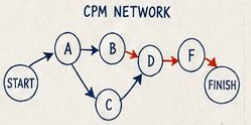
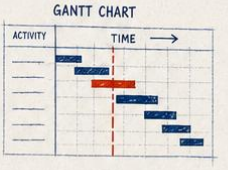
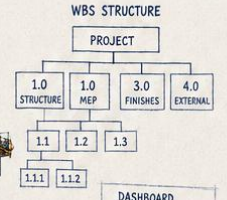
CONSTRUCTION PLANNING & SCHEDULING HANDBOOK







Practical Methods for WBS, CPM, Baselines, Progress Tracking, Delay Analysis, Recovery Planning & Executive Schedule Control



"Projects succeed by design, not by chance."

DR. HASSAN KHAMES ELIWA, PhD

Project Controls & Planning Specialist

ELIWA PROJECT CONTROLS LIMITED

AUCKLAND • NEW ZEALAND

CONSTRUCTION

PLANNING &

SCHEDULING

HANDBOOK

Practical Methods for WBS, CPM, Baselines, Progress Tracking, Delay Analysis & Recovery Planning

By Dr. Hassan Khames Eliwa

Project Controls & Planning Specialist

ELIWA PROJECT CONTROLS LIMITED

Auckland • New Zealand

Published by

Eliwa Project Controls Limited

Auckland, New Zealand

Eliwa Project Controls Limited is a specialist project controls consultancy focused on planning, scheduling, project controls, delay analysis, reporting and construction management support services.

The company combines practical project delivery experience with academic research to provide reliable, data-driven project controls solutions for infrastructure, building and engineering projects.

Additional resources, planning tools and professional insights:

eliwa.co.nz
pmmilestone

© 2026 Eliwa Project Controls Limited. All rights reserved.

No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher, except in the case of brief quotations embodied in reviews and certain other non-commercial uses permitted by copyright law.

This handbook is intended as a practical educational guide. While every effort has been made to ensure accuracy, the author and publisher accept no liability for decisions made on the basis of the material contained herein. Readers should apply professional judgement and, where appropriate, seek specialist advice for their specific projects and contracts.

First Edition - 2026

ABOUT THE AUTHOR



Dr. Hassan Khames Eliwa

Dr. Hassan Khames Eliwa is a Project Controls and Planning professional with more than 17 years of experience across infrastructure, building and engineering projects in New Zealand and internationally.

He holds a PhD in Construction Management and has published multiple academic and industry papers in project management, project controls and construction technology.

Throughout his career, Dr. Eliwa has specialised in planning, scheduling, delay analysis, project controls, earned value management and executive reporting using industry-leading platforms such as Primavera P6, Microsoft Project and Synchro 4D.

He is the founder of PMMilestone.org, a knowledge-sharing platform dedicated to practical project controls education, and Director of Eliwa Project Controls Limited, New Zealand.

His mission is simple: to make professional project controls knowledge accessible, practical and immediately useful for project teams worldwide.

CONTENTS

How to Use This Handbook 1
Part 1. Introduction to Planning 2
Part 2. Project Lifecycle 8
Part 3. WBS Development 13
Part 4. Activity Definition 19
Part 5. Sequencing Logic 25
Part 6. CPM Fundamentals 30
Part 7. Critical Path Analysis 35
Part 8. Float Management 40
Part 9. Baseline Scheduling 45
Part 10. Progress Updating 50
Part 11. Lookahead Planning 55
Part 12. Delay Analysis Basics 60
Part 13. Recovery Planning 65
Part 14. Acceleration Techniques 70
Part 15. Executive Schedule Reporting 75
Part 16. Conclusion and Summary 80
Planning Cheat Sheet 84
About This Handbook 90

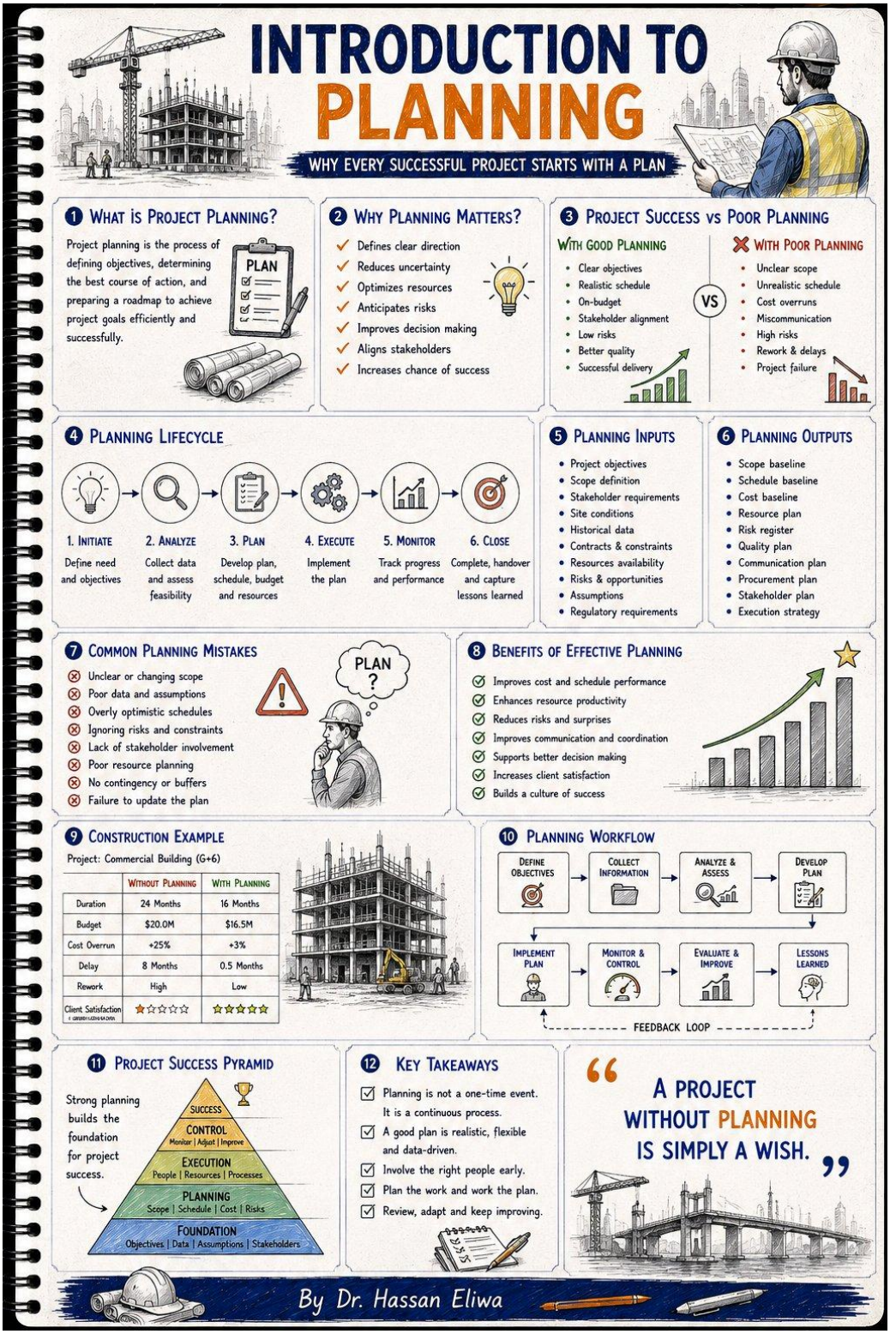
How to Use This Handbook

This handbook is built the way a real project is built: one disciplined step at a time. It begins with the purpose of planning, moves through the structures and techniques that turn intent into a schedule, and finishes with the reporting and recovery skills that keep a project on track when reality pushes back.

Each part opens with a full-page visual summary you can pin above your desk or share with your team, followed by a practical, experience-based discussion of the topic. You will find worked construction examples, comparison tables, expert tips drawn from the field, and the common mistakes that quietly wreck otherwise good schedules.

You can read the handbook cover to cover, or treat it as a reference and jump straight to the part you need. The final Planning Cheat Sheet pulls the essential rules and formulas into a single quick-reference guide.

A note on tools: the techniques here are tool-agnostic. Whether you run Primavera P6, Microsoft Project, or a well-built spreadsheet, the principles are the same. Good planning is a way of thinking before it is a piece of software.


INTRODUCTION TO PLANNING
WHY EVERY SUCCESSFUL PROJECT STARTS WITH A PLAN
1 What is Project Planning?
Project planning is the process of defining objectives, determining the best course of action, and preparing a roadmap to achieve project goals efficiently and successfully.
PLAN
2 Why Planning Matters?
Defines clear direction
Reduces uncertainty
Optimizes resources
Anticipates risks
Improves decision making
Aligns stakeholders
Increases chance of success
3 Project Success vs Poor Planning
With Good Planning
Clear objectives
Realistic schedule
On-budget
Stakeholder alignment
Low risks
Better quality
Successful delivery
VS
With Poor Planning
Unclear scope
Unrealistic schedule
Cost overruns
Miscommunication
High risks
Rework & delays
Project failure
4 Planning Lifecycle
1. Initiate
Define need and objectives
2. Analyze
Collect data and assess feasibility
3. Plan
Develop plan, schedule, budget and resources
4. Execute
Implement the plan
5. Monitor
Track progress and performance
6. Close
Complete, handover and capture lessons learned
5 Planning Inputs
Project objectives
Scope definition
Stakeholder requirements
Site conditions
Historical data
Contracts & constraints
Resources availability
Risks & opportunities
Assumptions
Regulatory requirements
6 Planning Outputs
Scope baseline
Schedule baseline
Cost baseline
Resource plan
Risk register
Quality plan
Communication plan
Procurement plan
Stakeholder plan
Execution strategy
7 Common Planning Mistakes
Unclear or changing scope
Poor data and assumptions
Overly optimistic schedules
Ignoring risks and constraints
Lack of stakeholder involvement
Poor resource planning
No contingency or buffers
Failure to update the plan
PLAN ?
8 Benefits of Effective Planning
Improves cost and schedule performance
Enhances resource productivity
Reduces risks and surprises
Improves communication and coordination
Supports better decision making
Increases client satisfaction
Builds a culture of success
9 Construction Example
Project: Commercial Building (G+6)
Without Planning
With Planning
Duration
24 Months
16 Months
Budget
$20.0M
$16.5M
Cost Overrun
+25%
+3%
Delay
8 Months
0.5 Months
Rework
High
Low
Client Satisfaction
10 Planning Workflow
Define Objectives
Collect Information
Analyze & Assess
Develop Plan
Implement Plan
Monitor & Control
Evaluate & Improve
Lessons Learned
FEEDBACK LOOP
11 Project Success Pyramid
Strong planning builds the foundation for project success.
SUCCESS
CONTROL
Monitor | Adjust | Improve
EXECUTION
People | Resources | Processes
PLANNING
Scope | Schedule | Cost | Risks
FOUNDATION
Objectives | Data | Assumptions | Stakeholders
12 Key Takeaways
Planning is not a one-time event. It is a continuous process.
A good plan is realistic, flexible and data-driven.
Involve the right people early.
Plan the work and work the plan.
Review, adapt and keep improving.
"A PROJECT WITHOUT PLANNING IS SIMPLY A WISH."
By Dr. Hassan Eliwa

PART 1

Introduction to Planning

Why Every Successful Project Starts With a Plan

Ask any seasoned project manager about the worst project of their career and they will rarely point to a technical failure. They will tell you about the project that drifted. The one where nobody could say with confidence what was supposed to happen next, where the schedule on the wall stopped matching the work on the ground sometime in the second month, and where every meeting turned into an argument about who promised what. Projects very seldom fail because the concrete was poured incorrectly. They fail because the plan was thin, optimistic, or simply absent.

This handbook is written from inside that reality. Over many years working as a planner and project controls engineer across infrastructure, building, and engineering projects, I have learned that planning is not paperwork you produce to satisfy a contract clause. It is the operating system of the project. A good plan tells the team what to do, when to do it, what they need to do it, and how you will know whether it worked. Everything else in project controls, from the critical path method to delay analysis, is built on this foundation.

What Project Planning Actually Is

Project planning is the disciplined process of defining objectives, deciding the best course of action to reach them, and turning that decision into a roadmap the whole team can follow. It converts intention into instruction. A vague ambition such as build a six-storey commercial building becomes a structured set of deliverables, activities, durations, sequences, resources, and dates that people can actually execute against.

It is worth separating planning from scheduling, because the two terms are often used as if they mean the same thing. Planning is the thinking: what work is needed, how it breaks down, in what logical order, and what could go wrong. Scheduling is the calculation: applying durations and a calendar to that logic to produce dates. You can have a schedule without a plan, and it will be a beautifully formatted set of dates that nobody believes. You cannot have a credible schedule without first doing the planning.

> **EXPERT TIP**
> If you cannot explain your schedule in plain language to the site foreman in two minutes, you have built a calculation, not a plan. The test of a plan is whether the people doing the work recognise their own job in it.

Why Planning Matters

Planning earns its place because it does several things at once that no other process does. It defines a clear direction so that hundreds of people pulling in slightly different directions can be aligned to one finish line. It reduces uncertainty by forcing the team to think through the work before committing money to it. It optimises resources, because once you can see the whole sequence you can level crews and avoid the classic problem of three trades fighting over the same floor in the same week. It anticipates risk while there is still time to do something about it. And it dramatically improves decision making, because decisions made against a plan are decisions made with context.

The contrast between good and poor planning is not subtle on a real project. The table below is drawn from a pattern I have seen repeated on commercial building projects of similar size and scope. The numbers are illustrative, but the shape of the difference is entirely real.

Commercial Building (G+6): Planned vs Unplanned Delivery

Measure	Without Planning	With Planning
Duration	24 months	**16 months**
Budget	$20.0M	**$16.5M**
Cost overrun	**+25%**	**+3%**
Schedule slip	**8 months**	**0.5 months**
Rework volume	**High**	**Low**
Client satisfaction	**Poor**	**Strong**

The unplanned project did not cost more because the materials were more expensive. It cost more because work was done out of sequence, then undone, then done again. It slipped because nobody saw the collisions coming. The planned project was not lucky. It simply spent a small amount of effort up front to avoid a large amount of waste later. This is the entire economic argument for planning in one table.

The Planning Lifecycle

Planning is not a single event that happens once at the start and is then filed away. It is a continuous loop that runs for the life of the project. I find it useful to think of it in six recurring stages.

1. Initiate. Define the need and the objectives. What problem is this project solving, and what does success look like in measurable terms?
2. Analyse. Collect data and assess feasibility. Understand site conditions, constraints, available resources, and historical performance on similar work.
3. Plan. Develop the work breakdown, the activities, the logic, the durations, and the resource plan. This is where the schedule is born.

4. Execute. Implement the plan. Issue the work, mobilise the crews, and start producing.
5. Monitor. Track progress and performance against the plan. Measure what is really happening, not what you hoped would happen.
6. Close. Complete the work, hand over, and capture lessons learned so the next project starts smarter.

The important word is recurring. You do not initiate once. Every change order, every new work package, every recovery effort runs through a smaller version of the same loop. The teams that treat planning as a living process consistently outperform the teams that treat it as a document.

Inputs and Outputs of Planning

A plan is only as good as the information you feed into it. When planning is rushed, it is almost always because the inputs were not ready and the planner was forced to invent assumptions to fill the gaps. The strongest plans begin with a deliberate gathering of inputs and end with a defined set of outputs that the rest of the project relies on.

What goes in, and what comes out

Planning Inputs	Planning Outputs
Project objectives	Scope baseline
Scope definition	Schedule baseline
Stakeholder requirements	Cost baseline
Site conditions	Resource plan
Historical data	Risk register
Contracts and constraints	Procurement plan
Resource availability	Communication plan
Assumptions and regulations	Execution strategy

Notice that several inputs are things many teams skip. Historical data, for example, is the single most underused input in our industry. If you have built three similar buildings, your own past actual durations are worth more than any textbook productivity rate. Assumptions are another. Every plan rests on assumptions, and the difference between a professional and an amateur is that the professional writes them down. An undocumented assumption is a future dispute waiting to happen.

Common Planning Mistakes

Most planning failures are not exotic. They are the same handful of errors repeated on project after project. Recognising them early is most of the battle.

COMMON MISTAKES TO AVOID

- Unclear or constantly changing scope that is never frozen long enough to plan against.
- Poor source data and assumptions that are never written down or challenged.
- Overly optimistic durations that assume perfect productivity and zero disruption.
- Ignoring known risks and physical constraints such as access, laydown, and weather.
- Lack of involvement from the people who will actually do the work.
- No contingency or buffers, so the first minor delay consumes the entire margin.
- A plan that is built once and never updated as reality unfolds.

The Benefits of Getting It Right

When planning is done properly the benefits compound. Cost and schedule performance improve because work flows in the right order. Resource productivity rises because crews are not waiting on predecessors or tripping over each other. Risks and surprises reduce because the team has already thought through the hard parts. Communication improves because everyone is working from the same picture. Decisions get faster and better because they are anchored to a baseline. Clients trust the team more, and that trust translates into smoother approvals and fewer adversarial moments. Over time, an organisation that plans well builds a genuine culture of delivery.

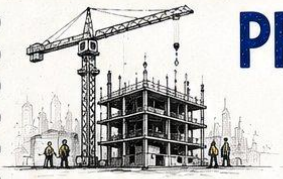
A Worked Mindset: The Project Success Pyramid

I often draw a simple pyramid for new planners. At the base sits the foundation: objectives, data, assumptions, and stakeholders. On top of that sits planning itself: scope, schedule, cost, and risk. Above that sits execution: people, resources, and processes. Near the top sits control: monitor, adjust, and improve. And only at the very peak sits success. The point of the image is blunt. You cannot stand success on top of a missing foundation. Strong planning is the layer that makes every layer above it possible.

KEY TAKEAWAYS

- Planning is the operating system of the project, not administrative overhead.
- Planning is the thinking; scheduling is the calculation. Do them in that order.
- A good plan is realistic, flexible, and driven by data, not optimism.
- Involve the people who will do the work, and involve them early.
- Plan the work, then work the plan, then review, adapt, and keep improving.

"A project without planning is simply a wish."



PROJECT LIFECYCLE

UNDERSTANDING THE JOURNEY FROM CONCEPT TO CLOSEOUT



1 Concept Phase

- Identify need and objectives
- Define vision
- Initial ideas
- Business case

2 Feasibility Phase

- Market analysis
- Technical feasibility
- Financial analysis
- Go / No-Go decision

3 Design Phase

- Develop design
- Engineer systems
- Estimate costs
- Prepare drawings & specifications

4 Procurement Phase

- Plan procurement
- Bid & evaluate
- Award contracts
- Mobilize suppliers & vendors

5 Construction Phase

- Execute work
- Manage resources
- Monitor progress
- Ensure quality & safety

6 Commissioning Phase

- System testing
- Pre-commissioning
- Commissioning
- Performance verification

7 Closeout Phase

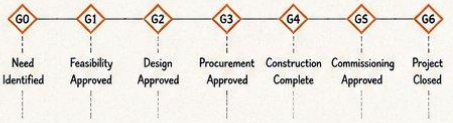
- Final inspection
- Handover
- Documentation
- Lessons learned
- Contract closeout

Lifecycle Timeline (Example)

Concept	Feasibility	Design	Procurement	Construction	Commissioning	Closeout
1–2 Months	2–3 Months	3–6 Months	2–4 Months	12–24 Months	1–2 Months	1–2 Months

Total Project Duration: ~ 21 to 39 Months (Depend on Project Size & Complexity)

Decision Gates



Stakeholder Involvement

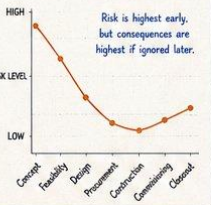
Stakeholder	1	2	3	4	5	6	7
Owner / Client	●	●	●	●	●	○	●
Project Manager	●	◐	◐	◐	○	○	○
Design Team	●	◐	◐	◐	○	○	○
Contractor	●	◐	◐	◐	○	○	○
Suppliers	●	◐	◐	◐	◐	○	○
Regulators	●	◐	◐	◐	◐	◐	○
End Users	◐	◐	◐	◐	◐	◐	◐

● High Involvement ◐ Medium Involvement ◐ Low Involvement ○ Minimal / As Needed

Cost Influence Curve



Risk Profile Over Time



Construction Example: Office Building Project

Phase	Key Activities	Duration (Example)	% of Total Cost Locked In
Concept	Define requirements, site shortlist, preliminary budget	1 Month	5%
Feasibility	Site studies, financial analysis, feasibility report	2 Months	15%
Design	Architectural & structural design, MEP design, permits	4 Months	35%
Procurement	Tendering, contract award, long-lead items	3 Months	60%
Construction	Site work, structural, MEP, finishes	16 Months	85%
Commissioning	Testing systems, balancing, training	1 Month	95%
Closeout	As-built docs, O&M manuals, final handover	1 Month	100%

Lesson: Most cost is locked in before construction begins.

Lifecycle Responsibilities (RACI Summary)

Phase	Owner	PM	Design Team	Contractor	Suppliers
Concept	A	R	C	I	I
Feasibility	A	R	C	I	I
Design	A	R	R	C	C
Procurement	A	R	C	C	R
Construction	C	A	C	R	C
Commissioning	C	A	C	R	C
Closeout	A	R	C	C	C

R = Responsible A = Accountable C = Consulted I = Informed

Key Takeaways

- ☑ Every phase adds value and reduces uncertainty.
- ☑ Front-end planning determines project success.
- ☑ Decisions early = lower cost, fewer changes.
- ☑ Engage the right stakeholders at the right time.
- ☑ Control the plan, or the plan will not control you.

> "The earlier decisions are made, the greater their impact."



Remember

A well-managed lifecycle leads to:

- ☑ On-time delivery
- ☑ On-budget performance
- ☑ Quality outcomes
- ☑ Happy stakeholders
- ☑ Sustainable value

By Dr. Hassan Eliwa

PART 2

Project Lifecycle

Understanding the Journey From Concept to Closeout

Every project, no matter how large or small, travels through a recognisable journey. It begins as an idea, passes through a series of distinct phases, and ends with a building handed over and the books closed. Understanding this journey is not an academic exercise. The phase you are in determines what decisions are still open, how much they cost, and who needs to be in the room. A planner who understands the lifecycle reads a project the way an experienced sailor reads the weather: they know what is coming and they prepare for it before it arrives.

The Seven Phases

Different organisations slice the lifecycle into different numbers of phases, but the underlying logic is consistent. I work with a seven phase model because it maps cleanly onto how construction projects are actually procured and delivered.

The construction project lifecycle

Phase	Core Purpose	Key Outputs
1. Concept	Identify the need and define the vision	Business case, initial ideas
2. Feasibility	Test whether the idea is viable	Go / no-go decision
3. Design	Turn the concept into drawings	Drawings and specifications
4. Procurement	Secure contractors and suppliers	Awarded contracts
5. Construction	Build the works	Completed physical works
6. Commissioning	Prove the works perform	Tested, working systems
7. Closeout	Hand over and close the books	As-builts, lessons learned

Each phase exists to reduce uncertainty and add value. Concept asks whether we should do this at all. Feasibility asks whether we can. Design decides exactly what we will build. Procurement decides who will build it and for how much. Construction produces the physical asset. Commissioning proves it works. Closeout captures the knowledge and releases the team. Skipping or compressing a phase rarely saves time in the end; it simply moves the problem downstream where it is more expensive to fix.

A Realistic Timeline

New planners often underestimate how front loaded the calendar is not. On a typical mid sized building, construction dominates the timeline even though the early phases dominate the decisions. The example below shows indicative durations for an office building.

Indicative lifecycle durations (office building)

Phase	Typical Duration
Concept	1-2 months
Feasibility	2-3 months
Design	3-6 months
Procurement	2-4 months
Construction	12-24 months
Commissioning	1-2 months
Closeout	1-2 months
Total	**~21-39 months**

Notice the spread in the total. The same building type can take twenty one months or thirty nine depending on size, complexity, ground conditions, and how decisive the client is in the early phases. That last factor is the one most teams ignore. A client who takes four extra months to approve a design has not saved time; they have simply shifted the project end date out by four months, often while still expecting the original handover date.

Decision Gates

The phases are separated by decision gates, sometimes labelled Go through G6. A gate is a deliberate checkpoint where the organisation decides whether to proceed, hold, or stop. Need identified, feasibility approved, design approved, procurement approved, construction complete, commissioning approved, project closed. Gates protect the organisation from pouring money into a project that no longer makes sense. The discipline of a gate is its honesty: it must be genuinely possible to say no. A gate that can only ever say yes is theatre, not control.

> **EXPERT TIP**
> Treat every decision gate as a chance to re baseline reality. The information you have at the design gate is far better than what you had at concept. Use it. Refusing to update the plan because it was approved months ago is how projects quietly drift away from the truth.

The Two Curves Every Planner Must Internalise

If you remember nothing else from this chapter, remember these two relationships, because they explain why early phases matter so much.

The Cost Influence Curve

Early in the project, your ability to influence the total cost is enormous and the money actually spent is tiny. A single decision at concept stage, such as the structural system or the building footprint, locks in a large share of the eventual cost. By the

time you are deep in construction, almost everything is already committed and your influence over total cost has collapsed to a sliver. The lesson is stark: the cheapest place to save money is on paper, at the start. The most expensive place is on site, at the end.

The Risk Profile Over Time

Risk is highest at the beginning when the most is unknown, and it declines as decisions are made and uncertainty is resolved. But there is a sting in the tail. Risks that are ignored early do not disappear; their consequences grow. A poorly resolved design risk that is waved through at the design gate can re emerge during commissioning as a very expensive, very public problem. Risk that is highest early becomes most consequential late if it is not actively managed.

Stakeholder Involvement Across the Lifecycle

Different people matter at different times. The owner and design team dominate the early phases. The contractor and suppliers take over through procurement and construction. Regulators appear at predictable points, and end users matter most at commissioning and handover. A common failure is engaging stakeholders too late: bringing the contractor in only after the design is frozen, then being surprised when they say it cannot be built economically. Early contractor involvement, where the procurement model allows it, consistently produces more buildable designs.

Lifecycle Responsibilities (RACI)

Clarity about who is responsible, accountable, consulted, and informed prevents an enormous amount of friction. The summary below shows a typical pattern across the phases for the major parties.

RACI summary across phases (R=Responsible, A=Accountable, C=Consulted, I=Informed)

Phase	Owner	PM	Design	Contractor
Concept	A	R	C	I
Feasibility	A	R	C	I
Design	A	R	R	C
Procurement	A	R	C	C
Construction	C	A	C	R
Commissioning	C	R	C	R
Closeout	A	R	C	C

Construction Example: How Cost Gets Locked In

Consider an office building. At concept, perhaps five percent of the total cost is locked in through high level decisions. By the end of feasibility, fifteen percent. After design, around thirty five percent. After procurement, sixty percent. Once you are well into

construction, eighty five percent and rising. By commissioning and closeout, you are simply confirming what was already decided. The lesson, repeated across thousands of projects, is that most cost is locked in before construction even begins. The planner who fights for quality decisions in design and procurement is fighting where the leverage actually is.

COMMON MISTAKES TO AVOID

- Treating early phases as a formality and rushing to get on site.
- Freezing the design before the contractor has reviewed buildability.
- Allowing decision gates to become rubber stamps that never say no.
- Engaging key stakeholders only after their input can no longer change anything.
- Assuming the plan approved at one gate is still valid two gates later.

KEY TAKEAWAYS

- Every phase reduces uncertainty and adds value; do not skip them.
- Front end planning determines project success more than site heroics.
- Decisions made early cost less and influence more.
- Engage the right stakeholders at the right time, not after the fact.
- Control the plan, or the plan will not control the project.

"The earlier decisions are made, the greater their impact."

WORK BREAKDOWN STRUCTURE (WBS)

BREAKING COMPLEX PROJECTS INTO MANAGEABLE WORK

1 What is WBS?

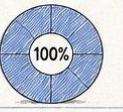
A Work Breakdown Structure (WBS) is a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables.

2 WBS Principles

- ☑ Focus on deliverables, not activities
- ☑ Decompose to the right level of detail
- ☑ Each element has a single parent
- ☑ Elements at the same level are peers
- ☑ Use consistent rules for all branches
- ☑ Keep it simple and usable

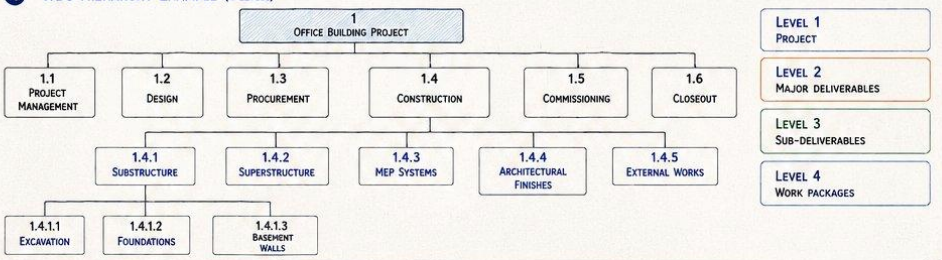
3 100 Percent Rule

The sum of the WBS components must represent 100% of the total project scope – no more, no less.

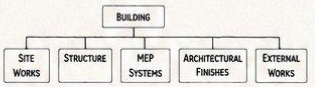


- ☑ All scope included
- ☑ No duplication
- ☑ No gaps
- ☑ Complete and mutually exclusive

4 WBS Hierarchy Example (4 Levels)

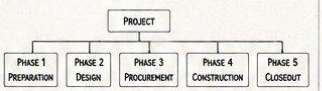


5 Deliverable-Based WBS



Organized by major deliverables the project will produce.

6 Phase-Based WBS



Organized by project phases or life cycle stages.

7 Coding Structure (Example)

Code Example	Description
1	Project
4	Major Deliverable
2	Sub-Deliverable
3	Work Package
1	Sequence

Consistent coding helps in sorting, filtering and reporting.

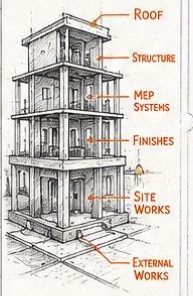
8 WBS Dictionary

The WBS Dictionary provides detailed information about each WBS element.

- Scope description
- Deliverables
- Acceptance criteria
- Responsible organization
- Assumptions & constraints
- Related documents
- Cost account / Code

9 Construction Building Example (WBS Summary)

Level 1 Major Deliverables	Level 2 Sub-Deliverables (Examples)	Level 3 Work Packages (Examples)
1.0 Project Management	• 1.1 Project Planning • 1.2 Project Control • 1.3 Administration • 1.4 HSE Management	• 1.2.1 Schedule Control • 1.2.2 Cost Control • 1.2.3 Reporting
2.0 Site Works	• 2.1 Mobilization • 2.2 Excavation • 2.3 Backfilling • 2.4 Temporary Works	• 2.2.1 Bulk Excavation • 2.2.2 Excavation Support • 2.2.3 Disposal
3.0 Structure	• 3.1 Substructure • 3.2 Superstructure • 3.3 Stairs & Ramps	• 3.2.1 Columns • 3.2.2 Beams • 3.2.3 Slabs
4.0 MEP Systems	• 4.1 HVAC • 4.2 Electrical • 4.3 Plumbing	• 4.2.1 Power Distribution • 4.2.2 Lighting • 4.2.3 Fire Alarm
5.0 Architectural Finishes	• 5.1 Walls & Partitions • 5.2 Flooring • 5.3 Ceilings	• 5.2.1 Tiles • 5.2.2 Stone • 5.2.3 Vinyl
6.0 External Works	• 6.1 Roads & Paving • 6.2 Landscaping • 6.3 Utilities	• 6.1.1 Road Base • 6.1.2 Asphalt Paving • 6.1.3 Kerbs & Gutters



10 Benefits of WBS

- ☑ Clear scope definition
- ☑ Better cost estimating
- ☑ Improved scheduling
- ☑ Enhanced resource planning
- ☑ Better communication
- ☑ Easier scope control
- ☑ Improved risk management

11 Common Mistakes

- ✗ Mixing activities with deliverables
- ✗ Too many or too few levels
- ✗ Lack of consistency
- ✗ Overly detailed (gold plating)
- ✗ Not aligning with scope
- ✗ Poor or missing WBS Dictionary
- ✗ Not updating the WBS

12 WBS vs Activity List

	WBS (Deliverable-Based)	Activity List (Task-Based)
Focuses on	What needs to be delivered	What needs to be done
Level	Summary to detail (scope)	Detailed tasks
Purpose	Define scope	Plan and schedule work
Changes	Changes are controlled	Changes are frequent
Responsibility	Aligned to organization	Aligned to execution team

WBS defines the WHAT, Activity list defines the HOW.

13 Key Takeaways

- ☑ WBS is the foundation of scope, cost and schedule.
- ☑ It must be deliverable-oriented and complete.
- ☑ Use a consistent structure and coding.
- ☑ Involve the right people in building the WBS.
- ☑ A good WBS makes everything else easier.

> *"If the work is not defined, it cannot be managed."*

By Dr. Hassan Eliwa

PART 3

WBS Development

Breaking Complex Projects Into Manageable Work

There is an old piece of advice about how to eat an elephant: one bite at a time. The Work Breakdown Structure, or WBS, is how we cut the elephant into bites. It is, in my experience, the single most important and most neglected tool in project controls. Get the WBS right and the schedule, the cost plan, the risk register, and the reporting all fall into place with surprising ease. Get it wrong and every downstream process inherits the confusion.

What a WBS Really Is

A Work Breakdown Structure is a hierarchical decomposition of the total scope of work to be carried out by the project team in order to deliver the project objectives. That formal definition matters word by word. It is hierarchical, meaning it breaks down from the top in levels. It covers the total scope, meaning everything, with nothing left out. And it is about the work that produces deliverables, not a random list of tasks. The WBS answers one question above all others: what are we delivering?

It helps to be precise about a distinction that trips up many teams. A WBS is deliverable oriented. It describes what will be produced: the substructure, the superstructure, the MEP systems, the finishes. It is not, at its core, a list of activities. Activities come later, when we decide how to produce each deliverable. The WBS defines the what; the activity list defines the how.

The Principles That Keep a WBS Honest

- Focus on deliverables, not activities. If an element does not produce something, it does not belong in the WBS.
- Decompose only to the level of detail you can actually manage and report. More levels is not automatically better.
- Give every element a single parent. An element that reports to two parents creates double counting.
- Keep elements at the same level as genuine peers, comparable in nature and scale.
- Use consistent rules down each branch so the structure is predictable.
- Keep it simple and usable. A WBS nobody can navigate is a WBS nobody will use.

The 100 Percent Rule

The most important rule in the whole discipline is the 100 percent rule. The sum of the work at any level of the WBS must equal 100 percent of the work of its parent. No more, no less. This single rule guarantees four things at once: all scope is included, nothing is duplicated, there are no gaps, and the children are complete and mutually exclusive. If your six level two elements do not add up to the whole project, you have either lost scope or double counted it, and that error will haunt every cost and schedule report you ever produce from that structure.

> **EXPERT TIP**
> Test the 100 percent rule out loud. Point at a parent element and ask, do these children, added together and nothing else, fully produce this parent? If the honest answer is no, the structure is broken, and no amount of clever scheduling later will fix it.

A Four Level Hierarchy Example

Consider an office building project. A clean WBS might run as follows. Level one is the project itself. Level two captures the major deliverables: project management, design, procurement, construction, commissioning, and closeout. Level three breaks the larger deliverables into sub deliverables, so construction becomes substructure, superstructure, MEP systems, architectural finishes, and external works. Level four reaches the work package level, where substructure becomes excavation, foundations, and basement walls. The levels carry meaning: level one is the project, level two is major deliverables, level three is sub deliverables, level four is work packages.

WBS levels and their meaning

Level	Represents	Example
1	The project	Office Building Project
2	Major deliverables	1.4 Construction
3	Sub-deliverables	1.4.1 Substructure
4	Work packages	1.4.1.2 Foundations

Two Ways to Organise: Deliverable Based and Phase Based

There are two dominant ways to structure the top of a WBS, and choosing well depends on the project. A deliverable based WBS organises the work around the things the project will produce: site works, structure, MEP, finishes, external works. A phase based WBS organises around the stages of the lifecycle: preparation, design, procurement, construction, closeout.

Deliverable-based vs phase-based structures

END OF FREE SAMPLE

Enjoyed the first 20 pages?

Keep reading Construction Planning & Scheduling Handbook by Dr. Hassan Khames Eliwa, PhD — available as an instant PDF download, paperback and hardcover.

Get the full book →

pmmilestone.org/books

Buying for a class, course or team?
Bulk PDF licences, printed copies and instructor review copies are available for training providers, universities and PMOs.

pmmilestone.org/for-training-providers

© 2026 Eliwa Project Controls Limited · Auckland, New Zealand.
Free sample — please share the link, not the file.