-assisted engineering and construction management systems. Many repetitive engineering functions may eventually become partially automated, including:

- Drafting
- Quantity takeoffs
- Specification coordination
- Code cross-referencing
- Clash detection
- Construction scheduling analysis
- Submittal tracking
- Quality control reviews
- Predictive risk analysis

This does not eliminate the importance of engineers, architects, or construction managers. Instead, it elevates the profession toward higher-level thinking:

- Strategic problem solving
- Creativity
- Innovation
- Leadership
- Human-centered design
- Systems integration
- Ethical decision-making
- Operational foresight

The future AECO professional may function more like a systems orchestrator than a traditional document producer.

Conclusion

The future of the AECO industry will depend on far more than software upgrades or modeling sophistication. The industry must evolve toward a more transparent, collaborative, intelligent, and human-centered framework that combines advanced technology with authentic professional expertise and practical field knowledge.

Success will increasingly depend on:

- Pattern recognition
- Constructability understanding
- Emotional intelligence
- Interdisciplinary collaboration
- Open communication
- Lifecycle thinking
- Intelligent automation
- Accurate foundational documentation

BIM, AI, and digital twins have tremendous potential, but they must be built upon disciplined first and second dimensional coordination, practical construction knowledge, and real operational understanding.

The firms and professionals who successfully integrate human expertise with intelligent technology — while maintaining transparency, accountability, and constructability awareness — will lead the next evolution of the AECO industry.

Branching Out

Anyone reading this book, can develop multiple sources of income such as software, a product or an invention to capture a percent of the market so the industry can grow, so individuals can work safely, to offer transparency, and so you can be creative when you are ready. There are no limits so package your expertise as a product and do it in the most enjoyable manner.

The work you want will provide you with increasing levels of responsibility, it will allow you to work with people, lead if you so desire and it will allow you to be empowered when you do work as a project manager, resident engineer or entrepreneur. You will come to realize there is no shortage of work, hence, no need for competition, only creativity.

If you are not an entrepreneur, then you will be an employee working for an employer and your work will be menial but can nevertheless be a stepping stone to multiple sources of income and creative endeavors. Even your work can be incredible creative by doing it to the best of your ability and imagining how your personal work and the industry can evolve.

With a positive mental attitude (PMA) Focused Resident Engineer and project management work is incredibly healthy for the brain and body.