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RESEARCH & DECISION STUDIO

# The anatomy of delivery

Dependency visibility and explicit change control matter more than the appearance of a complete schedule.

Project execution, dependencies and governance

METHODS / EVIDENCE / WORKED STUDIES

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## THE DECISION

# The anatomy of delivery

A schedule is useful when it represents commitments, dependencies and acceptance conditions that govern delivery. This playbook distinguishes a complete-looking chart from a controlled model of work, then connects network reasoning to estimation, interfaces, baselines, change decisions, accepted progress, recovery and commissioning. Frozen fictional studies reproduce the Delivery atlas calculation and show how sequencing, duration changes, omitted release work and parallel paths alter the result. The selected-path normal deadline approximation remains explicitly separate from whole-project completion confidence. Practical records preserve the evidence, authority and conditions needed to act on a forecast. Public institutional guidance supplies scoped methods rather than empirical duration rates for an unnamed project. The recommendation is conditional: use dependency visibility and change control where they improve the decision, while adapting the planning method when discovery, scarce resources or noncompensable constraints make a fixed precedence model insufficient.

## Questions this study answers

- Which accepted outcomes and dependency evidence make the delivery baseline usable?
- When does a duration or interface change move the critical path or invalidate the apparent margin?
- What distinguishes accepted progress from activity, expenditure and an optimistic forecast?
- Which authority and evidence should permit baseline change, recovery action and service handover?

## Scope and limits

Illustrative inputs explain mechanisms and are not actual project data or empirical estimates.

A deterministic model cannot establish implementation feasibility, legal effect, lender acceptance or future outcomes.

Cited public guidance is used only within explicitly stated source scope; institutional frameworks require local adaptation.

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## DECISION ARCHITECTURE

01

# A schedule is a model of commitments

*A delivery control charter*

## A chart becomes a promise

A delivery schedule becomes consequential when someone relies on it. A sponsor reserves funding, an operator prepares a shutdown, a supplier books a factory slot, or a regulator arranges an inspection. The date then represents more than a planning preference. It carries conditions about what will be ready, which dependencies will have been satisfied, and who will accept the outcome. A useful control system makes those conditions visible before reliance hardens into a commitment. A beautifully complete chart can conceal them just as easily as a rough list.

The starting question is therefore not whether every activity has a bar. It is what decision the schedule should support. An internal design forecast may help allocate engineers without being suitable for a customer delivery promise. A financing milestone may require an accepted certificate rather than physical completion. A commissioning window may depend on operating staff and permissions absent from the construction programme. These uses need different control perimeters. One shared schedule can serve them only if its milestones preserve their distinctions instead of collapsing them into a single label such as complete.

This playbook develops a fictional equipment installation. Design release enables equipment supply and receiving works. Assembly waits for both branches; integrated tests and an acceptance decision follow. The case is expressly invented to reveal scheduling mechanisms. It is not an observed project, a productivity benchmark, or an estimate for a client. The companion Delivery atlas computes the frozen networks. Its scope is a finish-to-start dependency model with continuous elapsed weeks. Resource limits, working calendars, contractual lags, cash flow and rework are discussed as separate control questions because the app does not calculate them.

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

The reference network produces an illustrative expected completion of 19.00 weeks. The word expected describes the engine's use of estimated task means, not a verified likelihood that an organisation can deliver by

that date. Missing work, unavailable crews or disputed acceptance could make the model unsuitable even when its arithmetic is exact. Model integrity and operational credibility require different evidence. Reproducing a calculation establishes what follows from the entered assumptions. It does not establish that the entered assumptions deserve to be relied upon.

A sponsor should state the commitment at the level where consequences occur. For an equipment installation, this might be a tested system available for operator acceptance, with specified outstanding items excluded. The statement names the beneficiary, the acceptance evidence and the permitted exclusions. It also names the forecast owner. When these are absent, a date can drift between meanings during a meeting without any visible change to the baseline. Explicit meaning is the first defence against a programme that appears stable while the promised outcome changes.

### *Permit reliance only for a stated use*

Use an internal forecast when its scope and uncertainty are understood. Permit an external delivery commitment only after confirming acceptance meaning, material dependencies and the authority to make the promise.

## The control charter

A control charter is a short agreement about the schedule's use. It identifies the outcome under control, the authority that can promise it, the information that informs the forecast, and the conditions that require escalation. It also separates baseline, current forecast and desired target. The baseline records an authorised reference. The forecast represents the present judgment of when accepted work can finish. The target records an aspiration or requirement. Treating these as interchangeable creates an incentive to edit assumptions until the chart resembles the target, rather than explaining the variance.

The charter should define a status date. Evidence received after that date belongs to a subsequent update, unless the publication explicitly revises its cutoff. Otherwise a team can unknowingly compare a cost report closed earlier with progress evidence gathered later. The chart looks coherent because all cells have values, while the values describe different moments. A status date is a boundary on interpretation. It should travel with exported reports and meeting extracts, since a detached screenshot rarely carries enough context to reconstruct the underlying forecast.

## Illustrative commitment charter

Complete the charter before using a network date as an external promise.

| Illustrative commitment charter |                                                                         |
|---------------------------------|-------------------------------------------------------------------------|
| Field or action                 | Illustrative completed record                                           |
| Input                           | Outcome: tested equipment available for operator acceptance             |
| Input                           | Forecast owner: integration manager                                     |
| Input                           | Commitment authority: sponsor within documented delegation              |
| Input                           | Accepted evidence: test records and readiness decision                  |
| Input                           | Cutoff: recorded status date                                            |
| Input                           | Exclusions: separately agreed outstanding works                         |
| Action                          | Distinguish baseline, current forecast and target.                      |
| Action                          | Name release conditions that cannot be represented by elapsed duration. |
| Action                          | Record who may authorise a revised promise.                             |

Commitment ownership differs from data ownership. A planner may maintain the network, a package manager may attest task readiness, and a sponsor may authorise a service promise. None should inherit another's authority through a software permission. A responsible forecast record states who supplied the evidence, who challenged it, and who accepted its use. These roles can belong to the same person in a small project, but their functions still matter. The point is to make reliance accountable without inventing a committee for every edit.

The charter also defines when a forecast becomes insufficient. A missing acceptance authority, an unresolved statutory condition or a material resource clash can prevent an external commitment even if the calculated finish remains attractive. These are release conditions, not necessarily task durations. Placing an arbitrary allowance in the network is not a substitute for resolving a categorical uncertainty. If a permit might be refused, a longer permit task cannot represent the consequence faithfully. The charter should distinguish conditional readiness from a forecast whose remaining uncertainties are only timing uncertainties.

A useful escalation trigger refers to a decision that can still change the outcome. It can be a predecessor whose acceptance evidence is unavailable before a procurement release, or a recovery action whose latest responsible decision point is approaching. A generic red flag after completion slips is

less useful because it arrives after the option has expired. The charter should connect each material trigger to an owner, response and decision window. Triggers remain conditional records, not a claim that a single fixed threshold fits every project.

### *The team already knows what complete means*

Shared experience can reduce ambiguity within a package. It does not demonstrate that a supplier, operator, sponsor and certifier use the same acceptance boundary. Test the definitions at the interfaces where reliance crosses organisations.

## Evidence and scope

Government project delivery guidance establishes expectations for directing and managing public projects.

Evidence: Government Functional Standard: Project Delivery

## Fictional case: a shutdown promise with two meanings

A fictional operator offers a shutdown window for installation. The sponsor's internal programme ends at assembled equipment, while the operator expects a tested system before the window closes. The difference has not yet appeared as a variance because both reports use the same heading, installation complete. The control charter review asks each party to describe the event it expects to rely upon. This reveals that the sponsor and operator are planning different accepted outcomes. The case is a reasoning exercise with no claimed historical event or operating duration.

The manager preserves the existing forecast and labels its narrower perimeter. The team then identifies the testing, evidence and operating decisions required for the wider promise. Some obligations may already sit inside package durations; others may be missing. The manager reconciles them before adding tasks to avoid double counting. The resulting network is less attractive visually but better describes the intended service. The sponsor can now decide whether the wider promise is executable, whether the shutdown scope should be bounded, or whether a different window is needed.

The operator also needs a fallback. If the new system is not accepted, can the existing service resume safely, and what work must remain reversible? Those questions concern the actual technical arrangement and cannot be answered by a duration range. The charter records who supplies the

fallback evidence and who accepts it. A shorter schedule is not sufficient to justify irreversible work inside a constrained shutdown. The control decision should identify the permitted intervention and the consequence if readiness remains incomplete at the release point.

The sponsor separates three dates in the meeting record: the authorised construction reference, the current forecast for accepted service and the desired shutdown outcome. This permits discussion of recovery without rewriting the earlier baseline. The operator can see the remaining evidence conditions and choose its level of reliance. If the sponsor makes a conditional reservation, the condition travels with the booking. A detached presentation should not remove it and leave the impression that the accepted-service date is firm.

The team rehearses the release question before mobilisation. The assembly contractor describes what it can finish; the test owner describes what it needs; the operator identifies the evidence required to return the system to service. Any mismatch becomes a recorded interface issue. The rehearsal is useful even without precise durations because it tests the meaning of the promise. It can prevent the organisation from reserving resources against a milestone that no one has defined consistently.

The lesson is a control rule with conditions: where an external window makes completion consequential, define the accepted outcome and fallback before treating the network finish as the promise. This does not imply that every installation requires the same shutdown process. It identifies the mechanism by which ambiguity creates exposure. A later project should inspect its own service, reversibility and authority rather than copying the fictional disposition.

## Reliance through a fictional installation

Consider a fictional sponsor preparing an operating handover. The construction manager calls assembly complete when the equipment is mechanically installed. The operator uses complete to mean that integrated tests have passed and operating instructions are approved. The contract administrator uses it to mean a certificate has been issued. No one is necessarily acting in bad faith. They are using locally sensible definitions. A programme that carries only an assembly completion bar allows those definitions to coexist until the handover meeting, when the disagreement becomes a delay rather than an early control issue.

The sponsor's charter makes these events distinct. Mechanical installation releases inspection. Accepted inspection releases integrated testing. Accepted test evidence releases the operator's readiness decision. The

certificate follows its own authority and requirements. This decomposition may reveal additional work and lengthen the visible programme. That change improves information; it does not create the underlying delay. The responsible comparison asks whether the earlier baseline omitted an obligation or assumed that it would be performed within another task. The answer determines the change record and responsibility discussion.

The charter should resist both optimism and indiscriminate contingency. Requiring every imaginable event to become a task produces a model too heavy to maintain. Leaving every interface implicit produces a model too weak to govern. The selection principle is consequence: include events that materially govern release, consume constrained capacity or create an acceptance obligation. Keep lower-level checklists in the package record when they do not independently drive cross-package decisions. The integrated network links to those records rather than duplicating their entire content.

Information quality can justify different commitments at different stages. Before supplier proposals arrive, the sponsor may commit to a decision process and a range of possible outcomes. After an executable delivery offer, receiving readiness review and confirmed testing resources, a firmer forecast may be justified. This is maturity in evidence, not merely elapsed time since planning began. The charter should allow the form of the commitment to change with evidence while preserving the history of what was previously promised and why.

Finally, the charter should describe how a user can challenge the schedule. A package owner needs a way to dispute a predecessor, an estimate basis or a completion claim without silently overwriting the baseline. The challenge record stores the question, evidence and disposition. A rejected challenge is still informative if the reasoning is recorded. It explains why the model retained its assumption and what future evidence would reopen it. This makes the schedule a controlled argument about delivery rather than a document whose apparent authority depends on its visual finish.

#### *A governance charter cannot verify execution*

The charter records control responsibilities. It supplies no physical evidence that work is feasible, no legal authority beyond the actual delegation, and no empirical task-duration distribution.

## Decision implications

- Define the accepted outcome before trusting the date.
- Separate baseline, forecast and target.
- Treat computational reproduction and commitment credibility as distinct evidence.

### DECISION ARCHITECTURE

02

# The work breakdown sets the control perimeter

*A deliverable acceptance architecture*

## Choose outcomes before activities

A work breakdown should explain what the project must deliver, not simply how its departments intend to stay busy. Organisational functions are useful for assigning effort, but their names can conceal the acceptance boundary. Engineering may report progress on drawings while procurement still lacks a releasable specification. Construction may report installed equipment while commissioning lacks approved test procedures. Starting from accepted outcomes exposes those gaps. Activities are then added because they create or verify an outcome, not because their presence makes a chart look exhaustive.

The appropriate decomposition depends on the decisions under control. A sponsor needs to see the integrated service outcome, package readiness and material release gates. A package manager needs enough detail to assign work, forecast completion and prove acceptance. An individual engineer may need a task list at a finer level. These structures should connect, but they need not have identical granularity. Copying every personal task into the sponsor's network makes maintenance expensive and weakens attention to the cross-package conditions that can govern the overall result.

An effective work package has a boundary a recipient can recognise. Its record states the deliverable, acceptance criteria, responsible producer, accepting party, required inputs and material exclusions. It also identifies the evidence of completion. Without the exclusions, a package can be interpreted to contain adjacent work after its budget and schedule have

been fixed. Without an accepting party, completed work can wait indefinitely for a decision. Without evidence, progress becomes a judgment detached from a reproducible record.

The fictional receiving works package illustrates the issue. The outcome is not simply a prepared area. It is a location ready to receive and assemble the specified equipment under agreed conditions. The accepted boundary may include dimensions, access, load capacity, utilities and inspection records. Those requirements are illustrative, not engineering advice for a real installation. The delivery logic is that the receiving outcome must be defined from the successor's need. A locally complete civil package that cannot support assembly is incomplete at the integration boundary.

Decomposition should follow uncertainty as well as physical structure. A novel design element may need a separate evidence milestone before detailed production is committed. A repeatable fabricated component may be controlled as a supplier package with documented inspections. Applying the same task granularity to both creates false precision. The uncertain element needs a learning decision and possible redesign branch; the repeatable element needs an executable production and acceptance basis. A useful work breakdown makes the difference visible rather than assuming every package is the same kind of work.

### *Approve the package boundary before the baseline*

Confirm deliverable, exclusions, acceptance evidence and recipient authority before allocating a package duration. Reopen the boundary when phase change or new evidence adds a material obligation.

## The acceptance perimeter

A control perimeter states which work and conditions the schedule includes. It can be smaller than the whole undertaking, but the excluded conditions must be explicit when the date is used. A contractor's programme may include installation but exclude operating permits. That can be appropriate for managing the contractor's obligation. It becomes misleading if presented as the date when the overall service will begin. The same network therefore needs different labels when shown to different audiences, unless it is expanded to contain the wider readiness conditions.

Perimeter exclusions should be owned. A line reading permits by others does not explain whether the permit is a prerequisite, who forecasts it, or what happens if it is refused. The integrated record should identify the external dependency and connect it to the relevant release point. The

project need not invent control over an authority it does not possess. It should acknowledge reliance on that authority, record the latest evidence and state the conditional nature of downstream commitments. Explicit lack of control is useful information; vague exclusion is not.

Illustrative receiving-package acceptance matrix

A fictional record distinguishes work performed from the release evidence needed by assembly.

| Illustrative receiving-package acceptance matrix |                  |                                              |                                           |
|--------------------------------------------------|------------------|----------------------------------------------|-------------------------------------------|
| Requirement                                      | Producer         | Acceptance evidence                          | Recipient decision                        |
| Equipment configuration                          | Supplier         | Released configuration and inspection record | Accept for assembly or reject discrepancy |
| Receiving interface                              | Works manager    | Verified interface against released need     | Release location or retain restriction    |
| Assembly access                                  | Site coordinator | Approved access and readiness record         | Permit assembly mobilisation              |
| Residual items                                   | Package owner    | Owned exception list with conditions         | Qualified release or hold                 |

A package acceptance test should distinguish an objective requirement from a preference that may emerge later. If the recipient expects a certain interface, configuration or document, that expectation should be specified before release. Later refinements may be legitimate changes, but they should not be retrospectively labelled failed completion of an undefined requirement. This protects both delivery integrity and fair responsibility. The acceptance record is not merely a policing device for suppliers. It also disciplines the recipient's ability to add obligations after work is substantially complete.

Completion evidence can be staged. A drawing package may be accepted for procurement while final operating documentation remains open. A subsystem may be accepted for integration while final performance demonstration awaits the complete system. Conditional acceptance is possible when the condition, residual obligation and consequence are recorded. It is unsafe when a qualified release is later reported as unconditional completion. The work breakdown should preserve the distinct acceptance stages so progress can be counted against the right boundary.

A controlled perimeter also makes double counting visible. Shared commissioning preparation can appear inside both the construction and operations packages, while each team assumes the other will supply the procedure. Conversely, both may budget it and the integrated estimate

may add it twice. A responsibility map links each obligation to a producing owner and an accepting owner. Financial allocation can differ from technical ownership, but the record should explain that difference. The schedule does not resolve allocation by assigning a task to the person who happens to update it.

### *Detailed scope freezes innovation too early*

Acceptance outcomes can be defined without prematurely prescribing the implementation. Preserve room to improve the means while controlling the outcome, interfaces and decision rights.

## Evidence and scope

Systems engineering guidance connects requirements, interfaces and verification across the lifecycle.

Evidence: NASA Systems Engineering Handbook

## Fictional case: a package split that hides an obligation

A fictional design package is split between a supplier and an in-house team. The supplier owns equipment drawings; the in-house team owns receiving design. Each package has an acceptance checklist, but the equipment-to-receiving interface drawing has no producing owner. Both assume the other will prepare it. The work breakdown appears complete because every department has a line, yet the integrated obligation is missing. The review begins from the successor's need rather than the organisational chart and identifies the gap.

The manager asks what assembly requires to proceed. The answer includes a controlled compatibility statement tying the two designs together. This is neither simply another supplier drawing nor an internal civil deliverable. It is an integration obligation. The team assigns a producing owner, a recipient and an actual technical authority. It also identifies the inputs each side must provide. The work breakdown now contains an accepted outcome that the departmental decomposition had failed to expose.

The scope addition requires a baseline disposition. The team investigates whether the obligation was included implicitly in either package. If so, the budget and duration mapping should be corrected rather than added again. If not, the authority must decide how the missing obligation is

treated. The current forecast should still include its consequence once the basis is credible. The manager does not wait for a commercial allocation decision before making the readiness gap visible to assembly.

The package split also affects evidence access. The supplier's records reside in its own system, while internal records use another version convention. The acceptance matrix therefore identifies a shared configuration reference and accessible evidence links. A recipient should not need to infer compatibility from two independently approved documents that use different versions. The integration record makes the comparison explicit. This improves control without forcing either party to copy its entire local document system into the sponsor's schedule.

The manager tests for double counting after assigning the integration task. The supplier may already budget a review, and the internal team may already include interface coordination. These efforts can remain legitimate even when the accepted outcome has a single owner. The financial mapping should distinguish effort contributions from outcome ownership. Otherwise a sensible control correction can be misinterpreted as redundant work, or genuine duplication can be hidden behind a newly named integration package.

The transferable lesson is to decompose from accepted outcomes and then map organisations to them. A departmental structure can still be useful for resources and reporting. It becomes insufficient where the recipient needs an obligation that crosses departments. The case does not prescribe a universal integration team or document. It shows why the work breakdown needs an explicit place for the evidence that joins locally complete packages.

## A package record that survives change

A package description should remain identifiable even when its scope changes. Stable identifiers make it possible to compare earlier and later definitions, link evidence and explain the effect of a change on successors. Renaming a package can improve clarity; reusing its identifier for a different outcome destroys traceability. When a receiving package becomes a combined receiving-and-utility package, the change should preserve the earlier perimeter and identify the added obligation. The same principle applies when work is split or merged.

An acceptance matrix should pair criteria with evidence and authority. Criteria alone can be too abstract; evidence alone can be irrelevant. A photo of installed equipment may establish presence without proving configuration or functionality. A signed document may establish review

without proving that the reviewer had the delegated authority to release the successor. The matrix makes these distinctions inspectable. It should identify what each item proves, where the underlying record is stored and what remains unproven after the item is accepted.

In the fictional installation, a supplier delivers equipment while the receiving works team prepares foundations and access. Assembly depends on both accepted packages. A work breakdown organised only by expenditure might show equipment purchase as complete when paid and receiving works as complete when invoiced. Neither event necessarily releases assembly. An outcome-based structure instead asks whether the equipment matches the released configuration and whether the site meets the assembly interface. This does not deny the importance of expenditure. It keeps cash status separate from delivery status.

Too much decomposition can be a control failure of its own. A network populated with tiny tasks can create frequent apparent variance and consume more effort to update than the decisions warrant. The remedy is not to abandon detail everywhere. It is to maintain detailed package records where local coordination requires them and expose only meaningful cross-package milestones in the integrated network. Roll-up rules must be explicit. A package cannot be treated as accepted simply because its subtasks have an average completion percentage that looks close to finished.

The perimeter should be reviewed when the project changes phase. Early feasibility work may legitimately focus on proving a technical concept. Procurement requires an executable specification, commercial responsibility and a delivery basis. Construction requires access, permits, materials and workface readiness. Commissioning requires system integration and operating acceptance. A work breakdown copied unchanged across these phases can retain familiar names while omitting newly material obligations. Phase transition is therefore an opportunity to test the perimeter, rather than a reason to reset history and erase earlier assumptions.

### *The matrix is not a technical specification*

Illustrative criteria demonstrate a control structure. Real engineering, statutory and contractual acceptance requirements must come from the applicable design and agreements.

## Decision implications

- Decompose accepted outcomes rather than departmental activity alone.
- Own exclusions and external readiness conditions.
- Preserve stable package identity when scope changes.

### DECISION ARCHITECTURE

03

## Dependencies carry the real sequencing logic

*A dependency register with typed edges*

### Dependencies have different causes

A predecessor link says that a successor cannot begin until an earlier task finishes. The reason for the link matters as much as its position in the network. Physical sequence, information release, scarce resources and contractual permission can all create apparent dependencies. They do not have the same remedies. A planner who deletes a link to improve the finish date must know whether the link represented an unavoidable physical condition or a convenience that can be changed. Network editing without a causal explanation creates a schedule that may be shorter but less executable.

A physical dependency arises from the work itself. Equipment cannot be assembled on an unready support if the required interface is absent. An information dependency arises because a successor needs a released specification, decision or verified measurement. A resource dependency arises when activities require the same unavailable crew or specialist. A contractual dependency arises because a notice, approval or permission must occur before the successor can be authorised. Some relationships contain several causes. A test may need both a physically complete subsystem and formal permission to energise it.

The Delivery atlas represents finish-to-start edges without encoding these dependency types. This is a deliberate limit of the small model, not evidence that the distinctions are unimportant. The paper's dependency register supplies the reason, owner and evidence behind each edge. The app then calculates the consequences of the entered topology and duration assumptions. A resource relation that is omitted from the

network remains omitted from its result. A typed register helps a reviewer understand what the model includes and what supplementary planning is still needed.

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

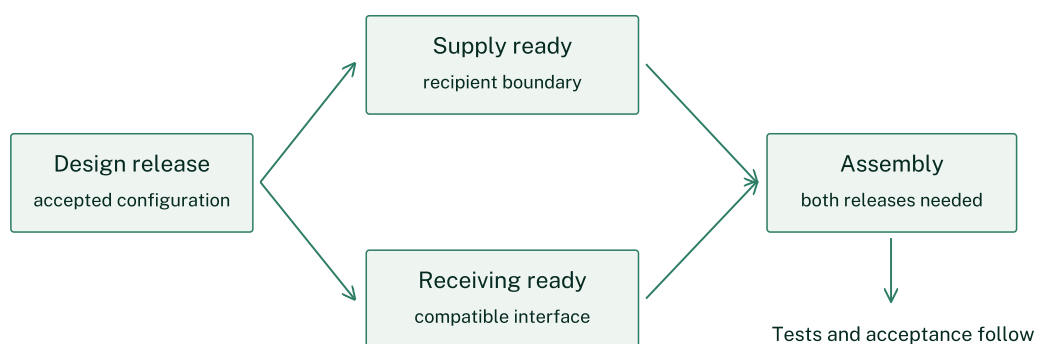
In the fictional installation, design release enables supply and receiving works in parallel. This topology assumes each branch can proceed from the same released information and neither needs the other's completed result. A revised method may instead require equipment readiness before receiving works can be finalised. The serial-release study changes that dependency while retaining the duration assumptions. Its expected completion becomes 25.00 weeks. The lesson is causal: changing the relationship can alter delivery even when no activity becomes slower. It is not evidence that parallel working is always preferable.

A dependency register should name the condition that releases the successor. Finished design is insufficient if the relevant specification remains unapproved. Equipment delivered is insufficient if it is not available in the configuration required for assembly. The wording should point to an observable event and its evidence. Otherwise the predecessor can be marked complete while the successor still lacks what it needs. This creates a hidden lag whose duration is later attributed to execution, although the original logic never represented the actual release condition.

### Exhibit: accepted branches join before assembly

Inspect the declared relationships within the captioned scope.

#### THE DATE DEPENDS ON ACCEPTED RELEASES



A missing release condition cannot be discovered by correct arithmetic.

Original conceptual diagram of the fictional release structure. Solid arrows express finish-to-start prerequisites only. Supply and receiving are parallel but both accepted outputs govern assembly. No durations, resources, calendar or critical-path quantities are represented. Its decision purpose is to test whether the network joins milestones with compatible meanings.

*Authorise a link change by its cause*

Change a dependency only when the replacement method, resource arrangement or release authority supplies a credible causal basis.

Recompute the complete network and review the acceptance consequences.

## Challenge edges, not only dates

An edge deserves a challenge when its reason is unclear, its evidence is unavailable or its consequence is disproportionate. The challenge should preserve the original link while examining alternatives. Can the successor begin with partial information? Can a separate release package be created? Can different resources remove the conflict? Can authority be delegated within the actual rules? These are different interventions. A blanket request to overlap tasks skips the question of what exposure the overlap creates and who is authorised to accept it.

Partial information release can be valid when the successor's scope is bounded. A supplier may begin a standard component before a custom interface is finalised, provided the frozen portion and rework exposure are clear. The network then needs a meaningful partial-release milestone and a later interface condition. Replacing the whole design predecessor with a shorter arbitrary duration erases the distinction. It also makes it difficult to explain responsibility if the unfinished information later changes. The dependency record should retain what was known and what was knowingly left open.

Resource sequencing can be mistaken for physical logic. A specialist may perform equipment inspection and then support site acceptance because both assignments rely on the same person. A finish-to-start link can encode this sequence, but it hides the cause if the resource register is absent. Bringing in another qualified specialist might remove the dependency without changing the work method. Conversely, deleting the link while retaining the same resource creates an infeasible overlap. The causal type determines whether a recovery proposal is a topology change, a resource change or an unsupported wish.

Contractual approval can be mistaken for inevitable waiting. Some decisions have mandatory periods or external jurisdictional constraints. Others wait because evidence arrives incomplete or the approver has no scheduled review capacity. The schedule should not assume all waiting can be compressed, nor should it treat administrative latency as a natural constant. Record the applicable requirement, the completeness condition

for submission and the responsible decision authority. A legal or regulatory interpretation belongs to the appropriate specialist and actual instrument, not to a generic scheduling rule.

Dependency challenges should be visible to the recipient. The producer may consider a predecessor unnecessary because its own work can start without it. The successor's accepting party may still need the result before it can approve completion. These are different release points. The integrated record should state whether the proposed change affects start readiness, completion acceptance or both. A local optimisation that accelerates production but defers essential acceptance evidence can leave the overall service date unchanged.

### *Typed edges add paperwork without improving delivery*

Typing every trivial local relation would be wasteful. Use the register at material interfaces and disputed links, where a missing causal basis can change commitments or hide a viable recovery option.

## Evidence and scope

Schedule guidance treats integrated activity logic as a basis for credible forecasting.

Evidence: [Schedule Assessment Guide: Best Practices for Project Schedules](#)

## Maintain a typed release register

A typed release register adds a practical layer to the network. For each material edge it records predecessor, successor, causal type, release evidence, owner, challenge status and consequence if the condition fails. It need not repeat every scheduling field. Its purpose is to let someone test the logic without reverse-engineering a chart. A reader should be able to follow why assembly waits for the receiving works and what precise evidence would allow that relation to be satisfied or changed.

The register is most valuable where the project crosses organisational boundaries. The supplier may forecast readiness using its factory acceptance event, while the assembly contractor plans from availability at the site. Transport, receiving inspection and discrepancy resolution sit between those events. If each party maintains a coherent local schedule but the integrated schedule joins mismatched milestones, the overall model contains a gap. The register makes the shared boundary explicit. It can reveal missing tasks without prescribing how either party manages its internal work.

## Illustrative typed dependency record

Record the release condition behind each material finish-to-start relation.

| Illustrative typed dependency record |                                                                       |
|--------------------------------------|-----------------------------------------------------------------------|
| Field or action                      | Illustrative completed record                                         |
| Input                                | Predecessor: receiving works ready                                    |
| Input                                | Successor: equipment assembly                                         |
| Input                                | Type: physical interface and acceptance information                   |
| Input                                | Release evidence: accepted receiving interface record                 |
| Input                                | Condition owner: works manager                                        |
| Input                                | Recipient: assembly manager                                           |
| Input                                | Challenge: can a partial location release safely permit bounded work? |
| Action                               | Verify that the named predecessor event matches the successor need.   |
| Action                               | Separate resource constraints from physical precedence.               |
| Action                               | Record the authority and rework exposure of any overlap.              |

A dependency must also have a version. A link that was valid for one design may be invalid after a change in installation method. Retaining it unquestioned may make the forecast unnecessarily conservative.

Removing it without recording the new basis may make the forecast unsupported. The register should record when the causal basis changed and which downstream assumptions were reviewed. The affected closure often extends beyond the immediate successor, since a new sequence can shift resource demand, acceptance timing and the critical path.

Do not infer a dependency from correlation in a historical report.

Activities may have occurred sequentially because the team preferred that order, even when parallel work was feasible. They may also have appeared parallel because the report's time resolution concealed a real release condition. Historical observation can suggest questions, but the executable relationship needs a current causal and acceptance basis. This is especially important when using lessons from another project, where equipment, authority, resources and contracting arrangements differ.

The register does not turn every uncertainty into a fixed edge. Discovery can reveal work that is not yet definable, and external decisions can create alternative branches. A static precedence model may then be a conditional

scenario rather than the whole delivery plan. State that condition and preserve the decision that selects the branch. The useful discipline is to make the relationship inspectable, not to force every possible future into a single tidy network. A model is strong when its boundary is clear enough that a reviewer can identify what would make it wrong.

*A finish-to-start network has a narrow vocabulary*

The app has no calendars, resource levelling, lags or general relationship types. The typed register records these distinctions but does not make the engine calculate them.

## Decision implications

- Different causes require different recovery interventions.
- Match predecessor evidence to the successor release need.
- Treat topology as a controlled assumption with a version.

### DECISION ARCHITECTURE

04

## Durations need an estimation basis

*A duration evidence worksheet*

### Estimate an executable task

A duration estimate is meaningful only after the task's beginning and end are defined. Design work that starts from an approved brief differs from design work that starts while requirements remain disputed. Equipment readiness at a factory differs from equipment readiness for site assembly. An estimate that silently includes missing prerequisites can look cautious while concealing an undefined scope. An estimate that excludes them can look efficient while creating an unmodelled waiting period. The basis record should say what conditions the estimate assumes at its start and what evidence marks its finish.

Distinguish effort, elapsed time and lead time. Effort describes the work a resource performs. Elapsed time describes the interval between the defined start and finish. Lead time can include waiting, approval, production, transport and receiving. Converting effort to elapsed duration requires assumptions about resource availability, working time and interruptions.

The companion app accepts elapsed weeks on a continuous basis. It does not infer working calendars or resource allocation from an estimate. A planner must translate the task basis deliberately before entering it.

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

The reference equipment supply task has optimistic, most-likely and pessimistic assumptions of 6.00, 8.00 and 10.00 weeks. These are authored fictional inputs, not estimates derived from supplier performance. Their purpose is to expose how the engine transforms estimates and propagates dependencies. In a real package, the corresponding values should refer to a stated scope, release condition, supplier basis and delivery boundary. A numerically tidy range is weak evidence if its endpoints refer to different outcomes.

Estimate ranges should reflect mechanisms. An optimistic case might assume prompt review and uninterrupted production. A pessimistic case might include a plausible additional test or a constrained shipping window. The record should explain which mechanisms are represented, whether they can occur together and what lies outside the range. Calling a value pessimistic does not make it an outer bound on all possible outcomes. Refusal of an approval, fundamental redesign or insolvency may require separate scenarios rather than a longer value on the same task.

The source of an estimate should remain visible through aggregation. A binding supplier commitment, a preliminary quotation, an experienced judgment and an analogy to another project carry different conditions. A single weighted mean can conceal that difference. The estimate record should preserve the evidence type and confidence rationale alongside the numerical assumptions. Confidence in the evidence is not itself a probability distribution. It describes why the team considers the basis suitable for the current decision and what further evidence could materially change it.

### *Accept the estimate only with its boundary*

Use a duration in the baseline when its start, finish, resources, calendar basis and evidence are sufficiently clear for the intended decision. Hold an external commitment when a material unbounded condition remains unresolved.

## Calendars and waiting are assumptions

A continuous elapsed-week model deliberately avoids working-calendar complexity. That simplifies comparison, but it limits transfer to an executable programme. A task spanning a shutdown, holiday, seasonal access restriction or scheduled review window cannot automatically be forecast by adding continuous durations to a real calendar date. The operational schedule must encode the relevant calendars or translate the durations with a documented method. The paper's relative week outputs should therefore remain relative. Presenting them as actual completion dates would add assumptions that the frozen studies do not contain.

Waiting can be embedded in a task or shown as a separate release activity. The choice depends on control. If inspection booking is governed by a distinct owner and materially drives a successor, separate representation improves visibility. If small routine waiting is part of a repeatable supplier lead time supported by evidence, embedding it may be appropriate. The same waiting must not be included twice. A basis reconciliation should compare the task's duration contents with the dependency register and identify where each material approval, inspection or transport interval appears.

Estimate updates should distinguish new evidence from managerial pressure. A shortened duration can be legitimate when a supplier confirms capacity or a changed method reduces work. It is unsupported when the only new fact is that the desired target is earlier. The estimate log should identify the evidence that changed, the mechanism by which it affects duration and any compensating exposure. Additional shifts may reduce elapsed time while increasing resource cost or fatigue risk. Those consequences belong in the recovery decision even though the small app does not compute them.

Historical rates should be normalised before use. Similar task names can conceal differences in scope, equipment, workforce, calendar, location or acceptance. A previous installation completed quickly because receiving works were already accepted; an analogy that includes those works in the new task is not comparable. The record should preserve both similarities and differences. A historical rate is useful when its transfer is argued, not when a single number is copied into a blank cell and later described as experience.

Avoid false precision in the basis record. Decimal durations can be appropriate for a short model experiment, but the displayed precision should not imply that uncertain field work has been measured to that accuracy. The frozen ledger preserves the engine's exact scalar for

reproduction; the manuscript formats it for interpretation. In operational planning, precision should follow the decision resolution and evidence. Rounding that changes an acceptance window deserves attention. Extra digits that change no decision can distract from the much larger uncertainty in scope and readiness.

### *Ranges encourage owners to protect themselves*

Ranges can be abused if their mechanisms are never challenged. Require a common scope, explicit cases and evidence of transferability rather than eliminating uncertainty from the record.

## Evidence and scope

DOE scheduling guidance discusses activity durations, logic and schedule development within its project context.

Evidence: Planning and Scheduling

## Fictional case: identical ranges with different evidence

A fictional review receives similar-looking duration ranges from two package owners. One range comes from a confirmed supplier slot under a released specification. The other is a judgment based on an earlier project with a different acceptance boundary. The numbers alone appear comparable. The estimate-basis review shows that their evidence is not. This does not automatically make the judgment unusable. It means the decision should recognise its transfer assumptions and the evidence needed before stronger reliance.

The confirmed slot still has conditions. Production may depend on a complete release, timely inspection and no configuration change. The reviewer records those conditions rather than treating the supplier's confirmation as unconditional certainty. The analogy requires a different check: which parts of the earlier scope match, which differ, and whether its reported finish included receiving acceptance. The ranges can remain numerically unchanged after this review while their permitted use becomes clearer.

The reviewer asks both owners to describe the optimistic and pessimistic mechanisms. The supplier's cases may concern capacity and inspection timing. The analogy may concern design maturity and workforce access. If these cases refer to different scopes, the range needs correction. If the mechanisms are coherent but weakly evidenced, the record should state

that weakness. A numerical transformation cannot repair the missing evidence. The model can calculate a mean, but it cannot make the input basis more credible.

The sponsor needs an internal sequencing choice before all evidence is available. The manager can use both ranges as explicitly conditional screening assumptions, provided the consequence is bounded. A later external commitment requires the missing confirmation or a suitable alternative analysis. This staged use prevents the project from stopping unnecessarily while also preventing a provisional estimate from silently becoming a firm promise. The same number can support different levels of reliance when its evidence boundary is stated.

The team defines an evidence update trigger. If the specification changes, the supplier slot is rechecked. If the receiving scope becomes materially different from the analogy, the judgment is revised. The forecast should move when those conditions change, even if management prefers the earlier date. The trigger is tied to the estimate's causal basis rather than a generic review interval. This makes updates more informative and less dependent on whether someone happens to notice a mismatch.

The lesson is that confidence cannot be inferred from the width or symmetry of a range alone. A narrow range may conceal missing mechanisms, while a wider range may reflect careful uncertainty analysis. The reviewer should inspect the scope, cases and evidence before interpreting precision. This fictional comparison supplies no calibrated distribution and no empirical claim that one estimate type is always superior. It demonstrates how the basis determines the appropriate use.

## A defensible estimate conversation

An estimate review should begin with the deliverable and release conditions. Ask the owner to describe what happens during the task, which resources and information are assumed available, and what could prevent acceptance. Only then compare numerical ranges. This sequence prevents the discussion from becoming a negotiation over an unsupported midpoint. It can also reveal that the task should be split. A technically straightforward production period may be preceded by an uncertain design decision whose outcome governs whether production should begin at all.

The reviewer should test whether the range is internally ordered and whether its cases refer to the same scope. The app rejects an optimistic estimate above the most-likely estimate or a most-likely estimate above the pessimistic estimate. This validation protects arithmetic integrity. It does

not prove the range is well calibrated. A consistently ordered set of guesses can still omit important mechanisms. The estimate register should record which uncertainties are represented as duration variation and which remain outside the task model.

Illustrative duration basis record

Record the executable scope behind the entered duration range.

| Illustrative duration basis record |                                                                      |
|------------------------------------|----------------------------------------------------------------------|
| Field or action                    | Illustrative completed record                                        |
| Input                              | Task: equipment supply ready for site assembly                       |
| Input                              | Start basis: accepted specification released to supplier             |
| Input                              | Finish basis: specified equipment accepted at the receiving boundary |
| Input                              | Calendar basis: continuous elapsed weeks in this illustrative model  |
| Input                              | Evidence: fictional study assumptions; no observed supplier rates    |
| Input                              | Outside range: fundamental scope change or approval refusal          |
| Action                             | Reconcile waiting with separately modelled release activities.       |
| Action                             | Keep effort and elapsed time distinct.                               |
| Action                             | Identify new evidence before revising the range.                     |

For the fictional receiving works, the estimate conversation identifies access, released dimensions, inspection capacity and required utilities as potential readiness assumptions. The owner decides which are embedded in the task and which appear as predecessors or separate activities. This is an illustrative reasoning exercise. It offers no site-specific construction durations. The important output is a traceable basis: a successor can see what the completion claim means, and a later delay review can distinguish failed assumptions from poor execution under assumptions that actually held.

Estimate ownership should include the right to state uncertainty. If an owner is required to give only the date management wants, the baseline loses diagnostic value. A useful challenge process can retain a sponsor target while recording the owner's current forecast and the actions needed to close the gap. This makes disagreement inspectable. It also permits a

decision to accept exposure knowingly, instead of hiding that exposure by editing the estimate. Control depends on truthfulness about the basis more than uniform optimism in the presentation.

After review, freeze the basis with the estimate version. Future updates should point to the earlier evidence and identify what changed. If the receiving method changes, the task may no longer be comparable to its baseline duration. If only the review queue grows, the physical scope may remain comparable but the waiting assumption changes. These distinctions support a fair and useful variance explanation. A simple record of old and new numbers cannot show whether the forecast changed because the project learned, the scope changed or execution departed from the agreed plan.

### *Ordered estimates are not calibrated distributions*

The engine validates numerical ordering. It does not verify empirical probabilities, supplier reliability, working calendars or estimate accuracy.

## Decision implications

- Define start and acceptance before estimating duration.
- Preserve effort, elapsed time and calendar distinctions.
- Update assumptions because evidence changed, not because the target changed.

### MECHANISMS AND WORKED STUDIES

05

## The critical path is conditional on the network

*A canonical delivery app critical-path study*

### Forward reasoning through the network

The forward pass asks when each task could begin and finish if its entered predecessors and duration assumptions govern. A root task starts at the relative origin. A successor starts after the latest finish among its predecessors. Its finish is that start plus its estimated mean duration. The project finish is the latest task finish. This is a conditional calculation. It assumes the task can actually start when the network permits, which is why resource and calendar exclusions matter. A computed early start is not a mobilisation authorisation.

Illustrative calculation. Assumptions and sensitivity are published with the model.

The reference study begins with design release. Equipment supply and receiving works then proceed on parallel branches. Assembly waits for the later branch, followed by integrated testing and acceptance. The engine reports project duration 19.00 weeks and selected critical path A, B, D, E, F. These identifiers refer to the fictional tasks listed in the appendix. The path is a consequence of the entered topology and means; its membership can change when either changes.

Illustrative calculation. Assumptions and sensitivity are published with the model.

Illustrative reference forward and backward dates

Relative weeks from the fictional model origin; continuous time with no resource or calendar calculation.

| Illustrative reference forward and backward dates |             |              |            |       |  |
|---------------------------------------------------|-------------|--------------|------------|-------|--|
| Task                                              | Early start | Early finish | Late start | Float |  |
| Design A                                          | 0.00        | 4.00         | 0.00       | 0.00  |  |
| Supply B                                          | 4.00        | 12.00        | 4.00       | 0.00  |  |
| Receiving C                                       | 4.00        | 10.00        | 6.00       | 2.00  |  |
| Assembly D                                        | 12.00       | 16.00        | 12.00      | 0.00  |  |
| Testing E                                         | 16.00       | 18.00        | 16.00      | 0.00  |  |
| Acceptance F                                      | 18.00       | 19.00        | 18.00      | 0.00  |  |

Illustrative calculation. Assumptions and sensitivity are published with the model.

The mean duration of equipment supply is 8.00 weeks. Its early start is 4.00 and early finish is 12.00, measured in relative weeks from the model origin. Receiving works finishes at 10.00. Assembly therefore waits for supply in this study. This identifies the binding branch under these assumptions. It does not prove supply is the only practical threat to delivery. Receiving can become critical if its duration changes, and omitted constraints can make both branches infeasible.

The critical-path result should be interpreted as a sensitivity of this network to its task means. A task with positive float can absorb some delay without moving the calculated finish, provided the rest of the model remains fixed. That proviso is essential. A delay can change resource availability, disrupt a review window or increase uncertainty on a successor. The static calculation does not capture those effects automatically. Float is a conditional network property, not a transferable reserve that one team can spend without affecting others.

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

The forward pass also exposes incomplete integration. If a readiness decision is omitted, the engine cannot wait for it. The interface-gate study inserts a separate decision between assembly and integrated testing. Expected completion becomes 22.00 weeks. The additional activity reveals a previously excluded condition. Calling this result worse than the shorter reference obscures the control improvement. The relevant question is which network represents the actual obligation; the more attractive output does not deserve preference simply because it is smaller.

### *Validate the binding path before choosing recovery*

Reproduce the complete network, verify critical task bases, inspect competing branches and test whether the proposed intervention changes accepted completion. Reject a claimed saving derived only from shortening a task without recomputation.

## Backward reasoning and float

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

The backward pass starts from the calculated project finish and asks how late each task can finish without moving that finish under the entered logic. A terminal task's late finish is the project duration. Other tasks use the earliest late start among their successors. Late start is late finish minus estimated duration. Float is late start less early start, subject to the engine's numerical safeguards. The reference receiving task has float 2.00 weeks. That is a property of the illustrative network, not a contractual allowance.

Float ownership is outside the calculation. A contract may specify how it is used, a sponsor may reserve it for integration, or teams may agree a control policy. The engine does not decide entitlement. A planner should avoid presenting computed float as permission to delay a deliverable. The delay could consume a shared margin, interfere with another resource or move an acceptance window that the simple network omits. The float register should state the model basis and the authority that may authorise reliance on it.

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

The duration-switch study reduces only the equipment supply assumptions. Its project duration is 17.00 weeks. Receiving works becomes critical, while supply gains float 2.00 weeks. The result demonstrates path switching. Improving the original critical task does not create unlimited improvement in project completion because another

branch becomes binding. Recovery analysis should therefore recompute the complete network after each meaningful intervention rather than extrapolating savings from a single task in isolation.

**Illustrative.** Tied branches create another interpretive issue. In the tied-branches study the engine counts 2 critical paths. Both branches govern the same finish under the entered means. Selecting one path for display does not make the other irrelevant. A review that focuses only on the selected list can miss a concurrent route to delay. The output provides a path count and bounded path enumeration to disclose this. The uncertainty approximation still uses a selected path, which is a narrower result discussed in the uncertainty chapter.

A task can have zero float because it is part of a critical route, because a zero-duration milestone lies on that route, or because multiple equal branches connect to a shared successor. These cases deserve different management attention. The model's label does not rank operational difficulty or consequence. A trivial acceptance recording milestone and a long supply activity can both be critical. The action should follow the mechanism and evidence, not merely the presence of a coloured bar.

### *Critical-path labels oversimplify a complex project*

They do when detached from their assumptions. Use them as conditional network results alongside resource, readiness and uncertainty reviews, rather than as a complete ranking of project risk.

## Fictional case: float is consumed without a release decision

A fictional receiving owner sees positive float in a conditional network and postpones work to accommodate another assignment. The owner treats the displayed margin as a personal allowance. The integrated manager discovers that the accepting authority has a reserved review window and may be unavailable at the later finish. The network had omitted that calendar condition. Its float was mathematically correct within the entered model, but the proposed use was not operationally supported.

The manager preserves the calculation and adds the missing evidence to the decision. The owner can either retain the original readiness date, secure another valid review window or propose a different executable arrangement. The authority governing the shared margin should decide within the actual project rules. The planner cannot resolve entitlement by

pointing to a float number. A resource or acceptance constraint can make a local postponement consequential even when the simple network's project duration does not move.

The control improvement is to pair reported float with its basis and permitted use. Where a margin depends on fixed review or resource windows, the operational programme should represent them appropriately. Where it is genuinely available, the authority can permit bounded use. The case does not imply that float must always be centrally reserved. It demonstrates why conditional network flexibility and actual permission to delay are separate questions. The result is a more executable forecast rather than a claim that the original arithmetic was wrong.

## Use the calculation to ask a better question

A critical-path review should trace each reported critical activity back to its scope, estimate basis and release evidence. Exact arithmetic on unsupported means produces an unsupported forecast. The review should also inspect near-critical branches and missing constraints. A receiving activity with modest float may be a greater operational concern than supply if its prerequisites are uncertain or its accepting party unavailable. The calculation helps locate conditional sensitivities; judgment determines which evidence and interventions deserve priority.

The app's dates are relative and its links are finish-to-start. Real programmes may use working calendars, start-to-start relations, lags, resources and external milestones. Those features can be valuable, but they complicate interpretation. The small model is useful as an inspectable reference precisely because it keeps the vocabulary narrow. It should not be presented as a replacement for an executable field programme when excluded features govern. A discrepancy between the app and another scheduling system should prompt a basis reconciliation, not an automatic judgment that one must be wrong.

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

Schedule targets should be shown alongside calculated outcomes without editing the network to match them. In the earlier-target study, only the deadline changes. Project duration remains 19.00 weeks. The target can change the selected-path deadline reading, but it does not accelerate work. This is a useful check against a common reporting error: a new desired date is announced and the programme is relabelled as if its logic now supported it. The forecast should retain its basis until an executable intervention changes that basis.

An action recommendation should name the affected mechanism. If supply is binding, investigate its release completeness, supplier capacity, inspections and logistics. If receiving becomes binding after supply improvement, investigate its own readiness and acceptance. If an omitted gate governs testing, resolve the gate's evidence and authority. General instructions to work harder do not follow from the network result. The model is most useful when it changes the question from which task is red to what credible intervention changes the accepted finish.

Retain the exact input and output with the review. This allows someone to reproduce the path, test a claimed intervention and distinguish model changes from display changes. A screenshot of a Gantt chart cannot establish the dependency topology or duration basis. The frozen studies in this paper provide input, output and scalar bindings so the published values can be checked against the canonical engine. Their reproducibility is evidence of calculation integrity, while their fictional nature remains an explicit limit on real-world inference.

### *Computed float does not establish entitlement*

Float is model-specific. The app supplies no contractual ownership, resource feasibility, calendar date or probability of accepted completion.

## Decision implications

- Critical paths depend on entered topology and estimated means.
- Recompute after an intervention because paths can switch.
- Keep desired targets distinct from calculated durations.

## MECHANISMS AND WORKED STUDIES

# 06 Resource constraints can invalidate an elegant network

*A resource-conflict framework*

## Precedence is not capacity

A precedence-feasible programme can still be impossible to resource. The network may allow equipment inspection and receiving acceptance to occur at the same time, while both require the same qualified specialist. The app calculates no resource allocation and cannot discover this

conflict. Its early dates describe what the topology permits under unconstrained start availability. A delivery manager should therefore treat the result as an input to resource planning, not as proof that the organisation can execute all permitted activities simultaneously.

Resource constraints include people, equipment, workfaces, specialist review capacity and operating access. Their significance depends on timing and substitution. A common labour category may be replenishable; a certified commissioning authority may be scarce and non-substitutable without qualification. A resource record should specify what capability is required, when it is needed, how availability is evidenced and what alternatives are credible. Headcount alone is a weak basis if the work needs a particular competence, permission or location.

An overlap can be physically feasible but organisationally constrained. The receiving works and equipment supply branches may use separate execution teams yet rely on the same design authority to resolve interface questions. The apparent parallel network then concentrates review demand. If design clarifications arrive together, queues can develop outside the model. Adding a generic contingency duration to both branches may obscure the shared cause. A resource and decision-capacity review should identify the common dependency and consider whether planned sequencing, additional qualified capacity or better release completeness addresses it.

Resource allocation can create a new critical sequence. If a specialist must finish one package before starting another, the operational programme may need a resource-driven relation or a separate levelling method. The typed dependency register should mark the cause so future changes remain understandable. A different resource arrangement could remove that sequence. If the relation is presented as physical logic, reviewers may overlook this option. If the relation is removed without obtaining alternative capacity, the programme becomes attractive but infeasible.

The model boundary should be repeated when its result enters a decision. A sponsor comparing the reference and duration-switch studies can see the conditional effect of shorter supply assumptions. The sponsor cannot conclude that adding labour will achieve those assumptions. That requires a separate productivity and resource basis, including supervision, access, fatigue, quality and cost consequences. Resource mobilisation is an intervention with evidence requirements, not a numerical adjustment justified merely because the network benefits from it.

*Confirm capacity before accepting overlap*

Treat concurrent starts as conditional until constrained capabilities, workfaces and acceptance authorities are available. Evaluate substitution and sequencing against the complete delivery outcome.

Resolve conflicts through the decision they affect

A resource conflict should be described by the accepted outcomes at risk. Saying that a specialist is overloaded is a start, but the delivery decision needs to know which release events compete and what happens if either waits. One event may have float in the conditional network; the other may govern accepted completion. Even then, assigning the specialist to the critical event is not automatically correct. The supposedly flexible task may have a fixed review window or a consequence outside the app's perimeter. Compare the complete obligations before choosing a sequence.

Resource availability evidence should have a validity period. A supplier's indicative promise of a crew differs from an executed mobilisation arrangement. A named person may be available at the planned date but committed elsewhere if the project moves. The schedule can therefore lose resource feasibility after a duration change even when the network's task means remain credible. A revised forecast should trigger a check of resource reservations and external commitments, especially near commissioning or shutdown windows where alternatives may be limited.

Illustrative constrained-capability register

A qualitative resource review supplements the app's precedence calculation.

| Illustrative constrained-capability register |                                   |                                              |                                                          |
|----------------------------------------------|-----------------------------------|----------------------------------------------|----------------------------------------------------------|
| Capability                                   | Competing need                    | Availability evidence                        | Executable response                                      |
| Inspection authority                         | Supply and receiving release      | Confirmed qualified booking                  | Sequence accepted inspections or secure valid substitute |
| Design authority                             | Concurrent clarification requests | Review capacity and released information     | Resolve critical interfaces before mobilisation          |
| Commissioning lead                           | Tests and operator readiness      | Named availability with acceptance authority | Reserve window and prepare complete evidence             |
| Assembly access                              | Multiple workfaces                | Approved access and safe coordination        | Allocate workface sequence within actual constraints     |

Resource substitution requires an acceptance basis. A technically capable substitute may lack authorisation for a regulated test or familiarity with the configuration. The record should name the qualification, induction or approval needed before substitution is executable. Treating every person within a job category as interchangeable can overstate recovery options. Conversely, assuming only one person can act without checking permitted delegation can understate them. The control question is what evidence makes the substitute valid for the specific obligation.

A resource intervention may transfer rather than remove risk. Adding another contractor can reduce a queue while increasing interface and supervision demands. Moving work to another shift can accelerate elapsed progress while affecting quality inspection or fatigue controls. Splitting packages can make parallel execution possible while creating new acceptance boundaries. These consequences should appear in the recovery record. The small app can test a new duration or topology scenario after the intervention is defined, but it does not value the resource arrangement or its wider exposures.

A resource plan should preserve both demand and capacity assumptions. A simple list of assigned names does not explain how much attention tasks require or whether the assignments overlap. The integrated manager needs enough information to see material conflicts without reproducing every local timesheet. Package managers can maintain detailed allocations; the integrated resource view should focus on constrained capabilities and release windows that govern cross-package outcomes. This keeps the control proportionate while preventing scarce capacity from remaining invisible.

### *Resource planning creates unnecessary conservatism*

It can if every resource is treated as scarce. Focus on evidenced constraints and distinguish actual limits from habits or untested assumptions about substitution.

## Evidence and scope

The public DOE lexicon supplies project management terminology within its institutional context.

Evidence: Project Management Lexicon of Terms

## Fictional case: the reservation that does not move with the forecast

A fictional commissioning specialist is reserved for the current test window. The supply forecast improves and the network now permits earlier tests. The schedule display moves the test bar forward, but the specialist's reservation remains at the old window. The manager identifies a resource-feasibility gap: the earlier conditional finish is mathematically valid under the new durations, yet its start availability is unsupported. The app has no reservation field and cannot discover this gap itself.

The manager checks whether the reservation can be changed. Availability may be constrained by another project, qualification requirements or access arrangements. A substitute might be possible, but its competence and authority must be evidenced. The resource record distinguishes a named person from the capability the test actually requires. This prevents the team from treating any available technician as a valid replacement or assuming that the original specialist is indispensable without checking the rules.

The earlier test window also affects preparation. Procedures and instruments may have been planned against the old date. Bringing the test forward can create new readiness demand even when the physical system is complete. The manager reviews these obligations before issuing a revised commitment. The recovery action may need an enabling task or a different scope. A local supply improvement is real, but the integrated benefit remains conditional until testing capacity and preparation align.

If the earlier resource window cannot be secured, the sponsor can retain the original test date or choose another executable alternative. The network's unconstrained result remains a useful sensitivity, labelled as such. The operational forecast uses the actual reservation basis. These two results should not be blended into an unexplained date. The report should show why the theoretical saving is not currently available and what evidence could make it executable.

The decision also considers opportunity cost. Moving a specialist from another obligation can create exposure elsewhere. That consequence belongs to the organisation's resource decision, beyond this project's local network. A recovery plan that assumes resources can be reassigned without effect may simply transfer delay. The authority should state which obligation has priority and what residual exposure it accepts. The schedule cannot decide that organisational tradeoff from criticality alone.

The lesson is to review reservations whenever the forecast moves materially. Earlier completion can lose feasibility just as later completion can. Resource control should follow the current executable window rather than remain attached to a superseded baseline. The case supplies no quantified capacity or mobilisation rate. It exposes the distinction between a network-permitted start and a start supported by qualified, available capability.

## A fictional shared inspection service

Imagine the fictional installation uses a shared inspection service for equipment acceptance and receiving works verification. Both branches are expected to finish near the assembly release. The precedence network allows their inspections to overlap. The service has committed capacity for only one inspection at a time. This is a qualitative case, not a further frozen numerical study. Its purpose is to show an exclusion in the app: the network's early dates do not resolve how the shared service will be allocated.

The integration manager first checks whether the inspections truly need the same capability. If one can be performed by a different qualified authority, the conflict may be removable. If not, the manager compares readiness and consequence. Booking an inspection before the package is ready wastes capacity and can make the competing package wait. The resource decision therefore depends on credible readiness evidence as well as network criticality. The supplier and receiving owner should provide the evidence needed for a firm booking, with a rule for releasing unused capacity.

The manager next tests the interaction with acceptance. A preliminary inspection may identify defects without releasing assembly. A final inspection may require completed documentation that another team owns. Allocating the inspector does not solve a missing document dependency. The resource register and typed edge register should be reviewed together. Otherwise the team can spend effort accelerating an inspection whose output still cannot be accepted. The correct intervention may be earlier evidence preparation, a partial inspection with an explicit condition, or a later but executable booking.

If the manager adopts a sequence, the revised operational schedule should preserve why it was chosen. The underlying physical branches may remain parallel while the inspection tasks become resource-sequenced. When additional capacity later becomes available, the manager can identify exactly which relation to reconsider. This traceability prevents a temporary resource workaround from becoming a permanent

unexplained constraint in subsequent baselines. It also supports a fair review of delay, since the record distinguishes package readiness failure from the consequences of an authorised shared-resource allocation.

Finally, the sponsor should know whether the resource arrangement is merely planned or actually secured. A forecast based on unconfirmed inspection capacity should be labelled conditional. The difference matters when downstream teams mobilise or external promises are made. Explicit conditionality can be uncomfortable, but it is more useful than treating a tentative booking as a completed readiness obligation. A resource plan becomes credible through evidence of availability and acceptance capability, not through the presence of a name beside each task.

### *The app performs no levelling*

No resource capacities or calendars exist in the Delivery atlas input. Resource recommendations here are original control analysis, not calculated app outputs.

## Decision implications

- A feasible topology can be impossible to resource.
- Preserve the cause of resource-driven sequence.
- Secure capability and acceptance authority before relying on overlap.

## MECHANISMS AND WORKED STUDIES

# 07 Interfaces deserve explicit acceptance tests

*An interface control worksheet*

## An interface is a release obligation

An interface is where one package's output becomes another package's prerequisite. It may be physical, informational, operational or organisational. The producer can finish its local work while the recipient still cannot proceed. This is why an interface deserves an acceptance test that reflects the recipient's need. A generic completion statement can hide an incompatible configuration, missing evidence or unresolved authority. Delivery control becomes stronger when the interface is defined before the parties report progress against it.

The fictional assembly task needs accepted equipment and accepted receiving works. The equipment interface includes configuration and availability at the agreed boundary. The receiving interface includes a location fit for the specified assembly method. These are illustrative control categories, not technical specifications for an actual installation. The integrated manager should make the correspondence explicit: which equipment version is being received, which works version supports it, and what evidence permits the assembly team to rely on the match.

Interface readiness has a producer and a recipient. The producer supplies the work and evidence. The recipient checks whether these meet the release condition. A third party may hold the authority to certify a particular requirement. Combining these roles casually can create self-acceptance where independent approval is actually required, or unnecessary waiting where the recipient has authority to accept. The record should follow the real delegation and applicable requirements. A schedule cannot create acceptance authority simply by assigning someone an approval task.

A rejected interface should produce actionable information. State the unmet condition, the evidence supporting rejection, the effect on downstream work and the owner of correction. A red status without a reason cannot guide recovery. A rejection should also be scoped: the recipient may be able to release unaffected work while holding a specific configuration or area. Partial acceptance requires an explicit boundary and residual obligation. It should not be used to conceal a material safety or statutory condition whose failure prevents the proposed work.

**Illustrative calculation.** Assumptions and sensitivity are published with the model.

The readiness event can be represented as a task when it consumes time and governs release. The interface-gate study inserts such a decision after assembly. Its estimated gate duration is 3.00 weeks and its project duration is 22.00 weeks. These fictional values reveal the consequence of including an omitted release activity. They do not estimate a real review queue. If the actual gate is a categorical permission with uncertain outcome, the network must be labelled conditional rather than treating elapsed duration as assurance of approval.

### *Release the successor only within accepted scope*

Accept, qualify or reject the interface against controlled criteria. Record the evidence and authority, then ensure the successor's planned work fits the actual release.

## Evidence that travels across the boundary

Interface evidence should be specific enough to survive a handover between teams. A signed checklist can be useful, but its version, scope and underlying records matter. An inspection against an obsolete configuration may be accurately performed yet irrelevant to the current successor. A readiness statement for part of a location may be incorrectly relied on for the whole area. The package record should link the acceptance decision to the exact configuration, place, scope and exceptions that were reviewed.

Evidence completeness should be tested before booking the accepting party's time. Review capacity is often consumed by incomplete submissions, which generate repeated cycles without advancing release. The control response is to define a completeness check separate from substantive acceptance. Completeness means the required material is present; it does not mean the material is correct. Keeping these stages distinct prevents a submission receipt from being reported as approval, while making avoidable administrative waiting visible.

The recipient should state how exceptions affect use. An outstanding document may be tolerable for limited assembly but unacceptable for energisation. A physical discrepancy may allow inspection while preventing integrated testing. The exception record should name permitted activities, prohibited activities, resolution owner and expiry or review condition. Without this scope, qualified release can gradually become unconditional through repeated reporting. The schedule should link each successor to the correct release level rather than treating all forms of acceptance as equivalent.

Changes can invalidate previously accepted evidence. A revised equipment configuration may require the receiving interface to be rechecked. A changed test method may require a different operating procedure. The change record should identify accepted records whose basis is affected, not only tasks whose durations change. Reopening acceptance is sometimes necessary even when physical work remains complete. The resulting schedule effect is a consequence of the changed obligation, not proof that the earlier acceptance was improper under the information then available.

## Illustrative interface acceptance record

A fictional assembly release record makes configuration and exceptions explicit.

| Illustrative interface acceptance record |                                                                              |
|------------------------------------------|------------------------------------------------------------------------------|
| Field or action                          | Illustrative completed record                                                |
| Input                                    | Producer boundary: equipment ready at the agreed receiving point             |
| Input                                    | Recipient need: specified configuration fit for the released assembly method |
| Input                                    | Evidence: configuration reference, inspection and receiving records          |
| Input                                    | Accepting authority: named role under actual delegation                      |
| Input                                    | Exception: affected interface held pending compatibility review              |
| Input                                    | Permitted work: only the explicitly unaffected scope                         |
| Action                                   | Check that producer and recipient use the same configuration.                |
| Action                                   | Separate submission completeness from substantive acceptance.                |
| Action                                   | Link every qualified release to its residual obligation.                     |

An interface register should be accessible to both sides. If only the producing team can see the evidence status, the recipient may maintain a conflicting readiness forecast. If only the recipient can edit criteria, the producer may face moving requirements without a change record. Shared visibility does not require unrestricted editing. It requires controlled criteria, clear submissions, recorded decisions and a way to raise a challenge. The important design principle is that both parties can inspect the current obligation and its history.

### *Formal acceptance slows experienced teams*

Routine low-consequence interfaces can use proportionate records. Material cross-team release still needs a shared configuration and clear evidence, especially when change can invalidate an earlier readiness claim.

## Evidence and scope

Public SRO guidance describes accountability and the governance role of responsible project leadership.

Evidence: [The Role of the Senior Responsible Owner](#)

## Fictional case: a qualified certificate loses its condition

A fictional recipient signs a receiving certificate that permits inspection but holds assembly pending a compatibility check. An executive summary later reports receiving accepted without the qualification. The planner uses that summary to release assembly. The original certificate was clear; the loss occurred when its scope travelled through reporting. This case shows why evidence control includes the meaning retained in summaries, not only the quality of the underlying document.

The manager restores the qualified state and informs the successor. Inspection progress remains valid, while assembly release remains open. The forecast identifies the compatibility obligation and its owner. The correction should preserve the earlier communication so the team can understand what reliance occurred. It should not silently replace the summary and claim that the recipient had always been correctly informed. If downstream work began, its actual scope and exposure need a separate disposition.

The reporting rule now requires material conditions beside accepted status. A concise phrase can be sufficient if it states permitted scope and the remaining hold. The linked certificate supplies detail. This is proportionate because the condition governs a successor. The lesson is that qualified acceptance can support useful action, but its qualification is part of the evidence claim. Removing it changes the claim and can invalidate the release even when every quoted document is genuine.

## A rejection that improves the plan

In a fictional handover rehearsal, the supplier reports equipment ready while the receiving team reports location ready. The assembly manager discovers that each used a different released equipment configuration. The integrated schedule had joined two valid local milestones that did not describe the same interface. The remedy is not to average the completion percentages. It is to identify the governing configuration, assess the

mismatch and record the correction or authorised change. This case illustrates an integration failure without claiming any observed occurrence.

The manager first preserves the evidence behind both readiness statements. This allows the team to determine whether the mismatch arose from an uncommunicated change, an incorrect interpretation or an incomplete release. The distinction matters for recovery and responsibility. Erasing the earlier records would make the immediate chart cleaner but destroy the basis for learning. A controlled correction records the new interface version and the reason that previous readiness no longer releases assembly.

Next, the manager tests whether any bounded work can proceed. A partial assembly activity may be independent of the affected interface. If so, define its scope and acceptance conditions explicitly. If the proposed overlap creates irreversible rework or violates a noncompensable requirement, hold it. The decision should compare executable alternatives, including correction before assembly, qualified partial work and a changed design. An attractive date is not sufficient authority to accept technical or legal exposure.

The schedule update should then represent the chosen remedy. A correction task, a renewed inspection or a readiness decision may be needed. Its duration basis should reflect the actual scope and resource arrangement. The app can test a simplified network once those assumptions are defined, but the qualitative interface record remains necessary to explain what the new task means. Without it, the correction bar can become another ambiguous completion event that repeats the original problem.

Finally, the team should improve the release process at the point of failure. If the configuration changed without recipient acknowledgment, add a controlled notification and compatibility review. If the criteria were ambiguous, revise the interface definition. If the submission was incomplete, strengthen the completeness check. The response should target the evidenced cause rather than adding indiscriminate approvals to every package. Interface control is valuable when it prevents reliance on mismatched evidence; it becomes burdensome when it multiplies signatures without clarifying the release obligation.

*Elapsed time does not guarantee approval*

The inserted gate study illustrates a duration assumption. It does not establish that a certifier will approve, that evidence is adequate or that the legal release condition is satisfied.

## Decision implications

- Match both sides of the interface to the same configuration.
- Preserve qualified acceptance and residual obligations.
- Correct the evidenced release failure rather than adding generic signatures.

### MECHANISMS AND WORKED STUDIES

## 08 Baseline approval must preserve assumptions

*A baseline approval record*

### Freeze a reference that can be understood

A baseline is an authorised reference for explaining change and performance. It is not a declaration that uncertainty has disappeared. The reference should preserve scope, logic, duration bases, calendars, resources, acceptance conditions and the decision context that justified its use. A date-only baseline cannot explain why later forecasts differ. It can show movement, but it cannot distinguish scope development from execution variance or an invalid original assumption. Baseline control begins with preserving the argument behind the dates.

The baseline should have an identifiable version and approval record. Its authority follows the project's governance, not the software's save function. A planner can publish a technically consistent candidate while the sponsor has not authorised a commitment. Conversely, a sponsor can approve a target that remains unsupported by the current forecast. The record should retain these distinctions. Calling every saved schedule approved creates false authority; calling every forecast revision a new baseline removes the reference needed to understand performance.

A baseline package should include its perimeter and exclusions. If operating readiness is excluded, state that the finish is construction completion under the defined acceptance boundary. If procurement

durations are preliminary, identify the condition that will require review. These qualifications do not make the baseline useless. They make its use conditional and its future revision understandable. An early baseline can be a valid control reference for a bounded phase without pretending to be a firm end-to-end delivery promise.

Freeze the evidence cutoff with the baseline. The forecast may use supplier information available at that moment, while later information improves or contradicts it. A reviewer should be able to tell whether the original assumption was reasonable given its evidence, rather than judging it solely by hindsight. The same principle protects against retrospective optimism: a late favourable outcome should not be used to claim that an unsupported initial forecast was sound. Decision quality depends on the evidence and reasoning available when reliance occurred.

The baseline is also a coordination instrument. Package owners should know the obligations and interfaces against which they are being managed. A sponsor-level programme that assigns dates without recipient agreement may be a useful target but a weak execution baseline. The baseline review should test whether package boundaries, acceptance events and shared resources are understood. Consensus alone is not proof of feasibility, but disagreement about basic meanings is strong evidence that the model is not yet ready for reliance.

### *Approve a baseline for a defined perimeter*

Authorise the reference only when scope, logic, acceptance and material assumptions are sufficiently clear for its stated use. Keep later forecasts truthful even while a change decision remains pending.

## Keep forecast changes visible

The current forecast should change when evidence changes. Protecting a baseline does not mean forcing the forecast to remain unchanged. A controlled system keeps the authorised reference while updating expected outcomes and explaining variance. This permits timely intervention. If teams suppress forecast movement because any delay is treated as a failure of loyalty, the baseline becomes a reporting constraint rather than a diagnostic tool. Delivery control needs a truthful forecast more than an unchanged chart.

Distinguish correction from authorised change. A typographical predecessor error may be corrected with a record explaining the defect and its effect. A revised design scope may require change approval. A different

estimate based on new supplier evidence may alter the forecast while the baseline remains intact. These cases need different dispositions. A single button labelled rebaseline should not erase their differences. The change log should identify the category, authority and reason for the update.

Baseline, forecast and target serve different purposes

Keep the three records identifiable through updates.

| Baseline, forecast and target serve different purposes |                                     |                                                 |                                                  |
|--------------------------------------------------------|-------------------------------------|-------------------------------------------------|--------------------------------------------------|
| Record                                                 | Meaning                             | Authority or evidence                           | Change treatment                                 |
| Baseline                                               | Authorised comparison reference     | Approved scope and planning basis               | Preserve prior versions and approved revisions   |
| Current forecast                                       | Present estimate of accepted finish | Latest credible readiness and duration evidence | Update promptly with explained variance          |
| Target                                                 | Desired or required outcome         | Sponsor or external requirement                 | Retain gap and identify executable interventions |
| Release status                                         | Permission for specified work       | Accepted evidence and actual authority          | Do not infer from baseline approval              |

A baseline revision should preserve comparability where possible. If a package splits, retain the mapping to its earlier identity. If new work is added, identify the added obligation and affected successors. If an estimate basis changes, state whether the scope remains comparable. This makes variance analysis useful without forcing artificial equivalence. It also allows lessons to distinguish a task that took longer than planned from a task whose actual scope became materially different.

Baseline changes can alter incentives. If delays are routinely absorbed into a new reference, performance appears to recover without a corresponding improvement in delivery. If legitimate scope changes are never recognised, owners are judged against obligations they did not accept. The control process should protect both historical truth and fair responsibility. Retain the original reference, approved revisions and current forecast, with a clear explanation of which comparison supports each reported conclusion.

Do not use baseline approval as a substitute for readiness. Approval may authorise a planning basis, budget or phase, while a subsequent release still depends on technical evidence and permissions. A package can be baseline-approved but not ready to start. A task can be forecast to finish without being accepted. The control vocabulary should preserve these states so a governance signature does not become an accidental physical completion claim.

*A fixed baseline is unsuitable for evolving work*

A fixed reference can still describe a bounded phase or decision. Use staged baselines and preserve their conditions when discovery prevents a credible end-to-end commitment.

## Evidence and scope

Analytical assurance guidance links model quality and review to the intended decision.

Evidence: The [AQuA Book](#)

## Fictional case: a logic correction and a scope change arrive together

A fictional planner discovers that an assembly task lacks a required receiving predecessor. At the same review, the sponsor requests an additional test. Both changes move the forecast, but they have different causes. The missing edge is a defect in the earlier network representation. The additional test is a proposed obligation whose treatment depends on actual authority and scope. Combining them into a single rebaseline would obscure the evidence needed to explain the variance.

The planner preserves the earlier version and records the logic defect. The corrected network reflects the already required receiving condition. Its effect is shown separately from the proposed test scenario. The sponsor can then see how much of the forecast movement comes from repairing the model and how much comes from changing the obligation. This is a controlled comparison, not an attempt to allocate legal responsibility through arithmetic. Actual agreements and contemporaneous evidence remain necessary for that question.

The test request receives a change record. The team asks whether it is a new requirement, clarification of existing acceptance or a different method of proving the same outcome. The answer affects scope and comparability. The current forecast can include a labelled scenario while the authority decides. The planner should not suppress the corrected receiving relation because the test decision remains pending. Model integrity and change authorisation are separate processes with different evidence.

The executive report retains the authorised baseline, corrected current forecast and test-change scenario. This may require more explanation than a single date, but it prevents a false story. A revised baseline can be approved later for future control while the earlier reference remains

available. The report should state which comparison supports its conclusion. Saying the project is back on baseline after adopting a new date would be incomplete unless the actual delivery performance also improved.

The package owners need the corrected logic immediately. Assembly must understand that receiving acceptance governs its release regardless of how the sponsor treats the reference. The proposed test should not become an instruction until authorised. The manager therefore distributes a controlled release clarification and a separate pending-change notice. This avoids the operational danger of mixing a necessary correction with an optional or unresolved obligation.

The lesson is to preserve change categories through the decision chain. A model defect, new evidence and scope revision can occur together, but their concurrence does not make them equivalent. Separate their bases, then reconcile the selected plan. This supports truthful forecasting, fair review and usable future control without inventing a universal rule about when rebaselining is permitted.

## A baseline that survives an interface discovery

The fictional installation baseline omits a separate readiness decision before integrated testing. During an interface review, the operator explains that the decision requires assembled-system evidence and a named accepting authority. The team has discovered a real obligation in the fictional case. The current forecast should include it immediately once its basis is sufficiently defined, while the change process decides how the reference and responsibility are treated. Waiting for formal rebaseline approval before showing the forecast would conceal useful information.

The baseline review asks whether the obligation was excluded deliberately, included implicitly in testing, or omitted unintentionally. Each answer leads to a different interpretation. If it was implicit, separating it may improve transparency without adding scope, but duration double counting must be avoided. If it was excluded, the baseline's stated finish may have had a narrower perimeter than the sponsor assumed. If it was omitted, the original reference was incomplete for its intended use. The record should state the conclusion and supporting evidence.

The revised network should show the selected remedy rather than a generic delay allowance. A readiness decision with a defined submission and acceptance boundary provides a clearer control event than adding unexplained time to assembly. It also lets the team investigate review capacity, evidence preparation and conditional release. The interface-gate

study offers an illustrative calculation of this structure. Its result should not be treated as the actual review duration or the financial value of the change.

The sponsor then decides whether an authorised baseline revision is justified. The decision should consider scope, governance rules, responsibility and the need for a usable control reference. Regardless of that decision, the earlier baseline remains available and the current forecast remains truthful. A revised reference can improve future management without rewriting the history of the earlier promise. This is especially important when external parties relied on that promise, since their consequences may remain even after internal reporting adopts a new date.

A baseline archive should be usable, not merely stored. Retain machine-readable inputs, relevant evidence versions, approval records and a concise explanation of change. Test that someone can reconstruct the comparison without relying on a planner's memory. An archive of screenshots may prove what was shown at a meeting but cannot reproduce the network. The frozen study bundles demonstrate the more useful form: explicit input, exact output, scalar bindings and method limits. Real baseline archives need the corresponding operational and authority records as well.

### *Approval is not operational validation*

A baseline signature establishes the recorded governance decision. It cannot prove resource availability, estimate calibration or statutory readiness.

## Decision implications

- Preserve the basis behind the authorised dates.
- Update the forecast without erasing the reference.
- Distinguish baseline approval from permission to start.

## MECHANISMS AND WORKED STUDIES

09

# Change control is a valuation process

*A change impact decision framework*

## A change affects more than its task

A proposed change should be described as a change in obligation, method or assumption before its schedule effect is calculated. A task duration revision may reflect added scope, better evidence, altered resources or a recovery method. These causes affect cost, risk, acceptance and responsibility differently. A change record that contains only an old date and a new date cannot support an informed decision. Begin with what changed and why, then trace its consequences through the delivery system.

The dependency closure is the set of successors and interfaces that may be affected. A changed equipment configuration can alter receiving works, assembly procedures, tests and operating documentation. A shortened supply duration can move assembly earlier into a period when inspection resources are unavailable. A new acceptance requirement can invalidate evidence already reported as complete. The change review should therefore inspect both the network closure and the associated package records. The app recalculates task dates, but it cannot discover these wider obligations from a duration edit alone.

Change valuation should include alternatives. Accepting the request unchanged may not be the only response. The team can reject it, defer it, separate its scope, adopt a different method or qualify the delivery promise. Each alternative needs an executable basis and consequence record. A comparison should preserve what is held constant. If one option changes scope, resources and acceptance while another changes only duration, their apparent schedule difference cannot be attributed to a single intervention. The frozen studies use narrowly declared changes to make this distinction inspectable.

Cost and benefit consequences belong to a separate valuation basis. The Delivery atlas provides no cash flow, productivity, delay damages or net present value output. A schedule change can affect those quantities, but the relationship is not a universal multiplier. The review should identify the mechanism and the evidence needed for valuation. A later service start

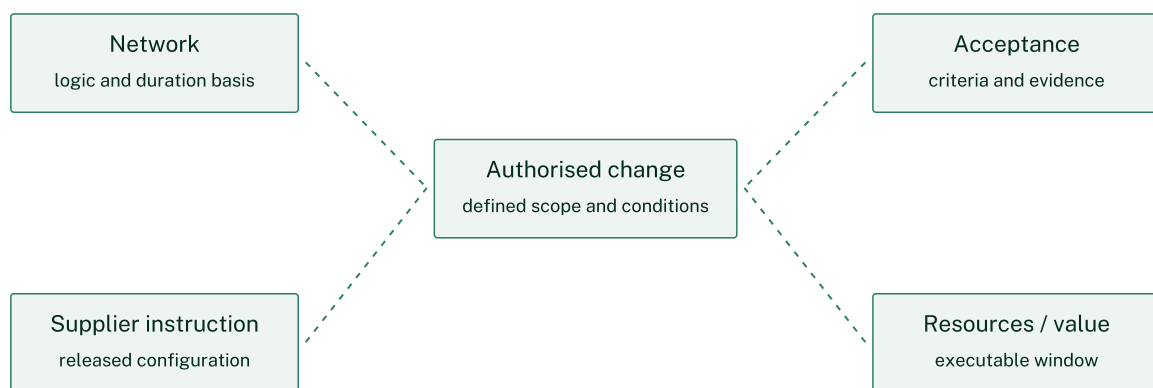
may defer benefits; a faster method may increase resource cost; concurrent work may create rework exposure. These consequences require their own assumptions and appropriate authority.

Some conditions are noncompensable. A change that violates a safety, statutory or contractual release requirement cannot be made acceptable merely by showing a favourable date or financial benefit. The record should distinguish admissibility from preference. First determine which alternatives can lawfully and technically be considered. Then compare their consequences within that admissible set. This prevents the schedule model from becoming a device for balancing away obligations it has no authority to reinterpret.

### Exhibit: the closure of an authorised change

Inspect the declared relationships within the captioned scope.

#### A CHANGE MUST REACH EVERY AFFECTED RECORD



Connections mean reconciliation, not new hierarchy or legal authority.

Original proposed reconciliation map. Dotted links mean that the selected change must be checked against affected records. They do not assign hierarchy, legal power or actual agreement. The model computes entered dates while supplier, acceptance, resource and value records retain their separate evidence and authorities.

#### *Approve the complete intervention*

Authorise a change only after its causal mechanism, affected obligations, admissibility and material consequences are sufficiently clear. Treat the modelled date as conditional evidence rather than the entire value case.

## Control the decision while uncertainty remains

The change record should identify the decision owner and the latest responsible decision point. Some alternatives expire when equipment is released, work becomes irreversible or a resource window closes. A request left unresolved can consume the very option that would have reduced its consequence. The programme should show decision latency where it governs release, and the governance record should state what evidence is needed before the authority can act. Escalation should be tied to an expiring option, not merely a late meeting.

A forecast can incorporate a conditional change scenario before approval. Label it clearly as a scenario and retain the current authorised basis. This allows the authority to see likely consequences without confusing analysis with permission. The programme may need separate scenarios for acceptance, rejection or partial implementation. A single blended duration can obscure the fact that these are mutually exclusive decisions. The small app can reproduce each entered network separately; it does not choose the correct branch or confer change authority.

### Illustrative change decision record

A supply acceleration proposal is assessed beyond its local duration.

| Illustrative change decision record |                                                                                  |
|-------------------------------------|----------------------------------------------------------------------------------|
| Field or action                     | Illustrative completed record                                                    |
| Input                               | Proposed change: revised supply duration basis                                   |
| Input                               | Mechanism evidence: supplier capacity and method confirmation required           |
| Input                               | Network effect: receiving branch becomes binding in the frozen study             |
| Input                               | Other effects: inspection, logistics, cost and quality to be assessed separately |
| Input                               | Admissibility: actual safety, statutory and contract conditions retained         |
| Input                               | Decision authority: sponsor within delegated change powers                       |
| Action                              | Compare executable alternatives with declared constants.                         |
| Action                              | Identify the latest responsible decision point.                                  |
| Action                              | Reconcile all affected configurations and acceptance records after approval.     |

A change assessment should state uncertainty in both the proposed intervention and its effects. A supplier's suggested acceleration may depend on unconfirmed capacity. A revised design may reduce installation time but require additional testing. The record should identify what is known, what is assumed and what evidence would resolve the assumption. When a decision must precede full evidence, the authority can accept a bounded exposure with monitoring and stop conditions. That is a recorded judgment, not a claim that the uncertainty has been eliminated.

Responsibility analysis should remain separate from immediate recovery where necessary. The team may need to protect delivery before contractual allocation is resolved. A without-prejudice operational action can be appropriate under actual agreements, but the legal meaning must come from those agreements and specialist advice. The schedule record should preserve facts, instructions and reservations without inventing legal effect. Mixing every recovery discussion with an unsupported allocation claim can delay action and weaken the evidence needed for a later fair assessment.

After approval, reconcile all affected records. Update the network, scope baseline, acceptance criteria, resource plan, procurement instruction and benefit assumptions where relevant. A change is not fully controlled when only the schedule bar moves. The operator can otherwise continue using an earlier configuration while the supplier acts on the new one. The closure record should show which versions changed, who received them and which previously accepted evidence remains valid. This is practical integration, not administrative completion for its own sake.

### *Change review can cost more time than the change saves*

Use proportionate authority and evidence for low-consequence edits. Material changes still need a clear mechanism and closure because an unreviewed local saving can create a larger integration failure.

## Evidence and scope

Public appraisal guidance separates objectives, options, consequences and uncertainty in decision analysis.

Evidence: [The Green Book](#)

## An illustrative supply acceleration request

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

In a fictional review, the supplier offers a shorter equipment supply basis. The duration-switch study represents a narrow numerical version: only the supply estimates change. Project completion becomes 17.00 weeks, and receiving works governs the accepted finish under the entered means. This result is useful because it limits the claimed benefit of supply acceleration. It does not establish the price, feasibility or risk of the supplier's offer. Those require separate evidence outside the model.

The integration manager asks what makes the shorter duration executable. The supplier may propose additional shifts, an alternative production location or a partial release. Each has different implications. Additional shifts require capacity and quality controls. A different location may change inspections and logistics. A partial release may allow bounded work while preserving a later interface condition. The change assessment should record the actual proposed mechanism before treating the shortened task range as credible.

The manager then checks the receiving branch. If it becomes binding, further supply acceleration may not improve the overall finish. The sponsor should avoid paying for a local saving whose integrated benefit is absent unless another justified objective exists. Earlier equipment availability could still reduce another exposure or preserve optionality, but that value should be stated and supported. The network result narrows the schedule claim; it does not make the whole commercial decision automatically favourable or unfavourable.

The fictional review records an intervention comparison rather than another approval checklist. Entry SUPPLY-SHIFT keeps equipment scope intact, changes the production arrangement and requires inspection attendance at the new location. Entry RECEIVING-RELEASE retains the production arrangement but changes which receiving information can be released independently. Entry WAIT retains both arrangements and preserves the existing resource reservations. The manager rejects a combined saving claim because its supporting papers describe different interventions. The supplier offer answers the production question; the receiving sketch answers the information question; neither establishes the operator's test window. The sponsor requests the missing interaction assessment before choosing a combined method.

The resulting fictional disposition has a useful counterfactual. If the supplier's acceleration were available without changing inspection or transport, SUPPLY-SHIFT could be compared directly with WAIT for

the supply mechanism. If it instead requires another factory, the inspection and logistics changes enter the same alternative and cannot be held constant in its explanation. The record retains the rejected combined claim beside the separate offers, so a later outcome review can identify which premise was actually secured. Its contribution is an incidence test: follow each proposed saving to the additional obligations it creates, and distinguish an unchanged surrounding system from a surrounding system that must change with it.

*No monetary valuation is calculated here*

The app computes schedule consequences only. Cost, benefit, damages and legal responsibility require distinct evidence and models.

## Decision implications

- Describe the changed obligation or method before calculating its dates.
- Trace the complete dependency and evidence closure.
- Value local acceleration by its integrated consequence.

## MECHANISMS AND WORKED STUDIES

10

# Progress must mean accepted work

*An evidence-based progress measurement protocol*

## Progress needs a defined state

Progress reporting becomes unreliable when different states are collapsed into a percentage. Work can be started, produced, inspected, delivered or accepted. Each state supports a different inference. Produced equipment may still fail inspection. Delivered equipment may still be incompatible with receiving works. Accepted equipment may still await a different package before assembly can start. A useful progress record states what happened and what the evidence proves, then connects the accepted event to the network's release condition.

A percentage-complete judgment can be useful within a package if its basis is explicit. It should not automatically release a successor or establish value earned. A design team may have completed most drawings while the unresolved interface governs procurement. A construction package may

have little physical work remaining but lack a critical test. Averaging completion across activities can make the package appear close to finished while hiding the item that determines acceptance. Report residual obligations and their consequences alongside any aggregate measure.

The schedule should use actual completion only when the defined event has occurred. If the task represents equipment accepted at the receiving boundary, factory production is insufficient. If it represents an approved design release, a submitted draft is insufficient. The actual-date record should link to the accepted evidence and the person who supplied it. This protects the meaning of the model. Otherwise the forward logic may release downstream work on an event that exists only in the reporting vocabulary.

Remaining duration is a new forecast, not simply the original duration multiplied by a remaining percentage. Work may be uneven, and the residual tasks may contain the hardest uncertainty. A package reported substantially produced can still face an uncertain acceptance cycle. The owner should forecast the remaining executable scope from the status date, with its prerequisites and evidence basis. The small app models complete fictional networks rather than actual progress updates; applying it to a remaining network requires deliberate restructuring and a declared origin.

Progress evidence has a date and a scope. A photo, inspection record or supplier report can be accurate at its time yet outdated after change. The integrated manager should know whether the evidence predates a configuration revision or whether it covers the entire package. A reported actual should not be overwritten casually when its basis changes. Preserve the original event and record the reopened obligation. This avoids making history appear different simply because the project later required additional work.

## Exhibit: evidence has a state and a scope

Inspect the declared relationships within the captioned scope.

### PROGRESS AND RELEASE ARE DIFFERENT CLAIMS



Each evidence item proves its own scope, configuration and date.

Only the required accepted event releases the relevant successor.

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A photo, payment or submission does not automatically prove acceptance.

Original reporting architecture. Produced, inspected, delivered and accepted are distinct claims; they need not be a universal mandatory sequence. Evidence must retain configuration, date and scope. The drawing contains no measured progress and no acceptance of an actual package.

#### *Use an actual only for the defined event*

Record intermediate progress honestly, but release a successor only on evidence matching its accepted prerequisite. Forecast remaining scope from the status date rather than from an unexplained percentage.

## Accepted work and readiness for the successor

Accepted progress should be measured against controlled outcomes. A package can have interim acceptances that support limited release while final acceptance remains open. The report should name the level.

Accepted for procurement, accepted for assembly and accepted for service are not equivalent. This vocabulary allows the network to represent staged readiness without pretending that each stage is final completion. It also prevents a milestone reached for one purpose from being used to justify another purpose with stricter conditions.

An evidence register should connect the reported event to the acceptance criteria, configuration and authority. A signed record can show that a review occurred, but the authority and scope determine whether it releases the successor. If a condition remains open, state its effect. The recipient may accept the package with an exception that does not affect immediate

work, or may hold the release entirely. Reporting both as complete makes the schedule less useful at precisely the point where integration judgment matters.

Progress states and the claim each can support

A qualitative reporting vocabulary prevents false successor release.

| Progress states and the claim each can support |                                                         |                                                  |
|------------------------------------------------|---------------------------------------------------------|--------------------------------------------------|
| State                                          | Evidence can support                                    | Still requires                                   |
| Started                                        | Work mobilisation occurred                              | Production and acceptance obligations            |
| Produced                                       | Specified work was performed within shown scope         | Inspection, delivery or acceptance as applicable |
| Inspected                                      | Defined checks were completed                           | Disposition and actual accepting authority       |
| Delivered                                      | Output reached the named boundary                       | Compatibility and recipient acceptance           |
| Accepted                                       | Controlled criteria were met within recorded conditions | Other predecessors and final service obligations |

Actual progress can reveal a defect in the model. If a successor begins before its entered predecessor is accepted, investigate whether the logic was unnecessarily restrictive, the work proceeded under qualified release, or the release control was bypassed. Do not simply move the predecessor’s actual date to make the chart consistent. The discrepancy is information. It can improve future logic or identify an exposure that needs corrective action. A programme should be reconciled with reality while preserving the reason for any departure.

The status update should distinguish evidence received from evidence verified. A supplier’s declaration of readiness may be accepted provisionally while an inspection is arranged. That can support a conditional forecast, but it should not be reported as independently verified acceptance. The distinction helps downstream teams choose an appropriate level of reliance. It also makes the eventual confirmation or rejection traceable. Control does not require distrusting every declaration; it requires stating what confidence and authority the declaration actually carries.

A progress meeting should focus on release and residual work. For each material package, ask what accepted outcome occurred, what remains, what evidence is missing and what decision could affect the forecast. This is more diagnostic than asking only whether the package is on track. A

green status can conceal an approaching acceptance problem; a red status can reflect a recoverable local delay with no integrated effect. The network and package records should be used together to identify the consequence.

### *State reporting is too detailed for executive meetings*

Executives need the consequential distinctions, not every local event. Show accepted readiness and material residual obligations; retain the detailed evidence in linked package records.

## Evidence and scope

DOE describes earned value as integrating scope, schedule and cost for project performance.

Evidence: Earned Value Management

## Fictional case: a persuasive photo supports the wrong claim

A fictional progress presentation shows installed equipment and labels the package accepted. The photo is genuine within the case, but it proves only that visible equipment was present at the photographed location and time. It does not establish the released configuration, hidden interfaces, test results or recipient acceptance. The manager challenges the claim rather than the image. Evidence quality depends on the proposition being asserted, not on visual persuasiveness.

The producing owner supplies the configuration and inspection records. The recipient identifies an open interface condition. The progress report is revised to distinguish installation evidence from accepted assembly release. This preserves genuine work while keeping the successor condition open. A correction should not erase the earlier photo or imply that nothing had been achieved. It should state the narrower claim the evidence supports and the additional evidence needed for the broader one.

The status date matters. The photo predates a configuration change, and part of the visible work may require modification. The manager records the earlier installation event and the later reopened obligation. Backdating acceptance would hide the change. Overwriting the actual with a new completion date without explanation would lose useful history. The record should retain both states and identify why the accepted scope differs from what was previously shown.

The executive audience needs a concise correction. The manager states that physical installation progressed, but acceptance remains conditional on the interface disposition. The forecast uses the remaining obligation rather than a percentage inferred from the photo. This is not excessive technical detail. It is the minimum information needed to avoid mobilising a successor on an unsupported readiness claim. The linked package record contains the deeper evidence for anyone who needs to inspect it.

The team also changes its reporting rule. Photos can accompany progress, but accepted milestones require the specified evidence and authority. A visual record should carry date, place and scope. This rule is proportionate where imagery is used for consequential release. It does not require every local activity to receive formal certification. The control follows the claim and the reliance it invites.

The lesson extends to dashboards and demonstrations. A functioning component, a successful test in one configuration or a saved document can be real evidence without proving the broader outcome. Report the property actually checked and retain its limits. This fictional case supplies no observed quality rate. It demonstrates how a truthful artifact can still be used to support an untruthful inference if its scope is lost.

## Progress can expose a missing package boundary

The team then examines the remaining basis. Transport readiness, documentation and receiving capacity may govern availability. If those were included within the original supply task, the remaining duration forecast should identify them rather than inventing new scope. If they were excluded, the network perimeter requires correction or clarification. The decision depends on the original package boundary. Progress evidence therefore tests both execution and model completeness. A status meeting can reveal an integration gap that existed before work began.

An omitted receiving obligation is a network-definition problem, not simply a more conservative supply duration. If the network event means accepted availability, an unrepresented inspection or release must be located within the task or represented as a separate predecessor. The team should first establish which scope owner actually carries it, then check for double counting against existing activities. Adding every remaining duty as a new task can be as misleading as deleting it. The authorised correction should preserve the original package basis, identify the topology or duration that changed and recompute successor dates under the corrected acceptance event.

An acceptance-boundary correction can expose dependencies beyond the visible supplier milestone. Receiving access might depend on another package, while an inspection requires a qualified resource or authority window. The next forecast should represent the dependencies material to the declared release, retaining unknowns as evidence requests rather than assigning convenient dates. The app can check supplied network logic and recalculate it. It cannot establish that the added obligation is contractually included, that its duration is supported or that the recipient has authorised the release. Those are distinct duties in the package record.

At closure, preserve the sequence of states. Production, delivery and acceptance dates can inform future estimates if their scope and conditions are retained. A single final completion date loses the waiting and interface information that could explain performance. The historical record should therefore carry enough detail to distinguish productive work from release latency. This does not require collecting every operational event. It requires preserving the events whose meaning and consequence governed the accepted outcome.

### *The frozen studies contain no actual progress*

All network inputs are fictional. The app does not validate field evidence, calculate earned value or infer remaining duration from completion percentages.

## Decision implications

- Keep production, delivery and acceptance distinct.
- An evidence item supports only its defined claim.
- Forecast residual work from current obligations.

## MECHANISMS AND WORKED STUDIES

# 11 Earned value can mislead on weak baselines

### *An earned-value limitation exhibit*

## Performance arithmetic needs a credible reference

Earned value combines scope, schedule and cost through a baseline and a rule for recognising completed work. Its usefulness depends on that foundation. If the scope is incomplete, budgets are poorly distributed or

progress rules reward ambiguous percentages, performance ratios can be precisely calculated yet misleading. A weak baseline does not become strong because its report contains an index. The first review should therefore test what work the reference represents and what evidence permits value to be recognised.

This chapter discusses the control logic qualitatively. The Delivery atlas has no cost baseline, planned value, earned value or actual cost inputs. It produces no earned-value indices or forecasts. The frozen schedule studies cannot be used to infer those quantities. A project that needs earned-value analysis should use an appropriate separately controlled model with scope mapping, time-phased budgets, progress rules and cost evidence. The conceptual distinctions here help a reader identify the prerequisites for that model without implying that the companion app performs it.

A schedule milestone and an earned-value event can coincide, but they need not. A supplier payment can occur before delivery acceptance. A design package can earn value under an agreed progress rule while a critical interface remains open. The performance system should explain these mappings. Otherwise favourable cost or value performance may be interpreted as readiness for a successor, which is a different claim. Integration requires a shared scope structure, not an assumption that every metric means complete in the same way.

A budgeted package should have a recognisable obligation and a progress rule suited to it. Discrete accepted deliverables can use evidence-based recognition. Ongoing support work may need a different treatment. The rule should be selected and documented before status pressure arises. Retrospective rule changes can make performance appear better without improving delivery. If a legitimate scope or method change requires a revised rule, preserve the earlier basis and explain the effect on comparability.

Unfinished work can dominate outcome even when much value has been recognised. A small remaining acceptance task may govern the service start. Conversely, a large budget package may be noncritical in the conditional schedule. A performance review should therefore show both economic progress and delivery release. Treating one as a substitute for the other conceals the causal structure. The sponsor needs to know what has been accomplished, what has been spent and which residual obligations still govern accepted completion.

*Use indices only after basis reconciliation*

Rely on earned-value metrics when their scope, budget distribution, recognition rules and cost cutoff are credible for the decision. Pair them with accepted-progress and dependency evidence before making a delivery conclusion.

## How a weak baseline distorts interpretation

An incomplete scope baseline can overstate progress by excluding work that later becomes essential. If commissioning preparation is missing, the remaining installation work may appear to represent nearly all completion while service readiness remains distant. Adding the missing obligation can make reported performance deteriorate even though the project has gained information. The correct response is to explain the baseline defect and its consequence. Suppressing the new obligation to preserve a favourable index weakens both the performance system and the delivery forecast.

Poor budget distribution can distort recognition. A package weighted heavily toward early procurement may show strong value progress before installation or acceptance, while another structure may recognise value later. Neither pattern is inherently wrong if it follows a justified scope and recognition basis. The danger is comparing ratios without understanding the mapping. A benchmark from another project is especially weak when scope, procurement strategy and recognition rules differ. The performance record should retain the basis needed for a fair comparison.

### Illustrative performance-basis reconciliation

A completed qualitative checklist tests whether the metrics refer to the same obligations.

| Illustrative performance-basis reconciliation |                                                                                      |
|-----------------------------------------------|--------------------------------------------------------------------------------------|
| Field or action                               | Illustrative completed record                                                        |
| Input                                         | Scope map: supply, receiving, assembly, testing and acceptance separately identified |
| Input                                         | Recognition rule: recorded for each package before status reporting                  |
| Input                                         | Cost cutoff: reconciled with schedule evidence cutoff                                |
| Input                                         | Missing obligation: integrated test preparation checked explicitly                   |
| Input                                         | Remaining work: forecast from executable residual scope                              |
| Input                                         | Metric boundary: no earned-value output from Delivery atlas                          |
| Action                                        | Challenge recognition that relies on ambiguous completion states.                    |
| Action                                        | Keep economic progress separate from successor readiness.                            |
| Action                                        | Explain scope changes before interpreting ratio movement.                            |

Actual costs can lag the work they describe. Accruals, invoices and payment timing may differ. A favourable cost report can therefore reflect incomplete cost capture rather than efficient delivery. The cost evidence should state its cutoff and treatment of incurred but unrecorded obligations. The schedule evidence needs its own cutoff. Comparing asynchronous records without reconciling can produce an apparent performance trend that is partly a reporting artifact. This is a control issue requiring accounting and project evidence, not a correction the scheduling app can calculate.

A favourable schedule performance measure does not necessarily imply an earlier completion date. Recognised value may be distributed across noncritical work while a critical release remains delayed. The dependency network should be reviewed alongside the performance metric. The integrated manager can then explain whether progress is occurring where

it changes accepted completion. This does not diminish the value of noncritical work. It prevents aggregate recognition from obscuring the remaining delivery mechanism.

Forecast-to-complete judgments should be based on remaining scope and credible execution plans. A mechanical extrapolation can be useful as a diagnostic comparison, but it should not automatically replace the package owner's forecast when scope or method has changed. The record should show why the chosen forecast is suitable and what assumptions it depends on. When different approaches disagree, the disagreement is a prompt to examine the basis rather than an invitation to select whichever produces the most attractive result.

### *Qualitative review undermines objective metrics*

It strengthens their interpretation by checking the objective being measured. Arithmetic objectivity cannot compensate for an incomplete obligation or an unsupported recognition rule.

## Evidence and scope

Cost guidance connects credible estimates to scope, assumptions, data and controlled updates.

Evidence: Cost Estimating and Assessment Guide

## Fictional case: cost evidence and progress close at different times

A fictional controller closes the cost report before the schedule team gathers its latest acceptance evidence. The executive pack compares both as if they share a status date. Some newly completed work has not yet entered the cost ledger, and some incurred obligations have not been invoiced. A favourable performance impression may partly reflect asynchronous evidence. The review identifies the mismatch without calculating a new index from incomplete data.

The controller states the cost cutoff and treatment of accruals. The schedule manager states the evidence cutoff and accepted-progress basis. The team reconciles material differences and identifies which comparison is suitable for the meeting. This does not require every record to be collected at the same instant. It requires a transparent basis and enough adjustment or qualification to prevent the audience from inferring a common period that does not exist.

The package map also differs. The cost report groups equipment procurement and logistics, while the schedule separates supply readiness and receiving acceptance. A single performance ratio cannot show which release obligation remains open. The controller and manager establish a mapping so economic progress and delivery readiness can be read together. The mapping does not force identical structures; it explains where their boundaries correspond and where they do not.

The sponsor asks whether the apparent favourable trend justifies a stronger delivery promise. The answer depends on residual work, acceptance and current resource evidence, not on the ratio alone. The team can acknowledge economic progress while retaining a conditional service forecast. This avoids both dismissing useful cost information and allowing it to stand in for a claim it cannot support. The report states what each lens establishes.

The review records a process improvement. Future packs will identify cutoffs, scope maps and material unrecorded obligations before drawing combined conclusions. This is a concrete control rather than a generic request for better reporting. Its effectiveness can be checked at the next close by inspecting the evidence fields and reconciliation. A later favourable metric still needs interpretation, but the basis will be easier to challenge.

The lesson is that performance arithmetic inherits the timing and scope of its inputs. A consistent formula cannot reconcile asynchronous evidence automatically. This case supplies no earned-value output or accounting opinion. It shows why the organisation needs a controlled bridge among progress, cost and forecast before treating their combined presentation as evidence of delivery health.

## A performance review with two lenses

Imagine a fictional project reports strong budgeted-work progress because equipment production is well advanced. The operator still lacks an integrated test procedure and a readiness decision. The executive review should recognise the real production achievement while stating that the service outcome remains constrained by integration obligations. A single favourable headline would be incomplete. A single negative headline would also be misleading. The useful report connects progress to the remaining conditions for the accepted outcome.

The fictional controller completes a reconciliation note headed PRODUCTION-TO-SERVICE. The procurement account covers manufacture and transport; the schedule's supply event means equipment

available for assembly; the operator's event means a tested service. The note records production recognition as supported, site compatibility as pending and service readiness as unresolved. It identifies an integrated test procedure that has no corresponding budgeted package. This is a missing obligation rather than a poor performance ratio. The repair is to locate its scope and funding in the control accounts before interpreting the aggregate trend. Merely moving value from procurement to commissioning would redistribute recognition without establishing the omitted work.

The package owners then review evidence rules. Production completion may support recognition under an agreed rule, but it should not mark receiving acceptance complete. Test preparation may earn progress before tests occur, while the test milestone remains open. These distinctions can be represented coherently if each rule is explicit. The executive report should use ordinary language to explain them. Technical abbreviations without the underlying obligation make it easier for readers to infer readiness that the metric does not establish.

The review then separates possible causes of a favourable cost reading. A missing supplier invoice directs the controller to incurred-cost capture. An early recognition rule directs the package owner to the earned-value basis. A delayed critical release directs the integration manager to the remaining network. These diagnoses can coexist; they should not be collapsed into a single explanation called efficiency. In the fictional disposition, production evidence is retained, the unrecorded logistics obligation is referred for accounting treatment, and the missing test procedure receives a scope assignment. The sponsor directs the procedure work because it governs service, rather than directing more already-advancing production to improve the headline.

PRODUCTION-TO-SERVICE closes with a contradiction test. If the cost ledger becomes complete while the service release remains blocked, the accounting repair has worked within its own boundary but has not removed the delivery constraint. If the test procedure is accepted while invoices remain incomplete, readiness has improved while the cost conclusion remains provisional. If both are repaired and the aggregate index barely changes, that does not negate either repair. Their value lies in different obligations. The note therefore carries separate statuses for economic recognition, incurred-cost capture and successor release. This produces an explanation of the disagreement between reports, rather than a demand that every report display the same colour.

*No EVM numerical example is claimed*

This chapter supplies original conceptual control analysis. Neither the app nor the frozen studies calculate earned-value indices, costs or cost forecasts.

## Decision implications

- Test the baseline before interpreting performance arithmetic.
- Reconcile scope and cutoffs across metrics.
- Use delivery evidence alongside economic progress.

### MECHANISMS AND WORKED STUDIES

12

## Schedule variance has a cash consequence

*A schedule-to-cash worksheet*

### Delay has a mechanism, not a universal price

A later completion can affect cash, benefits, operating readiness and contractual exposure. The effect depends on the obligation and its timing. A delay may defer revenue, prolong a support cost, miss a fixed operating window or trigger a specific contractual consequence. It may also have little immediate financial effect if a successor was not ready for unrelated reasons. A universal cost-per-week multiplier obscures these mechanisms. Begin by identifying whose cash or benefit changes, at which boundary and under what evidence.

The Delivery atlas computes relative schedule outcomes. It has no revenues, costs, debt, discount rates or contract terms. Its duration differences are not monetary valuations. A reader can use the network to identify a conditional timing change, then assess financial consequences in an appropriate separate model. That model needs its own scope, units, dates and assumptions. The separation matters because a task saving can be exact in the schedule study while its economic value remains uncertain or absent.

Benefit start should correspond to an accepted operating outcome. Physical construction completion may not release service revenue if testing, permits or operator readiness remain open. An appraisal that starts benefits at the earlier construction date can overstate value.

Conversely, partial service may become available before full project completion if the accepted operating boundary permits it. The financial model should follow the actual service release logic rather than adopting a generic project finish label. The schedule and benefit model need a reconciled interface.

Delay-related costs should distinguish fixed commitments, duration-dependent costs and event-triggered consequences. Some mobilisation costs occur regardless of a short slip. Some support costs continue with time. Some expenses arise only if a window is missed or a contract condition is activated. These categories are original analytical distinctions, not rates for a real project. They help the team ask for relevant evidence and avoid double counting. A prolonged supervision allowance may already be embedded in a forecast; adding another generic delay factor would repeat it.

Contractual consequences depend on actual terms and applicable law. A schedule can show a timing difference, but it does not determine entitlement, causation, notices or enforceability. The evidence record should preserve the event, instruction, affected work and contemporaneous forecast for specialist assessment. Avoid converting a model difference directly into a damages claim. The appropriate legal and commercial interpretation belongs to the actual agreement and authorised advice, not to a general planning equation.

### *Value the consequence through a separate controlled basis*

Translate a schedule scenario into money only after identifying the accepted event, causal cash or benefit mechanism, actual evidence and model perspective. Retain admissibility gates and avoid universal delay factors.

## Timing can create discontinuities

Some consequences change sharply at a boundary. A missed outage can defer work to another window. A vessel, train or inspection slot can become unavailable. A permit or financing condition can expire. The financial effect then depends on the event, not merely the length of the initial task slip. A sensitivity that varies duration smoothly may fail to represent this discontinuity. The decision record should identify such thresholds and model the alternative state explicitly when it is material.

A target can have different meanings. It may be a contractual date, a desired service start, a resource reservation or an internal performance objective. The same schedule variance can have different consequences against each. A report should state which target is being compared and why. If the target changes, preserve its earlier basis. The earlier-target study demonstrates that changing a deadline alone does not change the network duration. In a financial assessment, the new target may alter consequences, but it does not establish any acceleration of work.

Cash timing and economic value are also distinct. A payment deferred because acceptance occurs later may improve short-term cash while reducing service benefits. A supplier paid earlier for acceleration may worsen near-term cash while improving an operating outcome. An analysis that treats all deferral as a benefit or all acceleration as a cost can mislead. Identify the perspective, the payment terms and the service consequence. The sponsor, contractor and operator may have different exposures even when they refer to the same milestone.

Uncertainty should be preserved in the financial bridge. If the schedule scenario depends on unconfirmed resources, the resulting cash timing remains conditional. If an acceptance event has an uncertain outcome, a duration-only case may not describe the full exposure. Use scenarios that retain the causal conditions rather than presenting a single money figure with false certainty. The separate financial model should make clear which quantities are observed, contractual, estimated or expressly illustrative.

A recovery expenditure should be compared with its integrated consequence. The duration-switch study shortens supply and makes receiving works binding. Paying for still more supply acceleration may produce no further conditional project saving unless another objective justifies it. The financial decision can still value earlier equipment availability, but that benefit must be identified separately. The network prevents an unsupported claim about project completion; it does not automatically rank every commercial option.

### *A rough multiplier is useful for quick decisions*

A rough factor can be a clearly labelled screening assumption when its mechanism and limits are understood. It should not become a contractual claim or investment conclusion without the evidence the decision requires.

## Evidence and scope

PPP preparation guidance distinguishes value for money from affordability within public procurement.

Evidence: EPEC Guide to Public-Private Partnerships

## Fictional case: a small slip crosses an operating boundary

A fictional operator can introduce the new equipment only during an agreed access window. A modest shift in assembly readiness could miss that window and require a different operating plan. A generic weekly delay factor would describe the consequence poorly because the effect is not smooth. The manager identifies the actual boundary and asks what happens on either side. This case supplies no monetary rate, operating calendar or empirical frequency. It illustrates why timing-to-value analysis must follow the causal event.

The first question is whether the window is fixed, negotiable or conditional. The operator supplies its actual basis and authority. The team should not treat a preference as a physical impossibility, nor assume a mandatory operating restriction can be waived by the sponsor. The decision record identifies admissible alternatives. If another window is possible, its readiness, resource and service consequences require evidence. A date-only schedule comparison cannot establish those conditions.

The financial bridge then distinguishes deferred benefits from additional costs and transferred exposure. Missing the window might postpone accepted service, extend support or require remobilisation. Some costs may already be committed; others depend on the selected alternative. The modeller should avoid adding every possible category indiscriminately. Each consequence needs a source, perspective and scenario basis. No universal multiplier can determine whether the same cost belongs to the sponsor, contractor or operator.

The sponsor considers acceleration to preserve the window. The complete network should show whether the proposed intervention reaches accepted readiness before the boundary, including testing and authority. A local assembly saving is insufficient if operating acceptance remains open. The decision also checks admissibility and reversibility. An intervention that makes the physical task earlier while compromising a required test does not solve the service problem. Value comparison begins after the executable options are established.

A contingent alternative can preserve optionality. The operator may reserve another window while the team closes current readiness evidence, if actual arrangements permit it. The reservation has a cost and expiry condition that need their own record. The schedule should not represent both mutually exclusive options as if they will occur. Use separate scenarios and identify the decision that selects one. This makes the timing-to-value bridge inspectable without pretending that uncertainty has become a single guaranteed date.

The executive report states the boundary plainly: the current conditional forecast approaches an operating decision whose consequence may be discontinuous. It names the evidence, owner and latest responsible decision point. The report does not invent a precise financial result from absent data. Its usefulness lies in directing attention to the event where action can still protect value. The transferable lesson is to inspect material windows and permissions before assuming that schedule consequences can be valued smoothly.

## Build a timing-to-value bridge

A practical bridge begins with the changed accepted event. State its original and revised timing basis, the affected successor and the reason the change occurs. Then identify the cash or benefit mechanism. For an illustrative installation, later operator acceptance might defer service availability while extending integration support. The bridge should identify the source of each rate, the calendar convention and any threshold event. This chapter supplies the structure without inventing numerical rates or claiming a financial result.

The bridge should state what remains constant. If the revised scenario changes service volume, scope or operating cost as well as timing, its value difference cannot be attributed solely to delay. A well-formed sensitivity isolates the mechanism or clearly declares the combined changes. This is the same discipline used in the frozen schedule studies. Narrow comparisons make causal claims easier to assess; broader alternatives may be useful decisions, but their explanations must acknowledge the changed perimeter.

## Illustrative timing-to-value bridge

No monetary rates or valuation outputs are invented.

| Illustrative timing-to-value bridge |                                        |                                          |                                                    |
|-------------------------------------|----------------------------------------|------------------------------------------|----------------------------------------------------|
| Changed event                       | Possible mechanism                     | Required evidence                        | Boundary to retain                                 |
| Operator acceptance later           | Service benefit starts later           | Accepted service scope and benefit basis | Construction finish is not automatic service start |
| Integration extends                 | Support obligations continue           | Actual resource and commercial basis     | Avoid costs already included elsewhere             |
| Release window missed               | Next executable window differs         | Confirmed calendar and availability      | Consequence can be discontinuous                   |
| Supply accelerates                  | Earlier availability or project saving | Complete network and offer basis         | Local saving may not move accepted finish          |

A completed fictional bridge entry, SERVICE-SLIP, identifies operator acceptance as the changed event and integration support as the affected cost obligation. The planner supplies the current acceptance forecast; the operator confirms that no useful partial service precedes that event; the commercial record states which support duties continue. The financial analyst leaves the amount unresolved because the applicable support basis is absent. The resulting decision is still specific: investigate continued support and deferred service separately. It rejects a proposed universal delay factor, which would merge different parties and potentially duplicate support already carried in the forecast. No rate or monetary output is supplied by this qualitative instrument.

A contrasting entry, PAYMENT-DEFERRED, concerns a payment that follows acceptance. Later acceptance can postpone that payment while also postponing useful service. The bridge records the temporary cash effect and the operating loss as separate mechanisms; a favourable payment movement cannot erase the service consequence. If the payment is instead contractually due on dispatch, the same schedule slip does not justify moving it with operator acceptance. The test is to follow the controlling payment event through the actual terms, not to shift every line by the schedule variance. This contrast exposes why a sponsor's liquidity perspective and an operator's benefit perspective can disagree without either calculation necessarily being wrong.

The bridge's version check is performed through its consequential event, rather than by comparing file dates alone. In the fictional packet, an earlier financial sheet starts benefits at mechanical completion while the current charter promises accepted service. The analyst records EVENT-MISMATCH and leaves the value claim unused until the event is

reconciled. A newer workbook with the same mistaken event would still fail. Conversely, an older workbook may remain applicable if the relevant accepted event and all dependent assumptions are unchanged. The completed packet contains the event definition, network reference, affected payment or service duty and unresolved valuation field. Its practical contribution is a reproducible diagnosis of interface mismatch between delivery and value.

### *Schedule reproduction is not financial validation*

The frozen networks contain no cash flow or commercial terms. Their outputs cannot establish bankability, damages, value for money or recipient acceptance.

## Decision implications

- Identify the accepted event that changes cash or benefits.
- Model material window effects explicitly.
- Keep schedule and valuation versions reconciled.

## GOVERNANCE AND APPLICATION

# 13 Forecasting needs explicit uncertainty

*A forecast language and evidence policy*

## Three kinds of statement about the future

A deterministic schedule answers what follows from entered durations and dependencies. A scenario asks what follows if a declared set of assumptions changes. A probability statement requires a model of uncertainty and a basis for its distributions and dependence. These are different claims. A report should identify which one it makes. Calling an optimistic scenario likely does not turn it into a probabilistic forecast. Calling a calculated mean expected does not validate the underlying estimates as empirical distributions.

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

The Delivery atlas transforms each entered estimate range using its stated PERT method. The canonical method is  $\text{PERT mean} = (\text{optimistic} + 4 \times \text{most likely} + \text{pessimistic}) / 6$ .  $\text{Variance} = ((\text{pessimistic} - \text{optimistic}) / 6)^2$ . The resulting task mean and variance are conditional on the fictional

inputs. The app then uses the mean durations for the dependency calculation. These transformations are reproducible, but reproducibility is not calibration. The paper supplies no field project-duration sample from which to estimate the inputs or verify the approximation against field outcomes.

Illustrative statements and their limits

Read the output as the specific claim the method supports.

| Illustrative statements and their limits |                                                     |                                                             |
|------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------|
| Statement                                | Supported by the frozen study                       | Cannot establish                                            |
| Expected duration                        | CPM on task PERT means                              | Actual project feasibility or calibrated finish probability |
| Optimistic and pessimistic scenarios     | Network recalculation using entered case durations  | Statistical confidence bounds or absolute outcomes          |
| Selected-path normal reading             | Normal approximation on one displayed critical path | Whole-DAG completion probability                            |
| Critical-path count                      | Count under entered mean-duration topology          | A complete ranking of operational risk                      |
| Deterministic boundary                   | Deadline rule when selected-path variance is zero   | Certain field delivery                                      |

Illustrative calculation. Assumptions and sensitivity are published with the model.

For the reference study, the selected path variance is 1.11 squared weeks and the selected-path standard deviation is 1.05 weeks. Against a target of 20.00 weeks, the engine’s selected-path normal deadline approximation is 82.9%. This percentage is explicitly not the probability of the whole project finishing on time. It excludes competing-path uncertainty and path switching, assumes the relevant independence conditions and relies on the entered estimates. It should be labelled with those limits wherever it is used.

Illustrative. The earlier-target study changes only the target to 18.00 weeks. The network duration remains 19.00 weeks while the selected-path approximation becomes 17.1%. The contrast shows that a deadline changes the question asked of the distribution approximation, not the work itself. It offers no evidence that management can improve completion confidence by selecting a different desired date. The target is an input to interpretation, not an acceleration mechanism.

Illustrative. Scenario envelopes also require careful language. The reference network’s all-optimistic duration is 13.00 weeks and its all-pessimistic duration is 25.00 weeks. These are whole-network recalculations using the

respective task assumptions. They are not confidence bounds and do not establish the maximum possible delay. An omitted approval refusal or redesign condition can sit outside both. The envelope is useful when the reader understands the cases it represents and the mechanisms it excludes.

### *Match the uncertainty claim to the method*

Use the deterministic and selected-path outputs only within their declared scope. Require a separate full-network uncertainty basis before claiming whole-project completion confidence.

## Competing paths and dependence

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

A project finishes only when all required terminal obligations are complete. A selected-path approximation describes a narrower event. Another branch can become slower even when it is not critical under the entered means. In the tied-branches study, the engine counts 2 critical paths yet reports the selected-path approximation 82.9%. The equality of that reading to the reference is not evidence of equal whole-project confidence. It reflects the selected path and variance used by the limited method.

Dependence can change uncertainty materially. Tasks can share weather, resources, design decisions or supplier exposures. Treating their duration variation as independent may understate or otherwise misrepresent aggregate uncertainty. The app contains no correlation inputs and performs no stochastic network simulation. A real completion-confidence analysis should use an appropriate model and evidence for dependence, competing paths and conditional events. This paper does not invent a correlation coefficient or claim that a single adjustment can repair all such omissions.

Path switching matters even without tied means. The duration-switch study changes which branch governs the deterministic finish. Under uncertainty, such switching can occur across possible outcomes as well. A probability method confined to one selected path cannot fully represent that behaviour. This is why a displayed percentage should not be promoted into an external warranty or a complete risk estimate. The network result can still be useful for screening sensitivities, provided its scope remains attached to the claim.

**Illustrative calculation.** Assumptions and sensitivity are published with the model.

The deterministic-path study sets each range to its most-likely duration and matches the target to the resulting finish. The engine then reports 100.0% for the conditional deadline event. This is a zero-variance boundary rule, not proof of certain real-world delivery. The inputs explicitly remove duration variation, and the model still excludes resources, calendars, omitted work and acceptance failure. A deterministic numerical boundary should be explained as such to avoid a misleading certainty claim.

**Illustrative.** The path-enumeration study has 64 critical paths while the display limit is 50. Counting and listing serve different purposes. The bounded list protects usability, while the total count discloses that more paths exist than are displayed. A reviewer should not infer completeness from the visible list alone. This fictional equal-branch network is a computational boundary case, not an empirical description of a project. Its purpose is to verify the distinction and its reporting.

### *The limited percentage should never be displayed*

It can teach and screen the selected-path mechanism when adjacent limits are unmistakable. Remove it from decisions whose audience would reasonably interpret it as a complete confidence measure.

## Evidence and scope

Risk guidance connects uncertainty, objectives and proportionate responses in public organisations.

Evidence: *The Orange Book: Management of Risk, Principles and Concepts*

## Fictional case: equal means do not imply equal completion confidence

A fictional sponsor compares a single-branch programme with a programme that has several competing branches. Both show the same mean-duration finish. The sponsor asks whether their chance of meeting a target is therefore the same. The manager explains that mean-duration equality does not establish distributional equality. The number and dependence of competing routes can affect completion. The small app's selected-path reading cannot settle that broader question.

The team identifies the claim the decision requires. For a bounded internal sequence discussion, the deterministic comparison may be adequate. For a consequential delivery promise, the authority may need a

full-network uncertainty model with supported distributions and dependence. The manager should not invent a correction factor based solely on the number of paths. Such a factor would add another unsupported model. The correct next step is an appropriate method and evidence, or a narrower commitment.

The report therefore retains the conditional mean dates and labels the selected-path approximation precisely. It states that the publication supplies no whole-project probability. This qualification is meaningful even when the displayed percentages happen to match. Numerical similarity does not prove equivalence of the events being measured. The case illustrates a communication and method-selection issue rather than a new frozen probability calculation. Its transferable lesson is to define the event before comparing confidence claims.

## Choose uncertainty analysis for the decision

The required uncertainty analysis follows the consequence of reliance. A local sequencing discussion may need a deterministic comparison with clear limits. A resource reservation may need scenarios around readiness and availability. A public delivery promise or major investment may require a more complete uncertainty model and domain evidence. The small app is not defective because it does not answer every question. It becomes misleading when its narrow output is used for a broader claim without the additional analysis the decision requires.

The fictional uncertainty register is completed by representation type. SUPPLY-VARIATION retains a duration range under a fixed equipment scope. CONFIGURATION-CHOICE records mutually exclusive equipment concepts and therefore needs alternative work definitions. TEST-DISPOSITION records a possible rejection and an unresolved correction obligation. INSPECTION-COVERAGE records uncertainty about executable capacity. The manager refuses to absorb all four into a longer supply duration: that edit would place the consequence on the wrong activity and imply that elapsed waiting settles configuration, quality and capacity. The register states a separate next instrument for each entry, without adding a probability or a new numerical case to the frozen studies.

A sensitivity should change a declared assumption and preserve the comparison basis. The frozen studies isolate topology, supply estimates, an inserted gate, tied branches and the deadline. This helps a reader identify the cause of an output change. Real alternatives may change several assumptions together; those can be useful scenarios, but their

interpretation should acknowledge the combined changes. A difference between broad scenarios is not automatically attributable to one named intervention.

The uncertainty communication test compares two fictional requests made from the same network. The planner wants to prioritise attention between branches; the operator wants a dependable shutdown promise. For the first request, the selected-path reading can identify a conditional sensitivity alongside competing routes. For the second, the manager records that dependence, resource availability and acceptance outcomes are not represented, so the printed reading cannot answer the requested event. The packet keeps the computation available and changes the claim presented to each audience. Its contribution is an event-to-method test: a number is informative when the event it calculates matches the decision question, not merely when its label contains the word probability.

A completed method-routing note makes the remaining work finite. Branch attention goes to the existing forward and backward dates. The shutdown commitment goes to an assessment of the whole release system, with distributions and dependence justified if a probability is required. Configuration choice goes to a scope decision before any timing model is strengthened. A missing inspection booking goes to resource confirmation rather than a more elaborate duration distribution. This ordering prevents expensive uncertainty analysis from compensating for an unresolved categorical prerequisite. It also identifies when further numerical analysis adds little: if a decisive operating condition already holds the proposed commitment, resolve that condition before refining a percentage that cannot release it.

### *No empirical probability is supplied*

All ranges are fictional, and the app omits dependence, competing-path simulation and uncertain acceptance outcomes. Exact reproduction validates the stated calculation only.

## Decision implications

- Distinguish deterministic, scenario and probability claims.
- Do not relabel a selected-path reading as project confidence.
- Use additional analysis when it can change consequential reliance.

## GOVERNANCE AND APPLICATION

14

# Recovery plans can consume the remaining margin

*A recovery option comparison*

## Recovery is a changed execution method

Recovery should describe an executable intervention rather than an instruction to regain time. Shortening a task in the model is an analytical scenario. Delivering that shorter duration requires a mechanism: changed resources, improved release completeness, a different sequence, reduced scope or another method. The recovery record should state the mechanism and evidence before using the revised date as a promise. Otherwise the schedule becomes a target generator detached from the work required to achieve it.

Crashing increases effort or capacity on an activity to reduce elapsed duration. Its benefit is not automatically proportional to added resources. Some work cannot be divided, and additional teams can create supervision, access or quality constraints. A supplier's acceleration offer should therefore explain the changed production basis, available capacity and acceptance implications. The Delivery atlas can test a revised duration assumption after that basis is defined. It cannot establish the productivity gain or calculate the intervention's cost.

Concurrency changes sequence or release boundaries. It can be useful when a successor can proceed safely from partial information. It can also expose work to redesign, rework or incompatible interfaces. The dependency register should identify which condition is relaxed, what scope is permitted and who accepts the exposure. A link should not be removed merely because its deletion improves the finish. The recovery method needs a causal basis that the recipient can rely upon.

Scope reduction can improve delivery when the revised outcome still meets the decision objective and admissibility requirements. It should be recorded as a change in obligation, not disguised as faster performance against unchanged scope. A deferred optional feature may be a reasonable response; an omitted mandatory test is not made acceptable by a favourable date. The authority should distinguish negotiable scope from noncompensable conditions before comparing recovery options.

Illustrative calculation. Assumptions and sensitivity are published with the model.

Recovery can move the critical path. The duration-switch study improves the supply assumptions and exposes receiving works as binding. Its conditional completion is 17.00 weeks. The result limits the schedule benefit of further supply-only action under the same network. An integrated recovery plan should therefore recompute after each material change and review competing branches. Local acceleration can be real without delivering an equal project saving.

### *Approve a mechanism, not a shortened bar*

Choose a recovery action only when its enabling conditions, acceptance scope and material exposures are sufficiently credible. Recompute the full network and retain a stop condition.

## Account for rework and new interfaces

Concurrent work can create a contingent rework obligation. If assembly begins before all design information is fixed, a later change can affect completed work. The recovery decision should identify the possible rework scope, detection point and stopping condition. The app's acyclic network does not represent rework loops or stochastic branch outcomes. A simplified scenario can add an explicit rework task, but it must be labelled as a separate assumed case. It does not estimate the probability or full consequence of rework.

A recovery action can create new interfaces. Splitting a supplier package may allow earlier partial delivery but require configuration control and additional receiving checks. Adding another contractor may reduce resource waiting while increasing coordination needs. Moving tests earlier may require different evidence or accepting authority. These obligations should be included in the revised perimeter. A plan that counts only the time saved and omits the integration work is systematically incomplete even if each local estimate is credible.

### Illustrative recovery authorisation

A proposed acceleration is approved only within a documented execution boundary.

| Illustrative recovery authorisation |                                                                              |
|-------------------------------------|------------------------------------------------------------------------------|
| Field or action                     | Illustrative completed record                                                |
| Input                               | Objective: earlier accepted installation                                     |
| Input                               | Mechanism: supplier capacity improvement subject to confirmation             |
| Input                               | Enabling condition: released specification and inspection arrangement        |
| Input                               | Network consequence: competing receiving branch reviewed after recomputation |
| Input                               | Exposure: quality, logistics and new interface work assessed separately      |
| Input                               | Stop trigger: enabling evidence fails or permitted exposure is exceeded      |
| Action                              | Screen admissibility before comparing value.                                 |
| Action                              | Include enabling work and new acceptance obligations.                        |
| Action                              | Monitor the mechanism that should produce the saving.                        |

Recovery should preserve quality and safety conditions. They are not generic preferences to be traded against a schedule gain. The actual applicable requirements determine the admissible set of methods. The control record should identify approvals or competence needed before the intervention begins. A sponsor’s desire to accelerate does not supply technical permission. Conversely, unnecessary administrative constraints should be challenged through the appropriate authority rather than treated as immutable physical laws.

A proposed action needs a readiness date of its own. Additional resources may require mobilisation, qualification or procurement. A changed method may need design review or equipment modification. If these enabling tasks are omitted, the recovery scenario can overstate the available saving. The complete network should include material enabling work or explicitly state that it is outside the study. A late decision can make an otherwise credible intervention no longer executable within the remaining window.

Recovery monitoring should test the mechanism rather than only the revised finish. If the action depends on complete design release, monitor release completeness. If it depends on supplier capacity, monitor the confirmed production arrangement. If it depends on a partial interface, monitor its condition and residual obligation. These leading checks reveal failure earlier than waiting for the final milestone to slip. They also let the authority stop an intervention whose exposure has exceeded its approved boundary.

*Recovery needs decisive action rather than more analysis*

Rapid action can be proportionate when the mechanism and authority are clear. Decisiveness does not justify omitting the condition that makes the action executable.

## Fictional case: overlap accelerates production but defers certainty

A fictional assembly contractor proposes to begin before the final interface drawing is released. It can perform some work from stable information, but another portion depends on a pending dimension. The original finish-to-start relation is too coarse to distinguish those scopes. Deleting it entirely would overstate readiness; retaining it unquestioned could miss a valid opportunity. The recovery review defines the unaffected work and the uncertain boundary before changing the network.

The technical authority determines which work can proceed under actual requirements. The authorised partial scope has an explicit stop point before irreversible interface-dependent work. The contractor states resources and acceptance evidence for that scope. The design owner states when the pending information can be accepted. This creates a causal basis for a partial-release scenario. The paper does not invent its durations or probability of rework. Those would need a separately frozen numerical study and evidence if relied upon.

The manager identifies contingent rework. If the pending dimension changes beyond the permitted boundary, completed work may need modification. The decision should state who monitors the change, what triggers a stop and which exposure is accepted. A generic contingency added to assembly does not explain this branch. The acyclic app can represent a declared correction scenario, but it cannot simulate a loop or infer its likelihood. The scenario's scope remains narrower than the real adaptive process.

The sponsor compares the opportunity with a wait-for-release alternative. Earlier activity may preserve resources or shorten completion, but it can also increase sunk exposure. The comparison includes enabling work, inspection and possible interface correction. The critical-path result helps determine whether the permitted scope affects accepted completion. It does not decide whether the exposure is admissible or worth accepting. Those judgments remain with the actual authorities and evidence.

The partial release is communicated to the recipient in exact terms. A meeting summary saying assembly approved would be too broad. It should state which area, configuration and activities are permitted and where the hold remains. The programme then distinguishes partial work from full assembly acceptance. This prevents activity from being reported as a completed predecessor while the final interface remains unresolved. Clear scope can make a recovery action both faster and more controlled.

The post-action review retains the release basis and the eventual interface disposition. If no rework occurs, that favourable outcome does not prove that unrestricted overlap would have been safe. If rework occurs within the accepted exposure, the decision may still have been reasonable. The record supports learning from the mechanism rather than from hindsight alone. The transferable lesson is to divide scope at a credible release boundary instead of treating concurrency as a binary permission to remove logic.

## A staged decision on acceleration

In a fictional recovery workshop, the sponsor asks for an earlier accepted installation. The supplier offers acceleration, the works team offers an overlapping receiving release, and the operator warns that test preparation remains incomplete. The manager treats these as separate proposed mechanisms. Combining them immediately into one optimistic network would make it hard to identify which assumptions drive the result or which intervention must be secured. The first analysis preserves the reference and evaluates declared changes.

The supply-only study shows path switching. The team then asks whether receiving can credibly improve, and whether earlier assembly would be useful given the operator's test readiness. This second question is outside the frozen supply comparison. It requires a defined test-preparation obligation, resource basis and acceptance condition. The manager should not extrapolate a project saving from a chain of local promises. The integrated plan needs the complete release path to the accepted outcome.

The recovery workshop completes an irreversibility comparison. Additional inspection preparation can be stopped with the unused work preserved. A production-location change commits qualification and logistics work before the first accelerated unit is accepted. A partial receiving release commits only the explicitly stable foundation work until the pending interface is resolved. These alternatives consume reversibility at different points even if their proposed finish dates are similar. The sponsor asks which evidence must precede each commitment and which later finding would be too late to reverse it economically or physically. The record does not price those exposures; it identifies the points at which a recovery decision stops being a reversible planning choice.

The fictional recovery instruction records METHOD-PARTIAL as its selected boundary: preparation of the stable receiving area is permitted; interface-dependent fastening remains held; the pending drawing revision governs the next release. The contractor acknowledges the stop point in its work instruction, while the design owner links the unresolved dimension to the receiving record. This is more specific than authorising acceleration in general. If the drawing changes outside the stable area, unaffected preparation can continue. If the change reaches that area, the instruction itself identifies the work to suspend and inspect. The monitoring object is the interface footprint, which lets the team respond before a final-date variance reveals the exposure.

The post-action instrument compares the chosen mechanism with its closest rejected alternative. It records whether the stable work remained usable, whether the pending interface entered the permitted footprint, whether extra inspection was needed and whether the governing downstream branch changed. A favourable finish with unusable early work indicates that another mechanism produced the outcome. An unfavourable finish with preserved useful work may show that the intervention helped while a separate constraint dominated. The review therefore avoids scoring the method from the final date alone. It preserves a causal fingerprint that the next recovery workshop can compare with its own work boundary, rather than treating successful acceleration as a transferable productivity rate.

*No crash-cost or rework probability is computed*

The app tests entered duration and topology assumptions. It supplies no productivity curve, intervention price, resource feasibility or stochastic rework model.

## Decision implications

- Recovery requires an executable causal mechanism.
- Include enabling tasks and new interfaces.
- Monitor the action basis before the final date slips.

### GOVERNANCE AND APPLICATION

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## Risk responses must enter the network

*A risk-to-schedule control map*

### Risk responses must become executable work

A risk response is useful when it changes a mechanism that threatens the objective. A register entry such as mitigate supplier delay does not show who will act, what evidence is needed or when the response must occur. Delivery control should connect the response to a task, resource arrangement, acceptance condition or decision. This makes the response inspectable and allows its own dependencies to be planned. The register then describes an intervention rather than a hope.

Risk identification should distinguish uncertain events from known obligations. A required inspection is work, not a risk merely because its date is uncertain. The possibility that inspection reveals a material defect is an uncertainty. The possibility that inspection capacity is unavailable is another. Combining these into a single entry can conceal the baseline task and confuse the response. Model the known obligation and describe the uncertain mechanisms separately, with their evidence and limits.

A response can prevent, reduce, transfer, accept or prepare for a consequence, within the actual authority and arrangements. These categories should not imply that exposure disappears. A contractual allocation may transfer financial responsibility without removing physical delay. A reserve may fund a response without ensuring that resources are available. A contingency plan may preserve an option only if its enabling work is completed in time. The response record should state the residual exposure and the condition under which the plan can be used.

The Delivery atlas has no event-probability or loss inputs. It can represent a defined response scenario as changed durations or topology, but it does not calculate expected loss or optimise risk mitigation. A scenario that

adds a test, alternative supplier or readiness task should preserve the intervention's scope and assumptions. The resulting date is conditional evidence about that network. It is not a measure of the response's probability of success or the financial exposure avoided.

Responses need an owner with the power to act. Assigning a mitigation to the planner can be ineffective if the action requires a supplier instruction, technical approval or sponsor decision. The record should distinguish monitoring owner, action owner and decision authority. These functions may be combined, but they should not be confused. An owner who can only report the risk should not be treated as having controlled it merely because a name appears in the register.

### *Select a response with an executable window*

Approve the response when its action, owner, authority, prerequisites and residual exposure are clear. Confirm that the trigger occurs while an effective option remains available.

## Place the response before the option expires

A response has a latest useful decision point. An alternative production arrangement may need confirmation before the original supplier enters an irreversible stage. A spare resource may need reservation before the commissioning window. A design compatibility review may need to occur before receiving works are finalised. The schedule should show enabling work and decision timing when they govern the response. A trigger that fires after the alternative is no longer executable is informative but not protective.

Triggers should be tied to evidence. A supplier readiness certificate not received by a release review, an unresolved interface discrepancy or an unconfirmed resource booking can justify escalation. A generic colour change based on subjective concern can be useful for discussion, but it should not be the sole basis for a consequential action. The record should explain what the trigger indicates, who verifies it and what decision follows. This makes the response repeatable without pretending that every project needs the same threshold.

## Illustrative response-to-work record

A configuration exposure becomes an owned compatibility review and release condition.

| Illustrative response-to-work record |                                                                                      |
|--------------------------------------|--------------------------------------------------------------------------------------|
| Field or action                      | Illustrative completed record                                                        |
| Input                                | Exposure: equipment change may invalidate receiving works                            |
| Input                                | Action: compatibility review before irreversible release                             |
| Input                                | Action owner: integration engineer                                                   |
| Input                                | Decision authority: actual technical delegation                                      |
| Input                                | Trigger: unresolved material interface at the release review                         |
| Input                                | Fallback: hold affected irreversible work; permit only agreed unaffected preparation |
| Input                                | Residual exposure: later changes and communication failure                           |
| Action                               | Separate known inspection work from uncertain defect outcomes.                       |
| Action                               | Include enabling tasks and scarce response resources.                                |
| Action                               | Report action completion separately from exposure reduction.                         |

A fallback should be tested as an executable scenario. Does it need different equipment, additional acceptance or a new logistics route? Are those prerequisites within the response window? Can the accepting party approve the changed configuration? A fallback described only by a shorter duration can overlook its enabling obligations. The app can calculate a simplified entered network after those obligations are defined, while the operational record supplies the evidence that the alternative can actually be implemented.

Risk responses can compete for resources. Several mitigations may rely on the same specialist, budget or shutdown window. Evaluating each independently can make the combined plan infeasible. The resource review should include response demand as well as baseline work. A reserve of money is not a reserve of qualified capacity. The authority should decide which response takes priority under the relevant scenario and what residual exposure remains elsewhere.

Avoid treating risk closure as evidence of outcome certainty. A response action can be completed while the underlying exposure remains. A supplier review may improve information without eliminating production uncertainty. An inspection plan may be agreed while defect risk remains. The register should distinguish action completion, evidence improvement and exposure reduction. This supports truthful reporting and prevents a closed action from being interpreted as a guarantee that the threatened event cannot occur.

### *Risk registers cannot capture every surprise*

They need not. Use them for material identified mechanisms and preserve adaptive capacity for uncertainty that cannot yet be modelled. Do not imply that a complete-looking register exhausts possible outcomes.

## Evidence and scope

PPP risk guidance distinguishes construction, operating, financial and regulatory mechanisms requiring specific assessment.

Evidence: Identifying Risks

## Fictional case: a funded response lacks an executable resource

A fictional sponsor sets aside money for an alternative commissioning resource. The risk register describes the response as available because funding is approved. When the trigger occurs, no qualified specialist can attend the required window. The response was financially provisioned but operationally unprepared. This case distinguishes a reserve of funds from a reserve of capability without supplying any actual resource rate or failure frequency.

The manager reviews the response's enabling work. Qualification, availability, mobilisation and authority were not confirmed. The action plan should have identified those conditions and a latest useful booking point. Money remains useful, but it cannot guarantee capacity at an expiring window. The fallback may need a different sequence or a later service commitment. The authority should see the residual exposure rather than receive a closed mitigation status based on the budget alone.

The revised risk record separates financial provision, executable option and exposure reduction. Each has its own evidence and owner. The response is considered available only within the confirmed scope and period. If those conditions lapse, the forecast and register are updated.

The lesson is to test responses as work with prerequisites. Approval of a reserve is a governance event; it is not proof that the real-world mechanism needed to protect delivery has been secured.

## A fictional interface-risk response

In the fictional installation, the receiving team is concerned that equipment configuration may change after works release. The risk response is a compatibility review before the receiving package becomes irreversible, together with a controlled notification requirement for later changes. This is qualitative original analysis. It contains no claimed event frequency or loss estimate. Its value lies in connecting a specific exposure to an action, evidence and decision point.

The action owner prepares the configuration comparison and identifies unresolved interfaces. The technical authority disposes of discrepancies within its actual delegation. The integration manager monitors whether the review occurs before the receiving release. These roles prevent the risk entry from remaining a general concern. If the review finds a material mismatch, the response branches into correction or an authorised design change. The schedule needs the chosen obligation rather than a vague allowance labelled interface risk.

The fictional response includes a concrete fallback state: unaffected receiving preparation remains available, but no interface-dependent work is released while the comparison is unresolved. The manager checks this state against another response that uses the same integration engineer for test preparation. Both cannot be assumed immediately available simply because each register entry has an owner. The completed conflict note gives the compatibility review priority before irreversible works and retains test preparation as a subsequent duty. If the operator's test window would expire under that sequence, the sponsor must choose between a different resource arrangement and a changed service commitment. This is response interference, which an isolated mitigation checklist would miss.

Residual exposure is separated into a retained mechanism and a newly created one. The compatibility review addresses the current equipment-to-works mismatch. Splitting the receiving release creates a communication exposure: a later crew may mistake partial permission for full release. The fictional packet therefore includes a marked work boundary and a recipient acknowledgement, not merely a closed review action. A later configuration change can reopen the compatibility question, while a crew handover can reopen whether the partial boundary

is understood. These are different triggers with different evidence objects. Treating them as one continuing interface risk would make the right response harder to select.

The response closeout reads: current mismatch disposed of; affected works kept reversible; partial-release instruction acknowledged; later configuration and crew-transfer triggers retained. It records neither elimination of all interface exposure nor a mitigation-success rate. A contrasting closeout, review completed but discrepancy unresolved, would retain the work hold despite the action's completion. Another, compatibility confirmed but recipient not informed, would leave the communication condition open. These completed states make the distinction between action and effect operational. The next planner can reuse the review sequence when its causal conditions match, while refusing to infer a protected release from the mere presence of a closed action in the register.

### *Risk categories supply no frequencies*

Public guidance and the fictional cases provide mechanisms and control structures. They establish no empirical probability, expected loss or mitigation-success rate.

## Decision implications

- Turn material responses into owned executable work.
- Trigger decisions while options remain available.
- Retain residual exposure after action completion.

## GOVERNANCE AND APPLICATION

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# Governance sets decision latency

*A decision-latency register*

## Decision latency is part of delivery

A programme can contain credible execution durations while omitting the time needed for decisions. A design release waits for a sponsor choice, a change waits for authority, or a readiness submission waits for an accepting party. These delays are not always administrative noise. They can govern the accepted outcome. Delivery control should identify

material decision dependencies and the evidence required to resolve them. The aim is not to invent a fixed duration for every judgment, but to make consequential reliance visible.

A decision task should have a defined question. Approve design is too broad if the authority is actually choosing among interface alternatives. The record should state the admissible options, required evidence, decision owner and consequence of no decision. This allows the team to prepare a complete submission and understand whether a provisional choice is possible. It also prevents a meeting from being treated as completion when the question remains unresolved.

Decision ownership follows actual authority. A steering group may advise while a sponsor signs. A technical authority may approve configuration within delegated limits while a commercial authority approves expenditure. A planner should not combine these into a single approval event without knowing which decisions release the successor. The governance map should distinguish recommendations, assurance, authorisation and acceptance. Their sequence can be proportionate, but their meanings should remain clear.

A decision window can be more useful than a desired meeting date. State when the evidence can be ready and when an option becomes unavailable or costly to reverse. The authority can then prioritise decisions by consequence. A routine report review may tolerate delay; an instruction required before irreversible production may not. Escalation should identify the expiring option and the evidence gap rather than merely count days since a request was sent.

The app can represent an entered decision activity as a finish-to-start task, as in the interface-gate study. It cannot verify authority, completeness or the decision outcome. If the decision may reject the proposed work, the network describes a conditional branch rather than guaranteed release after elapsed time. This limitation matters. Assigning a duration to approval should never be used to imply that the approval must arrive favourably at its end.

### *Escalate before a useful option expires*

Name the unresolved question, authority, required evidence and consequence of no decision. Escalate while an executable alternative remains, and preserve conditions after approval.

## Assurance and authorisation serve different purposes

Assurance examines whether evidence, reasoning and controls are suitable for the decision. Authorisation permits an action within actual powers. Acceptance confirms that a defined obligation has been met. These functions can interact, but one does not automatically substitute for another. A favourable assurance review may still leave a sponsor decision open. An authorised expenditure may still require technical release. An accepted subsystem may still lack operating permission. The schedule should connect each successor to the function it truly needs.

An assurance review should have a clear scope and independence statement. It may inspect a model, a package, a business case or readiness for a phase. The record should state what was reviewed and what remains outside the conclusion. This paper’s mechanical checks establish model reproduction, source receipt integrity and PDF properties. They do not supply independent domain acceptance. The same discipline applies to project assurance: a passed checklist should not be presented as a universal endorsement of delivery feasibility.

### Decision functions and release evidence

A qualitative governance map prevents one signature from acquiring several meanings.

| Decision functions and release evidence |                                            |                                          |                                    |
|-----------------------------------------|--------------------------------------------|------------------------------------------|------------------------------------|
| Function                                | Question                                   | Release evidence                         | Limit                              |
| Advice                                  | What option is recommended?                | Reasoned recommendation                  | Does not itself authorise action   |
| Assurance                               | Is the basis suitable within review scope? | Scoped review findings                   | Does not guarantee delivery        |
| Authorisation                           | May the defined action proceed?            | Actual authority and recorded conditions | Does not prove physical readiness  |
| Acceptance                              | Has the obligation been met?               | Controlled criteria and evidence         | Does not replace other permissions |

Governance can become a bottleneck when evidence is repeatedly incomplete or authority is unclear. The response should target the cause. Standardise the submission boundary, prepare options early and secure the right decision owner. Simply adding more review meetings can increase latency without improving judgment. Conversely, removing a

required review to meet a date can create unacceptable exposure. The governance design should preserve essential challenge while eliminating duplicated or purposeless circulation.

Decision records should state rationale and conditions. A bare approved stamp cannot explain why the authority acted or what assumptions limit the permission. Conditions may require further evidence before irreversible work, a spending limit or a configuration boundary. The execution team needs those conditions in its release record. Otherwise a qualified approval can become an unrestricted instruction as it passes through summaries and email extracts.

A delegation should be usable at the point of action. If a package owner is empowered to resolve a bounded issue, the record should state the boundary and escalation condition. If the issue exceeds it, the owner should know where it goes and what evidence to provide. Ambiguous delegation encourages either unauthorised action or excessive escalation. Both can damage delivery. Clear authority supports speed because it lets the right person act without pretending that every decision requires the same forum.

### *Clear delegation can weaken independent challenge*

Delegation and challenge are compatible when their scopes are explicit. Preserve required assurance for material decisions while permitting bounded routine action by the responsible authority.

## Evidence and scope

The published Gate Review framework provides assurance around an investment decision within government projects.

Evidence: Gate Review: Investment Decision

## Fictional case: a forum meets but the decision remains open

A fictional steering forum reviews a configuration choice. It agrees that the preferred option is sensible, but its members have advisory roles and no delegated authority to issue the technical release. The minutes say approved, and the planner marks the decision task complete. The actual authority later requests additional evidence. This case illustrates how governance language can release a successor incorrectly even when the meeting itself was well conducted.

The manager reconstructs the decision chain. The forum's recommendation is retained as a genuine event. The authorisation and technical acceptance remain separate obligations. The forecast is corrected to show what actually governs release. The correction should not blame the forum for failing to exercise powers it never had. It should clarify the record and identify how the wording created unsupported reliance. A governance map would have exposed the distinction earlier.

The submission to the actual authority needs a precise question and complete evidence. The manager identifies the configuration, admissible alternatives, unresolved conditions and consequences of delay. The authority can then decide within its scope rather than interpret a vague endorsement. If further evidence is legitimately required, the record should state it and its effect. The schedule's decision duration remains conditional on completeness and outcome; elapsed meeting time is not approval evidence.

The project also examines why the planner used the minute as a release. Perhaps the reporting convention calls every positive forum conclusion approved. Perhaps the authority map is inaccessible. Perhaps the task label conflates recommendation and permission. The corrective action should target the evidenced cause. Adding another steering meeting would not solve an unclear delegation. Removing the forum might lose useful challenge without supplying the missing authority.

The sponsor can improve speed by clarifying bounded delegation where actual rules permit. Routine decisions may be authorised by a responsible owner, while material choices retain higher review. The boundary and escalation conditions need to be clear. Delegation does not mean dispensing with required evidence or assurance. It means placing permission with the right role so completed submissions do not circulate through forums that cannot act.

The release rehearsal now asks which record permits execution and what conditions remain. The team should be able to identify it without relying on the tone of a meeting summary. The lesson is that governance progress has states just as physical work does: recommended, assured, authorised and accepted. Their meanings should remain distinct in the network and executive report. A completed meeting is evidence of a meeting, not automatically of the permission the successor needs.

## A fictional decision queue

The installation team prepares integrated testing, but the operating representative has not decided which residual defects can remain open. Construction assumes all minor defects permit testing. Operations assumes a particular class must close first. The network shows testing after assembly, while the real release depends on a decision whose criteria are disputed. This qualitative case illustrates governance latency and scope ambiguity, not an empirical delay rate.

The integration manager frames the question precisely. Which residual items prevent the specified tests, which can remain under controlled conditions, and who has authority to accept the exposure? The submission separates technical admissibility from operating preference and commercial responsibility. Specialists provide the actual requirements. The decision authority then receives a set of executable options rather than a generic request to approve readiness. This makes the review more likely to resolve the real issue.

The fictional decision queue is diagnosed through submission states. A complete residual-defect disposition waits for the operating authority: this is authority capacity. Another submission lacks the configuration against which defects were assessed: this is evidence completeness. A third asks a technical reviewer to approve an operating exposure: this is a misrouted question. The manager gives each a different remedy: obtain decision coverage, return for the missing configuration, and redirect the operating choice. Adding all three to another steering agenda would conceal the causes. The resource reservation is linked only to the decision that actually governs testing, so escalation identifies the option that will expire.

The completed release record distinguishes a decision from satisfaction of its conditions. The operating authority permits a bounded test after the configuration check is accepted; the technical authority disposes of that check separately; the test coordinator records when both conditions coexist with the reserved capability. The planner therefore keeps the decision event and the executable test release as separate states. If configuration acceptance arrives after the resource reservation lapses, the favourable decision remains real but the planned release is no longer executable. This state comparison explains an apparently paradoxical delay: all signatures can be present while the required combination never existed within the useful window.

The queue review concludes with a routing repair rather than a request for faster decisions in general. Residual-defect submissions must include their controlling configuration and proposed test use. The operating

authority supplies an alternate decision route for absence; technical questions remain with the technical authority. The manager removes duplicate advisory circulation that provided no additional evidence, while retaining the review that can change the admissible test scope. The next queue is inspected for recurrence of the specific returned or misrouted states. Its contribution is diagnostic separation of preparation failure, capacity shortage and authority mismatch, allowing governance latency to be reduced without pretending that every approval is an interchangeable waiting task.

*This map creates no legal powers*

Actual delegations, agreements and applicable law determine authority. The app and paper cannot confer permission or independent assurance.

## Decision implications

- Represent material decisions and their evidence.
- Separate assurance, permission and acceptance.
- Escalate against the consequence of an expiring option.

### GOVERNANCE AND APPLICATION

## 17 Suppliers are part of the delivery system

*A long-lead procurement control framework*

### Supplier delivery is an integrated chain

Supplier management connects design release, commercial instruction, production, inspection, logistics, receiving and acceptance. A purchase order date alone does not establish the readiness of that chain. The integrated schedule should identify material events that govern the project outcome and preserve the supplier's own perimeter. A supplier forecast can be credible within its boundary yet insufficient for site readiness if transport, receiving or configuration compatibility sit elsewhere.

The released specification is a key interface. Procurement before scope is executable can preserve time, but it can also create rework or commercial ambiguity. The decision should state what is frozen, what remains open and who accepts the exposure. A provisional order should not be reported

as equivalent to an unconditional production release. The supplier and recipient need the same configuration basis. Later changes should identify the affected production, inspection and receiving obligations.

A delivery promise should state its boundary. Factory completion, dispatch, arrival, receiving acceptance and assembly availability are distinct events. Commercial terms may allocate responsibilities differently, but those actual terms must be read rather than assumed. The schedule should join the supplier's forecast to the recipient's need through explicit logistics and acceptance interfaces. A mismatch can remain invisible while both local programmes appear on time.

Supplier estimates should retain their evidence type. An indicative lead time from market discussion differs from a confirmed production slot, and both differ from an accepted contractual commitment with stated conditions. The baseline should not promote a preliminary value into a firm promise without new evidence. The current forecast should update when the supplier confirms or loses capacity. A stable chart is less useful than a truthful account of the commitment's changing basis.

The Delivery atlas represents supply as an entered task or set of tasks. It does not model procurement law, manufacturing capacity, shipping schedules, commercial terms or supplier default. A more detailed entered network can expose material release events, but the app will still calculate only the stated finish-to-start logic and duration assumptions. Supplier credibility requires public or project evidence beyond the reproduced arithmetic.

### *Release supplier work on an executable basis*

Confirm configuration, instruction authority, material inspections and recipient readiness before relying on the supplier milestone as a project release. Preserve intermediate events without overstating acceptance.

## Control changes and acceptance across the contract boundary

A supplier instruction should be traceable to authorised scope. An informal request can change configuration or sequence without being recognised in the baseline. The commercial and technical records should identify which instruction is binding, which is exploratory and which remains under review. The schedule should use the executable instruction basis. A planning scenario should not accidentally become a production instruction through circulation without the appropriate authority.

Inspection planning should follow the acceptance obligation. Some checks occur before dispatch, others at receipt or during integration. The record should state who performs them, who accepts the results and what discrepancy process applies. An inspection certificate may prove a defined factory condition without proving site compatibility. The integrated manager should avoid using a local certificate as a universal readiness statement. Each evidence item should retain its scope when included in executive reporting.

### Illustrative supplier-to-site release record

A dispatch decision preserves the difference between movement and accepted availability.

| Illustrative supplier-to-site release record |                                                                              |
|----------------------------------------------|------------------------------------------------------------------------------|
| Field or action                              | Illustrative completed record                                                |
| Input                                        | Supplier boundary: dispatch-ready equipment under the released configuration |
| Input                                        | Recipient boundary: equipment accepted for assembly at site                  |
| Input                                        | Open condition: receiving access and document disposition                    |
| Input                                        | Authority: actual commercial and technical delegations                       |
| Input                                        | Qualified action: dispatch only if expressly permitted and useful            |
| Input                                        | Residual obligation: receiving inspection and acceptance retained            |
| Action                                       | Match supplier milestones to recipient needs.                                |
| Action                                       | Keep exploratory changes separate from executable instructions.              |
| Action                                       | Include qualification and receiving consequences in any substitution.        |

Logistics interfaces need readiness on both sides. Dispatch can fail to improve the project if receiving access, unloading capability or storage conditions are absent. Conversely, a receiving location can be ready while the supplier has not released documents required for acceptance. These conditions may be represented as separate tasks or package release records depending on their materiality. The selection principle is whether they govern cross-package reliance, not whether they fit neatly within an organisational department.

Supplier performance reviews should distinguish the agreed obligation from the current forecast. A supplier can be contractually late while the project finish remains unchanged because another branch governs. A supplier can meet its own boundary while the overall project is late due to integration work elsewhere. These distinctions matter for action and responsibility. The model should not be used to infer legal consequence solely from criticality, nor should noncritical status excuse an unmet obligation.

Alternative suppliers or production methods need a complete change assessment. A shorter quoted lead time can conceal qualification, redesign, inspection or receiving changes. The recovery record should include those enabling obligations and admissibility conditions. A numerical replacement of the supply task is a scenario, not proof that switching is executable. Compare the complete accepted outcome, cost, uncertainty and reversibility before authorising the alternative.

### *Early ordering is essential to protect long lead items*

It can be, when the frozen scope, open interfaces and accepted exposure are explicit. Early ordering is a managed conditional decision rather than evidence that design and receiving obligations no longer matter.

## Evidence and scope

World Bank procurement guidance addresses rated criteria within its specified investment project context.

Evidence: Procurement Guidance: Evaluation Criteria

## Fictional case: partial supply changes the receiving obligation

A fictional supplier offers to deliver a standard portion of the equipment before a custom component is complete. The offer may permit useful early work, but the original supply milestone represents the whole accepted package. The manager should not mark that milestone complete on partial delivery. The review defines the partial lot, its independent acceptance boundary and the successor scope it can actually release. This is a qualitative case with no invented shipment duration or productivity rate.

The recipient checks whether the partial lot can be used without the custom component. Physical fit, configuration control, storage and testing may differ from the original method. The supplier identifies the

remaining package and the evidence required to join it later. The technical authority determines admissibility. A partial release can be useful when these conditions are clear. It becomes misleading when the programme reports the whole supply obligation complete while integration work remains.

The changed method can create additional work. The site may need separate receiving inspections, temporary storage or a staged assembly procedure. These obligations can reduce the apparent saving. The app can calculate a newly entered network once their duration bases are defined, but the original duration-switch study does not represent them. A reader should not use that study's output as evidence for this different mechanism. Each comparison needs its own declared scope and constants.

Commercial instructions should follow actual authority. The supplier's offer may change payment, delivery responsibility or acceptance conditions. Those effects require the actual agreement and authorised assessment. The schedule records the selected operational boundary without inventing contractual consequence. An exploratory option should remain a scenario until the instruction is executable. This protects both the supplier and recipient from acting on a planning suggestion mistaken for approval.

The integrated manager tests whether the partial lot changes accepted completion. It may advance preparation while the custom component remains binding. That can still have value, but the value should be named rather than described as an automatic project saving. Earlier work may preserve resources or reveal defects sooner. It may also consume storage or increase rework exposure. The sponsor compares those consequences within the admissible options and records the rationale.

The final records preserve both partial and full acceptance. The recipient knows what can proceed and what remains held. The supplier knows the remaining obligation and configuration. The baseline history explains the changed method. The lesson is to split scope where the accepted outcome genuinely divides, then include the interfaces created by that split. Dividing a delivery label alone does not establish independent readiness.

## A fictional dispatch-ready package

The fictional supplier reports dispatch readiness. The site team has not confirmed receiving access, and the configuration documents remain under review. The sponsor asks whether dispatch should proceed to protect the delivery date. The manager separates the questions: is dispatch

technically and commercially permitted, can the recipient receive the equipment, and will receipt release assembly? The answers may differ. A single ready label cannot support the decision.

The fictional dispatch packet is completed by event. Equipment is prepared under the released supplier configuration; the carrier reservation is available; receiving access is unconfirmed; site acceptance documents remain in review. The receiving manager records that movement can create a storage and custody obligation before it creates assembly readiness. The sponsor therefore compares dispatch into a permitted interim custody arrangement with holding equipment at the supplier. The comparison needs the actual storage, handling and contractual basis, which this case does not supply. Its immediate output is a request for that basis and a retained assembly hold, rather than a general endorsement of earlier movement.

The schedule scenario should reflect the selected boundary. If dispatch proceeds but acceptance remains open, the model should not mark supply accepted for assembly. It can represent dispatch as an intermediate event and retain receiving acceptance as a successor obligation. If dispatch waits, the remaining basis should identify the condition that governs it. This prevents a commercially expedient action from creating a false operational release in the integrated programme.

Dispatch is then tested against an operational counterexample. If the shipment arrives while site access is unavailable, earlier departure can consume handling capacity without advancing accepted assembly. If a verified interim store preserves the required condition and a later receiving slot remains secured, earlier departure may protect a transport opportunity. These are different alternatives, not favourable and unfavourable readings of the same ready label. The fictional manager records the custody location, condition-preservation obligation and transfer evidence each alternative requires. No route duration or cost is invented. The instrument makes the additional obligation visible before movement is credited as a project saving.

The reconciliation at transfer joins the supplier's dispatch event to the recipient's custody event and eventual assembly acceptance. A disputed receipt does not erase departure, and an accepted custody record does not establish technical compatibility. In the fictional closeout, departure is retained, interim custody remains conditional on its missing evidence, and assembly acceptance stays open. A later configuration revision identifies which inspection documents need reconsideration without rewriting the transport history. The contribution is an event chain that can distinguish

lost evidence, a changed obligation and a physically incomplete transfer. It gives the supplier and recipient a shared question to resolve instead of asking them to agree on an ambiguous overall completion flag.

*No procurement or contract conclusion is implied*

Illustrative supplier records do not determine applicable procurement rules, commercial liability, logistics feasibility or actual manufacturing lead times.

## Decision implications

- Join supplier promises to the actual receiving boundary.
- Preserve the evidence level behind lead times.
- Treat dispatch and assembly acceptance as distinct events.

### GOVERNANCE AND APPLICATION

18

# Commissioning integrates what construction separated

*A commissioning and readiness record*

## Commissioning is integration work

Commissioning establishes whether the assembled system can perform the defined service under accepted conditions. It is not simply a label placed after construction completion. It may require subsystem evidence, procedures, qualified personnel, utilities, permissions, operating documentation and an accepting authority. These obligations should be planned early enough to govern interfaces and release. Otherwise the programme can report construction success while the service outcome remains unready.

The fictional reference places integrated tests after assembly and acceptance after tests. Use that simplified sequence to expose release conditions, not to infer an actual protocol or test adequacy. The real plan needs applicable technical requirements and configuration, with test scope, evidence, safety controls and disposition defined in technical records. The network should represent material releases while those records establish what the scheduled test means.

Subsystem acceptance should state what it releases. A component test can permit integration without proving whole-system performance. A mechanical completion certificate can permit inspection without authorising energisation. An operator training record can establish participation without proving competence for every operating condition. The integrated manager should preserve these scopes. When different evidence levels are collapsed into complete, commissioning becomes a place where earlier ambiguities surface as late delay.

Test preparation is executable work. Procedures, instruments, access, resources and evidence templates need readiness. If these are omitted, the test duration can appear too short or the start can be unsupported. The programme should include material preparation obligations or clearly state where they are embedded. The readiness review should check their actual completion rather than infer it from the calendar. A test window is useful only when the system and the testing capability are ready together.

Acceptance should connect to the promised service outcome. The operator may need evidence of performance, maintainability, documentation and residual-work management within the actual scope. The receiving authority should be identified before tests occur so results can be collected in an acceptable form. Late discovery of evidence requirements can lead to repeated tests or disputed handover. Planning the acceptance boundary early improves both delivery and the credibility of the final readiness decision.

### *Accept the service boundary expressly*

Permit testing or handover only within the accepted configuration, evidence and actual authority. Retain residual obligations and distinguish technical test success from operating readiness.

## Control defects and conditional handover

Defects should be classified by their effect on the proposed activity and outcome, using actual requirements. Some prevent testing; others permit a bounded test under conditions; others can remain after qualified handover. This paper supplies no universal defect categories or safety thresholds. The responsible technical and operating authorities must determine admissibility. The control record should show the classification, evidence, permitted use and residual obligation so the schedule does not treat every open item alike.

A conditional handover should be specific. Name the system scope, permitted service, open items, responsible owners, resolution conditions and consequences if the conditions fail. The recipient should know what it is accepting and what it is not. A generic punch list without consequence can allow material obligations to drift after transfer. Conversely, insisting that every trivial item close before any useful service can be disproportionate where actual requirements permit bounded acceptance. The decision should follow the obligation and exposure.

Illustrative readiness layers for service acceptance

The layers describe claims, not universal technical requirements.

| Illustrative readiness layers for service acceptance |                                                 |                                                     |                                               |
|------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------|-----------------------------------------------|
| Layer                                                | Typical control question                        | Evidence boundary                                   | Remaining limit                               |
| Assembly complete                                    | Is the specified physical scope complete?       | Configuration and inspection records                | Does not authorise testing automatically      |
| Test ready                                           | Are system, procedure and resources admissible? | Readiness decision with conditions                  | Does not predict test success                 |
| Tests accepted                                       | Do results satisfy the stated objective?        | Configuration-linked results and disposition        | Does not establish every operating condition  |
| Service accepted                                     | May the defined service begin?                  | Actual operating authority and residual-work record | Qualified scope and conditions remain binding |

The commissioning sequence can reveal feedback. Failed tests may require correction and retesting. The Delivery atlas requires an acyclic network and does not simulate rework loops. A planned scenario can include explicit correction and retest tasks as a conditional case, but their probability and full behaviour remain outside the engine. Do not hide this limitation by representing a repeating process as a single guaranteed duration. State the assumed test outcome or scenario branch.

Passing technical tests can leave service release dependent on staffing, procedures, maintenance, spares or permissions. Identify which obligations are material to this undertaking, which the integrated schedule includes and who forecasts exclusions. The final milestone must match the sponsor's service commitment and benefit-start assumption. Otherwise a tested system can be reported as operating-ready while a separate release obligation remains open.

Handover changes responsibility but should not erase evidence history. Preserve configuration, tests, exceptions, operating documents and the acceptance decision. The recipient needs a usable record, not merely a certificate that asserts completion. The delivery team also needs the record

to distinguish residual work from newly requested scope. Good handover control protects both continuity of service and a fair understanding of the obligations that remain.

*Commissioning cannot be planned until construction is nearly complete*

Detailed procedures may mature later, but acceptance objectives, material interfaces, resource needs and evidence requirements can govern early design and package planning.

## Evidence and scope

DOE measurement guidance addresses baselines, measurement boundaries and verification in energy performance work.

Evidence: Measurement and Verification Activities Required in the Energy Savings Performance Contract Process

## Fictional case: successful tests and an unready operator

A fictional installation passes its defined technical tests. The operating team has not accepted the maintenance arrangement or completed the readiness evidence required for service. The project celebrates test success, which is a real achievement, but the sponsor's promise concerns an operating service. The manager preserves the accepted test milestone while keeping service acceptance open. This avoids both diminishing technical progress and overstating the outcome.

The operator should identify the remaining applicable staffing, procedure, maintenance-capability, permission or residual-work condition and its evidence. These are possible obligations, not universal requirements. Link each actual service-readiness gap to the accepting authority; a visible technical certificate cannot close a different operating decision. This locates the condition that still blocks the fictional installation's service release.

The schedule perimeter is reviewed. If operating readiness was excluded deliberately, the reported finish should be labelled accordingly. If the sponsor used it as the service promise, the wider integration model needs correction. If readiness was included inside another package, its remaining scope should be made visible without double counting. The forecast changes based on the accepted boundary, while baseline and responsibility treatment follow the controlled process.

The benefit-start assumption is reconciled with this distinction. A financial model that starts service benefits at technical test completion may use an unsupported interface. The timing-to-value bridge should follow the accepted operating event. This case supplies no cash flow or benefit rate. It shows the evidence needed to connect delivery and value honestly. A favourable technical result does not automatically validate every downstream assumption.

The team considers qualified service if actual requirements permit it. The operator might accept a bounded function while residual obligations close. The decision must state scope, conditions, owners and stop triggers. A generic operational label would be insufficient. The programme should preserve the limited service event and the later full acceptance where relevant. This allows useful progress without turning qualified permission into an unrestricted claim.

The handover rehearsal asks the operator to use the records. Can it identify the accepted configuration, permitted service and residual obligations? Can maintenance staff locate the evidence they need? Can the sponsor understand what remains conditional? The lesson is that the recipient's use determines whether evidence is adequate. A complete technical dossier can still be an incomplete operating handover if it does not address the actual service boundary.

## A fictional test-readiness review

The installation team reaches mechanical assembly completion. The test procedure is drafted, the operating representative is available conditionally, and a required configuration check remains open. The sponsor asks whether integrated testing can be reported ready. The manager separates preparation, technical admissibility and resource availability. Each needs evidence. The physical assembly event is genuine progress, but it does not settle the test-release question.

The fictional test-readiness packet records three different gaps. The procedure describes an earlier configuration, the accepting representative is conditionally available, and the installed system awaits a compatibility disposition. The manager links each gap to the use it blocks: procedure revision concerns valid test evidence; attendance concerns an executable witness window; compatibility concerns admissible system use. An apparently complete procedure cannot compensate for unavailable attendance, and attendance cannot make an obsolete procedure valid. Bounded instrument preparation may proceed if independent of the open

configuration. The packet's contribution is a combination test: identify when system, procedure and accepting capability are concurrently fit for the intended test.

*Illustrative calculation. Assumptions and sensitivity are published with the model.*

If a condition remains unresolved, the forecast should show its consequence and the action required. The interface-gate study illustrates a separate readiness decision before tests, producing conditional completion 22.00 weeks. The value is not a real test forecast. Its purpose is to show how omitted readiness work can affect the network. A real review would supply its own scope, durations, resources and authority evidence.

The completed fictional pair distinguishes two service holds. RESULT-PASS accepts performance within the procedure's configuration but leaves operating maintenance open. RESULT-INCONCLUSIVE retains physical test execution while an instrument fault blocks the performance inference and acceptance. Route the first to the operator's maintenance arrangement and the second to the test owner's evidence and appropriate repetition. Neither closes because elapsed test time is recorded. This diagnostic vocabulary asserts no technical threshold, actual result, probability or correction duration.

### *No technical acceptance protocol is prescribed*

The chapter supplies original delivery-control reasoning. Real test requirements, defect admissibility and service permissions must come from applicable engineering and operating authorities.

## Decision implications

- Plan commissioning evidence before late integration.
- Keep test readiness, test acceptance and service readiness distinct.
- Preserve qualified handover conditions and residual obligations.

## GOVERNANCE AND APPLICATION

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# Lessons require original forecasts and actual outcomes

*A delivery learning protocol*

## Keep the forecast that existed before the outcome

Delivery lessons require the original forecast, its evidence and the changes that occurred. A final completion date alone cannot explain why a project differed from its plan. The actual scope may have changed, resources may have become unavailable, an acceptance obligation may have been omitted or the original estimate may have been poorly supported. These causes have different implications. Preserve the contemporaneous basis so the review can distinguish them rather than judging every decision solely from the final result.

A useful learning record connects forecast, actual event and accepted scope. The forecast should have a version, cutoff, task boundary and estimate basis. The actual should state the event and evidence. The scope comparison should identify whether they describe the same obligation. Without this mapping, a duration comparison can be numerically correct but substantively meaningless. A larger package cannot fairly be treated as the same task simply because its identifier stayed unchanged.

Outcome quality and decision quality differ. A well-supported decision can have an unfavourable outcome because an acknowledged uncertainty materialises. An unsupported decision can have a favourable outcome through luck or an unrecorded intervention. Learning should examine the reasoning and evidence available at the time as well as what happened. This protects against copying successful but unsound practices and abandoning reasonable controls merely because a particular outcome was poor.

The project should retain rejected alternatives and challenges. They reveal what options existed and why the authority chose one. A recovery decision may look unnecessary after the original supplier delivers early, but the contemporaneous record may show a credible threat and an expiring fallback. Conversely, an acceleration can look successful while another unrelated change actually produced the saving. The record should preserve the causal assumptions so later analysis can avoid attributing the whole outcome to the most visible action.

The frozen studies reproduce fictional assumptions and exact outputs; they are no historical performance dataset. A lessons programme needs comparable accepted events, contextual conditions and a transfer-evaluation method. The paper supplies that record structure, without observed rates or task-distribution calibration from invented mechanism examples. Numerical transfer must therefore await an appropriate empirical account.

### *Transfer a lesson only with its conditions*

Use historical evidence when the accepted scope and relevant context are comparable. Prefer a mechanism-based question when numerical transfer lacks support.

## Explain variance by its mechanism

A variance taxonomy should be specific enough to guide improvement. Scope change, estimate-basis change, execution departure, resource conflict, interface failure and decision latency can all move completion. These are original analytical categories for the record, not a universal attribution standard. The review should permit more than one cause where evidence supports it. Forcing every delay into a single code can obscure interactions and encourage responsibility arguments before the facts are understood.

The reviewer should compare the planned and actual release conditions. If the supplier task was forecast from design release but actually began while the configuration remained unstable, the duration difference may reflect a start-basis departure. If the receiving scope expanded, the original duration may no longer be comparable. If the task completed physically but waited for acceptance, the difference may concern release evidence rather than productivity. These distinctions help the next estimate and interface design.

## Illustrative forecast-to-actual learning record

A qualitative record preserves comparability and the decision basis.

| Illustrative forecast-to-actual learning record |                                                                            |
|-------------------------------------------------|----------------------------------------------------------------------------|
| Field or action                                 | Illustrative completed record                                              |
| Input                                           | Original event: equipment accepted for assembly                            |
| Input                                           | Forecast basis: released design, supplier capacity and receiving readiness |
| Input                                           | Actual event: acceptance under the recorded configuration                  |
| Input                                           | Scope comparison: additions and exclusions reconciled                      |
| Input                                           | Interventions: changed resources or partial releases retained              |
| Input                                           | Lesson: verify milestone meanings before integrated reliance               |
| Input                                           | Transfer limit: no universal duration rate inferred                        |
| Action                                          | Preserve the forecast before the outcome was known.                        |
| Action                                          | Separate scope change from execution variance.                             |
| Action                                          | Turn the evidenced lesson into an owned control improvement.               |

Record interventions that changed the outcome. Additional resources, partial releases, changed logistics or scope decisions can make actual duration shorter or longer than the original basis. A lessons dataset that records only the final duration loses this information and may produce misleading analogies. The next planner could copy a short duration without knowing it depended on exceptional capacity or deferred scope. Context is part of the evidence, not an optional narrative beside the number.

A review should also examine reporting behaviour. Did the forecast change when evidence changed? Were completion states used consistently? Did an unaccepted submission release a successor in the chart? Did rebaselining remove the comparison needed for diagnosis? These controls affect whether the team saw the problem in time. Improving them can be more valuable than adjusting a generic contingency factor. The lesson should identify the point where better evidence or a clearer decision could have changed action.

Responsibility and learning can coexist, but their purposes should be explicit. A contractual assessment may need causation and notice evidence under actual terms. A learning review may seek process improvement across organisations. Combining them without clear rules can inhibit candid evidence. The control record should preserve facts for both while avoiding unsupported legal conclusions. The reviewer can state an operational mechanism without claiming that it determines liability.

### *Detailed records discourage candid learning*

Proportionate records and clear review purposes can support candour. Losing the contemporaneous basis invites hindsight and makes both accountability and learning less fair.

## Evidence and scope

Evaluation guidance connects evidence design with learning and the decisions evidence should inform.

Evidence: **Magenta Book: Central Government guidance on evaluation**

## Fictional case: the successful recovery is a poor analogy

A fictional archive records a short supply duration from an earlier installation. The headline says the supplier performed exceptionally. The detailed record shows that the project paid for additional capacity, accepted a partial lot and used a different receiving arrangement. A planner preparing the next baseline wants to reuse the short duration. The learning review asks whether those conditions exist in the new undertaking before treating the outcome as a transferable rate.

The archive's original forecast and change record are essential. They reveal that the short duration was not the supplier's ordinary basis under unchanged scope. It resulted from a specific intervention with cost and interface consequences. The next planner can consider a similar intervention, but it needs current capacity, admissibility and acceptance evidence. Copying the outcome without the mechanism would turn a genuine success into an unsupported estimate.

The scope comparison also matters. The earlier supply event may have been partial acceptance, while the new task means full availability for assembly. The same package name does not make the events comparable. The learning record should map accepted outcomes and residual work. If

the archive contains only a final date, the planner should state that the evidence is insufficient for a strong numerical transfer. The absence of detail is a data limitation, not a reason to invent equivalence.

Review unsuccessful and ordinary cases where available alongside celebrated recoveries. Selection can overstate normal capability; an empirical account must define population, context and missingness. This paper provides no such dataset or calibration. Its qualitative archive rule is to retain interventions and conditions with outcomes so future estimates expose survivorship and selection effects rather than inherit them unnoticed.

The organisation turns the review into a concrete archive rule. Supply records will distinguish original basis, authorised changes, accepted event and material interventions. They will retain configuration and receiving boundaries. The rule is checked on a subsequent closeout rather than declared successful immediately. This makes learning an operational control with evidence, not a collection of optimistic anecdotes.

The next baseline can still use the earlier project as an analogy, but the record explains the adjustment or qualification. A mechanism-based question may be more defensible than a rate: is the required supplier capacity actually secured, and does partial delivery release useful work under this configuration? The lesson preserves the value of history while preventing a favourable outcome from becoming universal proof.

## Retain unfinished cases and revise the learning rule

A reusable lesson can take the form of a question or control rule rather than a numerical rate. For example, verify that supplier readiness and receiving acceptance use the same configuration before joining their milestones. This rule follows from a mechanism and can be adapted across settings. It does not imply that every interface review takes the same duration. Qualitative lessons are valuable when they direct attention to a causal condition without pretending to offer a universal empirical parameter.

A second archive problem arises even when the organisation keeps every project. A package still open at the collection cutoff has no observed accepted-completion duration. Treating it as zero, discarding it from a completed-duration average or inventing its eventual date can bias the apparent performance. Preserve its start, cutoff, current scope and unfinished state. The elapsed observation is real; the completion outcome is not yet known. A later analytical dataset should state how it handles

these incomplete observations using a method suitable for its intended estimate. This paper supplies no fitted duration distribution or numerical accuracy claim.

Cancellation creates a different observation again. A cancelled obligation can carry real cost and elapsed time without producing the accepted event used by a completed delivery forecast. A scope replacement may close the old package administratively while another package carries its remaining service duty. The archive should retain those dispositions instead of treating administrative closure as physical acceptance. The appropriate comparison depends on the question: elapsed exposure, completion timing, resource use and achieved service require different outcome definitions. Combining them under one completed flag loses precisely the mechanism that the learning process needs to preserve.

The archive state determines the permitted inference

Original completed archive design for a fictional delivery portfolio. No empirical records or benchmark rates are asserted.

| The archive state determines the permitted inference |                                                                  |                                                        |
|------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------|
| Record state                                         | Retain                                                           | Do not infer                                           |
| Accepted under the original scope                    | Original forecast, actual event and evidence basis.              | Comparability to another configuration without review. |
| Accepted after an authorised change                  | Original and revised scope, intervention, cost and actual event. | Ordinary performance under unchanged conditions.       |
| Still open at collection cutoff                      | Start, cutoff, elapsed observation and remaining duty.           | An observed final duration or a zero-duration success. |
| Cancelled or replaced                                | Disposition, elapsed exposure, cost and transferred obligations. | Accepted physical service from administrative closure. |
| Partially accepted                                   | Released outcome and the residual obligation.                    | Equivalence to full package availability.              |
| Missing event or configuration evidence              | The missing field and its decision consequence.                  | A convenient substitute completion date.               |

A fictional lesson-retirement record tests a previously useful rule: inspect every supplied module at site before assembly. Its original basis was a mismatch between factory inspection and the installed interface. A later receiving method supplies a different configuration-linked acceptance sequence. The reviewer retains the objective, compatibility before reliance, but retires the universal site-inspection wording when the new sequence addresses that objective. If the new record omits interface evidence, the lesson remains applicable. This disposition shows how a lesson can be

narrowed without erasing its history. The transferable object is the failure mechanism and controlling claim, rather than the organisational location where an earlier project happened to perform its check.

### *No empirical learning dataset is presented*

The fictional studies cannot calibrate forecast accuracy, estimate distributions or failure rates. Actual transfer requires an appropriately defined evidence population.

## Decision implications

- Preserve the forecast and evidence before outcomes are known.
- Explain variance through scope and causal mechanisms.
- Transfer lessons conditionally rather than copying rates.

## GOVERNANCE AND APPLICATION

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# When a complete schedule is not useful

*A strongest-counterargument method boundary*

## The strongest objection to a fixed network

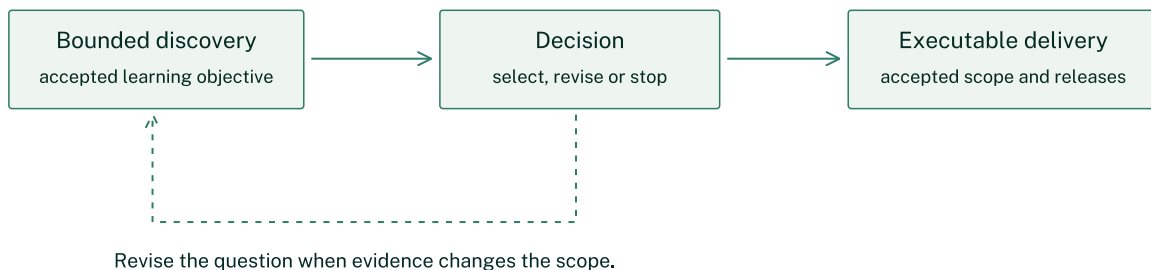
A fixed precedence network assumes the required work and its material relationships can be defined well enough to support a calculation. That assumption can fail during discovery, complex design or adaptive service development. New information may change the objective, reveal tasks or invalidate earlier relationships. In those settings, a complete-looking end-to-end network can create false certainty. The strongest counterargument to this playbook is therefore substantive: dependency visibility does not require pretending that every future dependency is already known.

Adaptive planning can make commitments to learning and decision points rather than to a fully specified delivery sequence. A team may first test whether a problem merits intervention, whether a technical approach is viable or whether a user need is correctly understood. The accepted outcome of that phase is evidence suitable for a decision. Subsequent work depends on what is learned. A static network can represent the bounded phase, but it should not silently extend its confidence to the undefined later undertaking.

## Exhibit: evidence before irreversible commitment

Inspect the declared relationships within the captioned scope.

### THE COMMITMENT FORM FOLLOWS THE EVIDENCE



Stop remains a legitimate decision where the objective is not met.

---

A bounded learning phase does not promise an undefined end-to-end outcome.

Original planning-method concept. A discovery phase can lead to revision, stopping or executable delivery. The loop represents a governance option rather than a cycle accepted by the acyclic scheduling engine. No duration or probability is inferred. The decision purpose is to preserve a credible commitment while scope remains uncertain.

The control perimeter can be staged. Define the current phase's accepted evidence, resources and decision authority. Identify the conditional branches that may follow without assigning unsupported detail to each. A later baseline is created when the branch and scope become sufficiently clear. Preserve the earlier phase record so the project can explain why its plan changed. This is controlled adaptation rather than unrestricted movement of goals. The commitment changes because evidence changes under a stated process.

Dependency reasoning still matters in adaptive work. A discovery experiment can require data access, permission or a technical environment. A design decision can require user evidence or safety analysis. An iteration can need a recipient's acceptance before a broader release. The difference is granularity and scope. The team should expose consequential prerequisites while allowing uncertain implementation work to evolve. Control is weakened by both overplanning unknown work and ignoring known release conditions.

The Delivery atlas is suitable for explicitly entered acyclic scenarios. It does not choose a discovery method, generate missing work or represent a continuously evolving backlog. It can help compare a bounded experiment or a conditional delivery branch once the assumptions are stated. It should not be used to claim that a novel undertaking has become

predictable simply because tasks have been assigned ranges. Numerical uncertainty within known scope is different from uncertainty about what scope will be needed.

*Use the planning form the evidence can support*

Commit to a fixed delivery network when the scope and relationships are sufficiently executable. Use bounded learning and decision commitments when discovery can materially change them.

Commit to evidence and decision cadence

An adaptive phase should have a decision question and evidence boundary. What must be learned to decide whether to proceed, change approach or stop? Who accepts the evidence? What conditions would make the phase insufficient? These questions prevent discovery from becoming indefinite activity. They also prevent a premature delivery promise from forcing the team to ignore findings that would justify a different approach. A bounded evidence commitment can be rigorous without pretending to know the eventual implementation date.

A cadence is useful when it supports timely decisions. Regular reviews can surface new evidence, reconcile priorities and authorise the next bounded work. The cadence should not be mistaken for guaranteed progress. A meeting that occurs on schedule can leave the decision unresolved. The record should show what was accepted, what remains uncertain and what obligation the next iteration undertakes. This preserves accountability while allowing the method to adapt.

Choose the commitment form from the uncertainty

A qualitative planning framework adapts without abandoning accountability.

| Choose the commitment form from the uncertainty |                               |                                            |                                                      |
|-------------------------------------------------|-------------------------------|--------------------------------------------|------------------------------------------------------|
| Condition                                       | Useful commitment             | Control evidence                           | Avoid                                                |
| Executable scope and stable interfaces          | Bounded delivery baseline     | Accepted packages and duration bases       | Uncontrolled changes hidden as updates               |
| Uncertain solution or scope                     | Evidence phase and decision   | Learning objective and accepting authority | Detailed end-to-end precision without basis          |
| Adaptive work joins fixed external package      | Explicit interface release    | Stable information boundary and conditions | Assuming iteration status equals external acceptance |
| Material irreversible decision                  | Staged gate before commitment | Evidence that can change action            | Review only after alternatives expire                |

A backlog item should not be treated as equivalent to an accepted package merely because both have an identifier. The item may be a hypothesis, an implementation task or an unresolved requirement. Its status and acceptance boundary should be clear. When adaptive work joins a fixed external interface, the integration manager needs a credible release condition and forecast. The external party may not be able to absorb continuous scope change. The interface must bridge the planning methods rather than force one team's vocabulary onto the other.

Staged commitments can preserve optionality. Before an irreversible procurement, the team may commit to a feasibility test and a design decision. Before a public service promise, it may require evidence of operating readiness. These gates should follow consequential uncertainty, not a generic bureaucracy. A gate is useful when its result can change action. Repeating the same review after the decision is effectively irreversible provides little protection and can create delay without value.

Stopping can be a successful decision. If discovery shows that the proposed intervention does not meet the objective or is inadmissible, preserving the option to stop protects resources and credibility. A schedule culture that treats every stopped project as failure encourages continuation despite adverse evidence. The charter should state when learning can justify termination or redirection. This keeps the project's purpose above the appearance of completing its original activity list.

### *Adaptive language can excuse uncontrolled scope*

It can when accepted evidence and decision authority are absent. Controlled adaptation preserves the question, phase boundary, rationale and history of change.

## Evidence and scope

GAO agile guidance addresses requirements refinement, validation, traceability and programme monitoring in software.

Evidence: [Agile Assessment Guide](#)

## Evidence and scope

Government service guidance frames discovery around understanding the problem before committing to a service solution.

Evidence: [How the Discovery Phase Works](#)

## Fictional case: discovery rejects the original installation concept

A fictional sponsor begins discovery expecting to install a particular equipment system. The accepted evidence shows that the proposed configuration cannot meet the defined operating need without a material redesign. The original delivery chart would have continued toward procurement. A controlled discovery charter instead permits the sponsor to revise or stop. The case illustrates why learning must be allowed to change the plan, rather than being treated as an obstacle to an already promised solution.

The team preserves the original objective and the evidence that contradicts the proposed means. It separates the operating need from the preferred equipment concept. A different solution may meet the need, or the undertaking may no longer be justified. The authority should compare admissible alternatives using the appropriate evidence. The Delivery atlas cannot choose that solution or infer missing tasks. It can model a bounded branch only after the new scope and relationships are sufficiently clear.

Procurement exposure is reviewed before further irreversible action. Any reservation or preliminary instruction has its actual conditions and consequences. The commercial assessment uses those terms rather than a generic assumption that stopping is free or prohibitively expensive. The schedule records the decision boundary and avoids treating a pending redesign as completed design. This preserves truthful readiness while the sponsor decides.

The receiving team identifies unaffected work that could continue, if any. Its scope must be demonstrably independent of the rejected configuration. Activity for its own sake is not progress toward the accepted outcome. The manager should resist retaining tasks merely to make the programme look active. A pause can be a controlled decision when it prevents avoidable rework and preserves options. The record should state what is held, what may proceed and why.

The sponsor communicates the changed commitment honestly. The earlier chart was a conditional concept plan, not an executable promise if its scope was still under discovery. If external reliance occurred beyond that boundary, the consequences need explicit management. A new baseline should not erase the earlier communication. The edition and project history should explain the evidence that changed the decision and the authority's disposition.

The learning review evaluates the discovery phase by whether it produced useful accepted evidence in time to affect action. Rejecting the original concept can be a successful outcome of that phase. This does not imply that all projects should remain adaptive indefinitely. Once the new scope becomes executable, a controlled delivery network may be appropriate. The lesson is to match the commitment form to evidence maturity and allow a legitimate decision to change the work.

## A fictional discovery-to-installation boundary

Imagine the sponsor has not yet selected the equipment configuration. The receiving works can be designed only after the relevant interface is known. An end-to-end installation chart could assign a single design duration and show a precise finish, but that would conceal the possibility that discovery selects a different configuration or rejects the concept. The manager instead defines a bounded feasibility phase with accepted evidence and a configuration decision. This qualitative case illustrates a planning choice, not a modelled forecast.

The phase has explicit prerequisites: access to requirements, relevant technical evidence and the decision authority. It has an accepted output: a reasoned configuration recommendation with its limits. The sponsor can then select, revise or stop. Once the selection is sufficiently stable, the team creates an executable supply and receiving network. The earlier discovery record remains available, explaining why the later baseline contains its particular scope and assumptions.

The fictional sponsor receives an early supplier request while equipment configuration remains unresolved. The branch record distinguishes a reservation of a production opportunity from a release of configuration-specific manufacture. Reservation may preserve an option under its actual terms; manufacture consumes that option by committing a design. The sponsor leaves the commercial exposure unresolved until those terms are reviewed and refuses to label discovery complete merely to satisfy the supplier's production form. If the eventual concept uses a different interface, the reservation is reassessed rather than treated as evidence that the selected configuration was known earlier. This is a branching commitment record, not a newly calculated network.

Unaffected work is tested by a change-of-concept counterexample. The receiving team proposes access preparation that remains necessary under the currently admissible equipment concepts. It also proposes foundations whose dimensions depend on the selected interface. The first proposal can be considered independently if its physical and commercial basis holds; the second waits for the configuration decision. The manager

records the reason for this split and asks whether a newly admitted concept would invalidate it. This test is stronger than describing preparation as generally low risk. It connects each proposed activity to the uncertainty that could make the work unusable and exposes the specific scope that discovery has not yet released.

The eventual baseline carries a discovery-to-delivery transfer note. Accepted findings settle the selected interface and retire rejected concepts; unresolved supply evidence becomes an estimate-basis obligation; the independent access work is recorded as already performed within its own scope. The planner checks that the new network neither forgets that work nor credits the held foundations as completed. A discovery finding that creates a new test requirement becomes actual baseline scope rather than a generic contingency. The note's contribution is closure by consequence: each finding changes a requirement, activity, estimate or accepted exclusion. Discovery has improved the plan only where this transfer can be traced, not merely because a preceding phase has been called successful.

### *No method is universally superior*

The app models entered DAGs only. The planning recommendation depends on scope maturity, consequence, actual interfaces and organisational authority.

## Decision implications

- Expose known prerequisites without inventing unknown scope.
- Make learning a bounded accepted outcome.
- Preserve explicit releases between adaptive and fixed work.

## PRACTICAL APPENDICES

# 21 Appendix: network calculation specification

*Reproducible critical-path calculation*

## The canonical input contract

The replication contract is the actual Delivery atlas input schema and compute function. A study contains a target deadline and a task list. Each task has a stable identifier, a human-readable name, optimistic, most-likely and pessimistic elapsed durations, and a list of predecessor identifiers. The

app validates the object before calculating. This appendix describes the mechanism so a reader can inspect the frozen input rather than trust a published chart. The public bundle preserves the machine-readable input and output alongside scalar bindings.

Identifiers carry dependency meaning. A predecessor refers to an identifier, not to the task’s display name or position in the list. Renaming a task therefore need not alter topology, while changing an identifier requires reconciliation of its references. The model rejects duplicate identifiers, unknown predecessors and self-dependencies. The paper retains the fictional reference identifiers from design through acceptance. Their simplicity supports inspection; it does not imply that an actual project should use the same naming convention.

Illustrative calculation. Assumptions and sensitivity are published with the model.

Illustrative canonical reference input

Elapsed weeks; every displayed input is bound to the frozen reference fixture.

| Illustrative canonical reference input |            |            |             |             |             |
|----------------------------------------|------------|------------|-------------|-------------|-------------|
| Task                                   | Identifier | Optimistic | Most likely | Pessimistic | Predecessor |
| Design release                         | A          | 2.00       | 4.00        | 6.00        | None        |
| Equipment supply                       | B          | 6.00       | 8.00        | 10.00       | A           |
| Receiving works                        | C          | 4.00       | 6.00        | 8.00        | A           |
| Assembly                               | D          | 3.00       | 4.00        | 5.00        | B and C     |
| Integrated tests                       | E          | 1.00       | 2.00        | 3.00        | D           |
| Acceptance                             | F          | 1.00       | 1.00        | 1.00        | E           |

Durations use a common continuous elapsed-week basis. Each task range must be nonnegative and ordered from optimistic through most-likely to pessimistic. The actual validator also enforces finite values, field structure, identifier rules and numerical precision limits. A zero duration is valid for a milestone under the stated schema. Tiny nonzero values below the accepted numerical precision are rejected rather than silently rounded into a milestone. These checks protect the calculation’s input integrity; none validates an estimate’s empirical plausibility.

The schema has no resource, calendar, lag, lead, monetary or acceptance-outcome fields. Adding such a field to a study does not make the engine calculate it; unsupported structure is rejected. The wider practitioner

records in this paper therefore remain outside the canonical numerical input. They explain how the network can be used responsibly. A replication user should preserve that boundary when importing a known study into the companion tool rather than assuming the narrative's governance and resource analysis have become automatic outputs.

The target deadline is an interpretation input for the selected-path normal reading. It is not a task constraint that changes the forward and backward dates. The earlier-target study verifies this distinction by retaining the network and changing only the deadline. A user who expects a deadline to drive resource levelling or automatic recovery is asking a different question from the one implemented. The app does not optimise a network to meet a target.

### *Replicate before relying on a published scalar*

Load the exact fixture, verify the supported model version, rerun the canonical engine and inspect both the output and its limits. Reject hand-edited output or an unexplained method substitution.

## Graph validity and the calculation sequence

The compute function first validates the input and builds the dependency graph. It determines a topological order so each predecessor is processed before its successor. A cycle prevents such an order and is rejected. This matters operationally: a rework loop cannot be represented directly as an acyclic finish-to-start network. It needs a declared conditional scenario or a different modelling method. Breaking a cycle arbitrarily to obtain an output would change the causal model and should not be treated as a harmless formatting repair.

**Illustrative calculation.** Assumptions and sensitivity are published with the model.

For each task, the canonical method transforms the entered range into an estimated mean and variance. The printed method is PERT mean = (optimistic + 4 × most likely + pessimistic) / 6. Variance = ((pessimistic – optimistic) / 6)<sup>2</sup>. These quantities are conditional on the inputs. The forward pass propagates early dates; the backward pass uses the calculated project finish to derive late dates and float. Reproduction checks the exact output object, not merely whether the displayed project duration resembles an independently typed number.

**Illustrative.** Critical activities have exactly zero total float under rational PERT means constructed from canonical input decimals. Critical paths connect start to finish through those activities with exact contiguous early

times; a small positive gap is not converted into a tie by an absolute tolerance. The canonical reporting method is Every critical path is a start-to-finish path of zero-float activities with contiguous earliest times. At most 50 are displayed. The implementation counts qualifying paths and enumerates a bounded list. Numeric table values, square roots and the normal deadline approximation retain their separately declared display or approximation scope. In a branching network, the path count can exceed the list length. The total count should travel with any display of selected paths. A visible list alone cannot substantiate a claim that every critical route has been reviewed.

**Illustrative.** The retained method states: Deadline probability uses a normal approximation with variance summed on the first displayed critical path. The corresponding standard deviation is evaluated against the stated deadline. When the selected variance is zero, the implementation uses a deterministic boundary rule. This is a method disclosure, not an endorsement of the approximation for every project. The exclusions in the output remain essential: no dependence, competing-path simulation or warranty of contract completion is supplied.

The optimistic and pessimistic network scenarios are calculated by separate forward passes using the respective task estimates. Their labels refer to the input cases. They do not define statistical confidence intervals or absolute bounds. A task whose scope or approval outcome is absent remains absent in all those passes. A reader should therefore inspect the network and its perimeter before interpreting the envelope. Exact arithmetic cannot reveal missing obligations that the input never declared.

### *Exact JSON equality is stricter than a practical decision needs*

It is appropriate for a frozen publication claim. Practical uncertainty remains in the inputs and scope, but publication reproduction should not add an unexplained numerical discrepancy.

## Evidence and scope

Government technology guidance connects technology choices to service needs and lifecycle responsibilities.

Evidence: [The Technology Code of Practice](#)

## Read the frozen input as an argument

The reference input lists design release, equipment supply, receiving works, assembly, integrated tests and acceptance. Design is the predecessor of supply and receiving. Both are predecessors of assembly. Testing follows assembly, and acceptance follows testing. This is a simple but complete declared topology for the fictional study. It lets a reader see where parallelism exists and which event joins the branches. The table below preserves the numerical inputs through ledgered tokens rather than manually retyping them.

A replication review should begin by matching each task to its narrative boundary. Supply ready means the fictional accepted equipment event, not merely procurement expenditure. Receiving ready means the fictional assembly interface. The initialisation script's task names and study purposes record those meanings. A user can change labels locally, but changing a boundary requires a new input basis and possibly a new topology. Renaming alone cannot establish that the model now represents a different real obligation.

Next inspect what each comparison changes. Serial-release alters the receiving predecessor. Duration-switch alters supply estimates. Interface-gate adds a readiness activity. Tied-branches alters receiving estimates. Earlier-target alters only the deadline. Deterministic-path collapses ranges. Zero-milestone adds a release event without duration. Path-enumeration replaces the topology with an explicit equal-branch boundary fixture. These changes have different purposes and should not be blended into one claim about a single recovery intervention.

The reproduction bundle includes full outputs, not only the scalar values used in prose. This supports inspection of task dates, float, selected paths, count, warnings, methods and scenario durations. Scalar bindings connect published tokens to exact input or output pointers. The audit reruns the canonical compute function and checks equality with the frozen output. A mismatched output is a substantive reproduction defect that must be resolved before the manuscript can rely on it. Formatting a rounded display does not alter the frozen value.

The bundle is a computational record, not a field data package. It contains no client, observed productivity or actual contract. Its valid numerical comparisons demonstrate mechanisms under stated assumptions. A practitioner applying the method should create a separate authorised input with current scope, resources, calendars and evidence as needed,

then use an appropriate execution system for features outside this small engine. The paper's replication path is useful precisely because its claims are narrow enough to be tested.

## Replication practice: input is the authority for recomputation

A replication user reopens a known fictional study in the companion app. The study's input and model-version metadata determine what can be recomputed. A saved display or exported result is not treated as an independent authority. This protects against stale output after an engine change or a local input edit. The user should inspect the loaded task meanings and the result's warnings before using the comparison.

The scenario vault preserves canonical input-only records. Unsupported versions are rejected rather than silently accepted as if they were equivalent. A valid import is recomputed through the implemented model. The publication's frozen output remains available for exact reproduction checks, while a modified local scenario has its own new result and basis. These are different records. Editing a scenario does not revise the published paper or establish an actual project forecast.

A practitioner using the workflow should give the local scenario a clear purpose and declare changes. The value of the vault is continuity and reviewability, not automatic acceptance. Local persistence requires the user's explicit opt-in; memory use can support a session without external transmission. These platform properties are separate from the schedule mathematics. The replication chain remains narrow: a supported input is recomputed, the conditional output is inspected, and the authority decides what additional evidence is required for reliance.

## Version the model and reject silent substitution

A reproducible study needs the engine version as well as input and output. The audit records hashes of the compute module, its imported method and shared modules, and the runner. An implementation change can affect validation or output even when the visible app title is unchanged. A retained study should not be reopened under an unsupported model version without warning and recomputation. The public scenario vault preserves inputs and version metadata rather than treating saved outputs as authority.

When the engine changes legitimately, refresh the frozen record through the controlled production procedure and review affected manuscript claims. Do not edit an output JSON by hand to make a comparison pass.

Do not duplicate the mathematics in an author script and claim canonical reproduction because it reaches a similar result. The authoring helpers select scalar pointers and write explicit prose; they do not replace the app's compute function. This separation keeps the numerical authority inspectable.

A reader may compare the app with another scheduling tool. Differences can arise from calendars, resource constraints, relationship types, rounding, milestone rules or uncertainty methods. Reconcile these bases before calling one output wrong. The frozen input is intentionally narrow and continuous. A richer execution programme may be more suitable for a real project, but it should explain how its scope and methods differ. Agreement of a single project duration is insufficient to establish equivalence of the full model.

Validation failures should remain visible. A cycle, unknown predecessor or unordered range is rejected because it prevents a supported computation under this contract. The appropriate response is to repair the declared input with a reason, or choose a model that supports the intended structure. Returning a plausible-looking schedule from invalid input would be worse than a clear refusal to calculate. The invalid-fixture receipts in the next appendix record actual rejection behaviour without publishing an invented project result.

Finally, replication should serve a decision. A reader can reopen the reference study, verify the published values, change a declared assumption and inspect the consequence. The result should be accompanied by the input basis and limits. This creates a transparent evidence-to-model link while leaving the authority's judgment explicit. The tool does not approve a baseline, a recovery intervention or an external promise. Its value is to make the conditional numerical argument reviewable.

### *The schema is computationally narrow*

Input validation proves admissibility under the app contract. It does not establish engineering feasibility, estimate calibration, governance authority or actual completion confidence.

## Decision implications

- Inspect identifiers, ranges and topology before interpreting output.
- Preserve the engine and module version with the study.
- Treat validation rejection as a meaningful boundary.

## PRACTICAL APPENDICES

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## Appendix: illustrative delivery studies

*Full inputs, results and sensitivities*

### Read the study slate as controlled comparisons

The study slate uses a reference network and declared modifications to isolate delivery mechanisms. Every input is fictional, every output comes from the canonical Delivery atlas compute function, and every printed scalar is bound to its frozen input or output. The cases are not project observations. Their purpose is to make a reader's inference testable: identify what changed, inspect what remained constant, reproduce the result and state the limit of the conclusion.

**Illustrative calculation.** Assumptions and sensitivity are published with the model.

The reference parallel network produces expected duration 19.00 weeks. Supply and receiving both follow design, and assembly waits for both. The serial-release study changes only receiving's predecessor from design to supply. Its duration is 25.00 weeks. The comparison isolates a topology change under the same task ranges. It demonstrates that sequencing can alter the conditional result without an increase in task durations. It does not establish that the parallel relationship is executable in any actual installation.

Illustrative calculation. Assumptions and sensitivity are published with the model.

## Illustrative study comparison

Expected duration in elapsed weeks; each row has its own frozen input and explicit change basis.

| Illustrative study comparison |                                     |                   |                                            |
|-------------------------------|-------------------------------------|-------------------|--------------------------------------------|
| Study                         | Declared change                     | Expected duration | Interpretation limit                       |
| Reference parallel            | Authored reference                  | 19.00             | No actual project represented              |
| Serial release                | Receiving follows supply            | 25.00             | Topology comparison only                   |
| Duration switch               | Supply range only                   | 17.00             | No acceleration feasibility or cost        |
| Interface gate                | Added readiness activity            | 22.00             | No approval-success guarantee              |
| Tied branches                 | Receiving range equals supply       | 19.00             | Selected-path approximation remains narrow |
| Earlier target                | Deadline only                       | 19.00             | Target does not accelerate work            |
| Deterministic path            | Ranges collapsed                    | 19.00             | Certainty exists only by assumption        |
| Zero milestone                | Root event without elapsed duration | 19.00             | No evidence of real approval effort        |
| Path enumeration              | Equal-branch boundary network       | 6.00              | Visible path list is bounded               |

Illustrative calculation. Assumptions and sensitivity are published with the model.

The duration-switch study changes only the supply range and produces expected duration 17.00 weeks. The selected path shifts to the receiving branch. The result shows why a local saving cannot be extrapolated indefinitely: another predecessor can become binding. The study contains no acceleration cost or supplier-capacity evidence. Its operational use is to identify the next question, namely whether the proposed shorter supply basis is executable and whether the now-binding branch deserves a separate intervention.

**Illustrative.** The interface-gate study inserts a readiness decision after assembly and before tests. It produces duration 22.00 weeks. This comparison illustrates omitted work rather than a productivity failure. The gate's scope and range are authored assumptions. A real decision

might have an uncertain outcome, different authority or an external calendar. The study should therefore be used to inspect the mechanism of including a release activity, not as a benchmark for how long approvals normally take.

**Illustrative.** The tied-branches study gives receiving the same range as supply. Expected duration remains 19.00 weeks and the engine counts 2 critical paths. The selected-path normal reading is 82.9%. This does not represent whole-network confidence. The case deliberately exposes a limitation: more than one branch governs the mean-duration finish while the approximation still evaluates a selected path. A reader should retain the distinction rather than infer equal reliability from an unchanged displayed percentage.

### *Make the inference no broader than the change*

Attribute a result to a declared assumption only when the comparison preserves the relevant constants. Treat invalid inputs as rejected models, not missing values to fill with invented output.

## Boundary cases preserve meaning

**Illustrative calculation.** Assumptions and sensitivity are published with the model.

The earlier-target study changes only the deadline. Its duration remains 19.00 weeks and its selected-path reading is 17.1%. This verifies that a target changes interpretation of the approximation while leaving the network dates unchanged. The case is useful in a governance discussion because it prevents an aspirational date from being mistaken for a changed execution plan. A new promise needs an intervention or a different accepted scope, not merely a new deadline value.

**Illustrative.** The deterministic-path study sets each task range to its base most-likely value. Its duration is 19.00 weeks, standard deviation 0.00 weeks and conditional deadline reading 100.0%. The output follows the engine's zero-variance rule. It supplies no empirical certainty. The case removes variation by assumption while retaining all the app's other exclusions. It therefore demonstrates a computational boundary rather than a warranty of delivery.

**Illustrative.** The zero-milestone study adds a root release event with duration 0.00 weeks. Project duration remains 19.00 weeks. A milestone can preserve a meaningful event without adding elapsed work under the entered topology. Its operational credibility still depends on the evidence that the event occurred. An assumed zero-duration approval should not

be used to hide review work or uncertain permission. The case distinguishes event representation from a claim about actual administrative effort.

**Illustrative.** The path-enumeration study replaces the reference with an explicit equal-branch network. Expected duration is 6.00 weeks, the engine counts 64 critical paths and displays at most 50. The case verifies bounded presentation separately from total counting. It does not imply that the displayed list is complete. A reader examining a highly branching project should use the count and the full input, not rely solely on the selected path or visible enumeration.

Boundary cases are useful because they can reveal silent assumptions. A zero duration tests whether a milestone is permitted. Equal branches test counting and uncertainty communication. A deadline equal to a deterministic finish tests the comparison rule. These are actual computational studies with frozen receipts. They should remain distinct from qualitative operational cases, which examine governance and readiness mechanisms outside the app. Both forms of analysis can be useful, but they support different kinds of evidence.

#### *Fictional studies are less persuasive than case histories*

They offer controlled, reproducible mechanism tests. Actual histories are needed for empirical rates and transfer evidence; the publication should use each for the claim it can support.

## Invalid-fixture practice: a self-reference is a model defect

An imported fictional task refers to itself as a predecessor. The actual validator rejects it through cycle detection. The rejection is correct under the DAG contract, but the reviewer still needs to understand its cause. It may be a mapping error from another system or an attempted representation of repeated work. The correction differs. A mistaken identifier should be reconciled; a genuine iterative process needs another representation.

The author receipt preserves the executed rejection rather than creating a null duration and calling that a result. A rejected computation has no supported schedule output. The user should not replace it with the last successful result, because that would attach an unrelated network to the invalid input. Clear failure states preserve the integrity of the evidence chain. They also make input repair easier by identifying the unsupported property.

After repair, recompute the entire network and preserve the reason for the change. A removed edge can materially alter completion, so it is not merely a data-cleaning operation. The review should verify that the new topology expresses the intended release conditions. This case supplies no new numerical output; it explains the disposition of an actual validation class. Its lesson is that model admissibility and operational meaning must be restored together before a plausible chart deserves reliance.

## Invalid inputs have no supported project result

The author ran invalid-input fixtures against the actual compute export. Cyclic dependencies, unknown predecessors, duplicate identifiers, self-dependencies, unordered ranges, negative durations, unsupported fields, nonfinite values and values below the numerical precision floor were rejected. The local receipt records the mutated input or construction basis, rejection message and engine hash. These are development observations of validation behaviour. They are not accepted schedule studies, and no duration or project output is fabricated for them.

A cycle deserves a substantive response. It may mean the input accidentally points backward, or it may mean the intended process contains rework that the acyclic model cannot represent directly. Repairing the first case requires a corrected dependency with a reason. The second may require explicit conditional scenarios or another model. Arbitrarily deleting a link to obtain a result changes the argument and should be recorded as such. A clear rejection is preferable to an unexplained plausible output.

An unknown predecessor can indicate a stale identifier after renaming or splitting work. The correction should reconcile the intended relationship rather than attach the task to whichever existing identifier looks convenient. A duplicate identifier can cause two obligations to become indistinguishable. These failures protect traceability as well as mathematics. The validation message should prompt review of the package mapping and dependency register, particularly when the input was imported from another planning system.

An ordered range can still be unsupported, but an unordered range has no valid meaning under this contract. The app therefore rejects it before calculation. Negative and nonfinite durations are likewise inadmissible. Unsupported fields are rejected because silently ignoring a calendar or resource field would invite a user to believe it affected the result. This strictness is useful for a small transparent tool. It makes the boundary inspectable rather than giving an impression of functionality that is not implemented.

The invalid receipts should be retained with the author evidence, while the public replication bundle supplies only valid frozen studies for reopening. A practitioner can use the rejection messages to repair input safely and recompute. The broader release decision still needs scope, evidence and authority. A valid schema is necessary for this calculation, but not sufficient for an external commitment. The appendix closes that distinction explicitly so passing validation is not confused with acceptance of the delivery plan.

### *The slate is not a performance sample*

No frequency, calibration or project-success conclusion can be drawn from expressly authored fixtures. Validation receipts cover the executed cases and current engine version.

## Numerical equality and a supported change of scale

**Illustrative calculation.** Assumptions and sensitivity are published with the model.

A positive total float does not become zero because the supplied schedule is expressed at a small magnitude. The small-distinct-paths fixture has independent deterministic activities A and B, at 1e-09 and 9e-09 weeks, against target 5e-09. The selected critical activity is B. Activity A has total float 8e-09 weeks and is not critical. These implausibly small calendar values deliberately test the engine; they do not recommend a scheduling measurement resolution.

**Illustrative.** The equal-decimal-paths fixture tests a different distinction. A path with supplied durations 0.1 and 0.2 weeks and a direct path with duration 0.3 weeks have the same exact canonical decimal total. The engine therefore records 2 critical paths and duration 0.3 weeks. Its deterministic selected-path deadline result is 1 at the same 0.3 target. A positive increment to the direct path makes it strictly longer. The arithmetic does not estimate duration uncertainty; the normal approximation remains limited to its selected path when a nonzero range is supplied.

## Decision implications

- Inspect each study change before attributing its effect.
- Preserve boundary-case meanings and narrow probability labels.
- Reject unsupported input rather than fabricate a schedule.

PRACTICAL APPENDICES

23 Appendix: operational control worksheets

Practical governance records

Use records that join the decision chain

A practitioner record should connect evidence, model and action. A dependency register without acceptance evidence is incomplete. An acceptance record without the successor it releases is difficult to use. A change form without a decision owner can remain unresolved while its options expire. The completed fictional records in this appendix show how the pieces join. They are not templates filled with generic advice alone; each has an explicit boundary, condition and disposition that a reader can inspect and adapt.

These fictional installation records contain no private agreements or client data. The numerical input supplies tasks, ranges and predecessors; the practitioner layer supplies meaning, evidence, ownership and authority outside the small app. Connect the layers without treating a displayed date as completed governance or supported operational credibility. The records demonstrate that control logic rather than claim the scheduling tool has performed it.

Completed fictional dependency record

The receiving-to-assembly edge retains its causal and acceptance basis.

| Completed fictional dependency record |                                                                                   |
|---------------------------------------|-----------------------------------------------------------------------------------|
| Field                                 | Completed fictional record                                                        |
| Predecessor and successor             | Receiving works ready to equipment assembly                                       |
| Cause                                 | Physical interface and acceptance information                                     |
| Evidence                              | Configuration-linked compatibility and readiness record                           |
| Owners                                | Works manager produces; assembly manager receives                                 |
| Disposition                           | Affected interface held; only explicitly unaffected preparation permitted         |
| Closure                               | Accepted configuration and hold disposition recorded before full assembly release |

The integration manager should maintain stable links between package, interface, task and decision identifiers. A changed label should not break those links. A scope revision should record which links remain valid and which need a new boundary. In a small project, a controlled document may be enough; in a larger one, a structured system may be appropriate. The principle is inspectability. A reviewer should be able to follow the obligation from its definition to the evidence and the decision that permits reliance.

Record completion should be judged by use. A filled form is not complete if its evidence reference is inaccessible or its authority undefined. A signed acceptance is not sufficient if the conditions are omitted from the successor release. A resolved change is not fully integrated if the supplier and operator still use different configurations. The closure check asks whether the authorised decision has reached every material affected record and recipient. Administrative appearance should not substitute for executable continuity.

Carry the records' qualifications into the summary: partial release stays bounded, recovery depends on capacity evidence, risk response retains residual exposure, and governance does not prove physical readiness. Those conditions tell the recipient what may proceed. Removing them creates a broad ready label that must be reinterpreted during mobilisation, delaying action rather than simplifying it.

### *Verify the records through an actual use question*

Rehearse the release with the recipient, including a plausible change. Close only when the user can identify permitted scope, accepted evidence, exceptions and actual authority.

## The dependency and acceptance records

The dependency record joins receiving works to assembly. Its causal type is physical interface plus acceptance information. Its release evidence is a compatibility and readiness record under the selected configuration. The producing owner is the works manager and the receiving owner is the assembly manager. The open challenge asks whether a bounded unaffected area can be released before the whole receiving package is accepted. The disposition permits only separately defined unaffected preparation while the affected interface remains held.

This disposition should travel into the schedule. The full assembly task remains dependent on accepted receiving readiness. A separate preparation activity can be added only if its scope and prerequisites are credible. The app can calculate such a scenario once explicitly entered, but this appendix does not invent its duration. The record demonstrates how qualified release can be represented without falsely completing the entire predecessor. It also preserves who accepted the exposure and why.

Completed fictional change screening

The supply acceleration offer remains conditional on executable evidence.

| Completed fictional change screening |                                                                       |
|--------------------------------------|-----------------------------------------------------------------------|
| Field                                | Completed fictional record                                            |
| Proposal                             | Shorter supply duration basis                                         |
| Numerical screening                  | Duration-switch study; receiving becomes binding                      |
| Evidence still required              | Supplier capacity, method, inspection and logistics                   |
| Other consequences                   | Cost, quality, resource and acceptance review outside the app         |
| Authority                            | Sponsor within actual delegated powers                                |
| Disposition                          | No external promise until the complete intervention basis is accepted |

The acceptance record identifies configuration, criteria, evidence and authority. Its fictional disposition holds the affected equipment-to-receiving interface pending compatibility resolution. Production evidence is accepted as evidence of production, while assembly release remains open. This is a useful distinction because it recognises genuine progress without overstating its consequence. The recipient can see what must happen next, and the producer can challenge the requirement or supply the missing evidence through the controlled process.

State the residual item’s permitted and prohibited activities. An open document may block one release alone; a physical discrepancy may permit inspection but prevent operation. A generic minor label cannot express those consequences. Classify against actual technical and statutory requirements, then record the permission and basis. The illustrative record demonstrates where that decision belongs and grants no universal permission.

When compatibility is resolved, the acceptance record should identify the accepted version and close the relevant hold. Earlier evidence remains in history, with its former scope. The schedule’s actual date should

correspond to the newly defined acceptance event. This prevents a retrospective correction from implying that the interface was ready earlier than it was. History remains useful for learning and responsibility while current readiness becomes clear.

*Completed examples can be copied without thought*

They can. Adapt the actual scope, authority and evidence rather than copying dispositions that were written for a fictional installation.

## The change, risk and escalation records

Screen the fictional supply-acceleration offer with the duration-switch study: receiving works becomes binding, while price and executable capacity remain unestablished. Request supplier method and capacity evidence, inspection and logistics confirmation, and receiving-branch review. The authority can then compare the complete intervention with current forecast and target. The filled assessment remains conditional and establishes no real-project acceleration approval.

The risk response concerns a configuration change that could invalidate receiving work. The action is a compatibility review before irreversible release, with a notification rule for later changes. The trigger is an unresolved material interface at the release review. The fallback holds affected irreversible work while permitting only agreed unaffected preparation. Residual exposure includes later changes and communication failure. This record distinguishes completing the review action from eliminating the risk mechanism.

### Completed fictional risk and escalation record

The action and residual exposure remain distinct.

| Completed fictional risk and escalation record |                                                                  |
|------------------------------------------------|------------------------------------------------------------------|
| Field                                          | Completed fictional record                                       |
| Exposure                                       | Configuration change can invalidate receiving works              |
| Response                                       | Compatibility review before irreversible release                 |
| Trigger                                        | Material interface unresolved at release review                  |
| Fallback                                       | Hold affected work; permit bounded unaffected preparation only   |
| Residual exposure                              | Later changes and communication failure                          |
| Escalation consequence                         | Expiring test-resource option requires timely readiness decision |

The escalation record concerns an expiring test-resource reservation. It names the unresolved readiness question, required evidence, actual decision authority and consequence of delay. The requested decision is whether the defined test scope may proceed under specified conditions. The fallback is to preserve permitted preparation and release unused resources according to the actual arrangement. The record avoids a generic urgent label by connecting urgency to an operational option that may disappear.

The baseline record preserves the authorised reference, current forecast and target separately. Discovery of the readiness decision changes the forecast immediately once its basis is credible, while the authority disposes of baseline treatment. The earlier reference remains available. This preserves both timely information and historical comparability. A change can improve the control model without erasing the earlier commitment or deciding contractual responsibility through a planner's edit.

At review closure, the manager reconciles these records. The configuration, task meanings, acceptance conditions, supplier instruction and resource reservations must describe the same selected plan. Any outstanding condition remains visible with an owner. This reconciliation is the practical test of integration. A collection of individually well-written forms can still fail if they refer to incompatible versions or if their decisions never reach the execution team.

## Run a release rehearsal

A release rehearsal asks a recipient to use the records as if the successor were about to begin. Can the assembly manager identify the accepted configuration, find the evidence, understand exceptions and know who authorised the release? Can the operator distinguish test readiness from service acceptance? Can the sponsor see the forecast's conditions and the action needed if one fails? The rehearsal exposes ambiguity before mobilisation turns it into delay or irreversible work.

The rehearsal should include a challenge. Suppose the supplier changes a document, the accepting authority is unavailable or a residual defect affects the proposed test. Follow the record through the consequence. Does the release hold automatically where required? Is the escalation owner clear? Does the schedule remain truthful? This is a qualitative control exercise, not a stochastic simulation. Its purpose is to test whether the record's wording and links support an actual decision under a plausible change.

A failed rehearsal should produce a specific correction. Clarify the scope, repair an evidence link, identify the authority or reconcile a configuration. Do not close it with a generic statement that teams should communicate better. The correction should be small enough to inspect and concrete enough to verify. Once repaired, repeat the relevant part of the rehearsal. This mirrors the discipline used for model reproduction: a claim is supported by an executed check of the property it asserts.

The records should remain proportionate. A routine local task may need only a simple accepted-outcome note. A material interface crossing suppliers, technical authorities and operators needs more explicit evidence. The control system should scale with consequence and uncertainty. Excess paperwork can obscure important releases just as insufficient records can hide them. The rehearsal helps identify which information a real user needs at the point of action.

Release the stated scope under its recorded conditions, evidence and authority, identifying what can be relied upon now and what needs monitoring. Future uncertainty remains. The record's practical value is an inspectable commitment chain: computational precision supports the forecast, while administrative completion and accepted delivery retain their distinct meanings.

### *These records confer no project permission*

The completed examples demonstrate control reasoning. They are not executed agreements, technical certificates or approvals for an actual installation.

## Decision implications

- Connect records through stable scope and version links.
- Preserve conditional dispositions and residual exposure.
- Rehearse release from the recipient's point of use.

## PRACTICAL APPENDICES

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## Appendix: source scope and release-mechanism fit

*Choose the timing representation that matches the actual accepting event.*

### Institutional and empirical scope

For each narrow primary statement, retain publisher, title, edition or access basis, locator, jurisdiction, limits and retrieval receipt. The receipt identifies retained bytes or browser evidence; it does not validate every interpretation. The claim ledger must connect the sourced note to its card and locator so an independent reviewer can examine the actual support rather than inherit authority from retrieval alone.

Institutional sources retain their original purposes. Government project guidance concerns government roles and controls. DOE material concerns its project-management context. GAO guides supply assessment methods within their stated scope. World Bank and EPEC procurement or PPP guidance have specific institutional and public-sector boundaries. Service-development guidance concerns technology and public services. Their inclusion does not make them universal law or a contractual requirement for an unnamed private project. The paper uses them as scoped methods rather than as authority to assign real obligations.

Fictional duration ranges are authored mechanism inputs, not source-derived rates, project populations or probability calibrations. Their computations come only from the canonical input and compute contract. A publisher's methodological support does not validate those parameters. Keep each numerical use labelled illustrative and bound to its frozen study so source authority cannot be mistaken for task-estimate evidence.

The practitioner records, objections and qualitative cases are proposed original reasoning, not reported engagements or observations. Test transfer through actual scope, consequence, authority and evidence. Applicable instruments and competent specialists determine material technical or legal requirements. Publication supplies no mandate, professional certification, recipient acceptance or legal opinion; it supplies a structure for identifying the real undertaking's unresolved questions.

The bibliography supports verification without repeating source summaries at length. Narrow sourced notes stay adjacent to their analytical use. The retrieval archive remains part of the production evidence, while public links allow readers to inspect the publisher's material. A publisher page can change after the evidence cutoff; the retained receipt records the basis used in this draft. Later editions should review both current source status and the manuscript claims affected by any change.

## An authority date is more than a task duration

An approval event can be represented as a task only when its meaning and timing basis fit the network. A prepared submission, a reviewed submission and an authorised release are different outcomes. The predecessor should release what the receiving activity actually needs, while the duration should represent the remaining process under its stated conditions. Treating a document as approval because the file is complete confuses production with authority. Treating every approval as a generic delay can conceal the review window or conditional resubmission mechanism that governs the next usable release.

A bounded review activity with supported continuous elapsed duration can belong in the supplied finish-to-start network. The authorisation event remains the task outcome, and the estimate basis should identify required inputs, scope and responsible review authority. This representation is useful when the review starts after its predecessors and its duration can be meaningfully declared under the accepted conditions. It does not prove that the authority will approve the proposal. A network date and an admissible decision are different properties, so the commitment record should state the condition that governs use of the forecast.

A review available only in scheduled windows has another timing mechanism. Completing a submission just after a window can create a much longer wait than completing it just before. A continuous-duration estimate does not reproduce that discontinuity simply because its average seems plausible. The team should retain the submission cutoff, actual review calendar, entry criteria and treatment of a missed window. If the window materially governs the commitment, use a calendar-aware representation or an explicit supported scenario outside the current demonstrator. Do not relabel the app's elapsed finish as a booked authority date.

Conditional rejection or resubmission creates a further boundary. The current app requires an acyclic network of supplied activities. It cannot loop through an unknown sequence of review, redesign and resubmission until an authority accepts an outcome. A team can define a bounded scenario containing a specified additional review sequence, but its inputs and interpretation must remain explicit. It should not disguise an adaptive process as a closed deterministic baseline. The decision may require a staged commitment that separates initial submission from later authority-dependent work, preserving what can actually be authorised now.

Scarce review or inspection resources can govern concurrency even when precedence is clear. Several tasks may be ready together, while the same person, facility or access arrangement can serve only a limited set. The app's earliest dates assume that supplied precedence is sufficient; it does not allocate those resources. Additional precedence can sometimes represent an already agreed sequence, but choosing that sequence is an operating decision with evidence and authority. A planner should not add arbitrary links merely to make the dates look feasible. Where resource competition matters, use the relevant allocation method and preserve the basis of the chosen order.

These timing distinctions matter to downstream value. A supplier mobilisation, financing condition or benefit-start assumption may rely on an approved operating event. If its input instead uses a document-ready or technical-test date, the bridge can be wrong even when the DAG calculation is exact. The receiving model should name the event it consumes and identify the evidence that establishes it. A timing model should not turn a technical forecast into a legal permission, and a financial model should not turn a forecasted permission into an executed entitlement.

The review decision has several defensible routes. Correct the activity definition when the wrong event was supplied. Correct the network perimeter when a required obligation is genuinely omitted. Use a calendar or resource method when the mechanism lies outside the continuous-time DAG. Define an explicit bounded scenario for a known additional sequence. Hold a downstream commitment when the authority or operating evidence is unresolved. The useful route is the one that changes the decision object accurately, not the one that produces the earliest completion number.

## Choose the representation from the release mechanism

Original completed representation screen for fictional authority and operating events. The entries do not establish an actual review timetable or approval right.

| Choose the representation from the release mechanism |                                                           |                                                                       |
|------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------|
| Event mechanism                                      | What the current DAG can represent                        | Additional evidence or method                                         |
| A supported continuous review duration               | A defined task after complete predecessors.               | Task outcome, estimate basis and the accepting authority.             |
| A fixed review calendar or submission cutoff         | A separately stipulated scenario, with its limit visible. | Calendar-aware timing, entry criteria and missed-window treatment.    |
| Conditional redesign and repeated submission         | A declared bounded additional sequence.                   | An adaptive or staged decision model where the loop is material.      |
| A scarce inspector, facility or access arrangement   | Precedence for an already agreed sequence.                | Resource allocation and evidence that the agreed order is executable. |
| An unresolved legal or operating permission          | An explicit unresolved release condition.                 | The applicable instrument and competent authority.                    |
| A downstream financial or service assumption         | The correctly named supplied timing event.                | A reconciled receiving-model boundary and evidence of the event.      |

The selected-path normal reading does not repair any of these missing mechanisms. It uses the supplied ranges on the selected critical path and excludes competing-path uncertainty and dependence. A percentile-like percentage cannot compensate for a misdefined approval event, a missing calendar or a shared resource. Before discussing confidence, establish whether the model represents the process whose finish matters. The optimistic and pessimistic cases remain declared input contrasts, while the relevant calendar, authority and operating records govern the interpretation in an actual undertaking.

*Scale the model to the commitment*

A simple network can remain the right decision aid when excluded details do not affect the commitment being considered. An organisation need not build a complex scheduler for every task. The screen should identify a material mechanism and show how a plausible change could alter the action or reliance. If a known approval window is safely outside the decision exposure, record that reasoning. If it governs a promised service date, further representation is justified. Complexity should follow the consequence rather than the availability of more software.

*A correct network can still represent the wrong release*

The screen transfers questions and representation choices, not fictional durations or legal powers. Public institutional guidance retains its own audience and purpose. No actual approval, resource schedule or operating permission has been established. The demonstrator remains a finish-to-start continuous-time DAG with selected-path approximations; where another mechanism matters, define and validate the additional method before relying on its conclusion.

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## Decision implications

- Define the accepted event before choosing its timing representation.
- Calendars, adaptive review and shared resources can require methods beyond precedence alone.
- A selected-path percentage cannot repair a missing release mechanism.

## PRIMARY EVIDENCE

# References and source scope

### wb-risk-identification

World Bank PPP Resource Center. Identifying Risks. live guidance, accessed 2026-10-10

Locator: Economic or financial; legal or regulatory

Scope: A list of possible risks supplies no empirical event frequency or project-specific probability.

<https://ppp.worldbank.org/identifying-risks>

### epec-guide

European Investment Bank, European PPP Expertise Centre. EPEC Guide to Public-Private Partnerships. 2026 edition, 16 April 2026

Locator: Printed pages 9, 15, 44 and 182; physical PDF pages 17, 23, 52 and 190: lifecycle, affordability, funding and value for money.

Scope: A public-sector PPP framework is adapted here as a comparison lens; it is not a universal private investment rule.

<https://www.eib.org/files/publications/20250124-160426-epec-guide-to-ppp-en.pdf>

### green-book

HM Treasury. The Green Book. 5 February 2026

Locator: Options appraisal; risk and uncertainty; monitoring and evaluation

Scope: Its social appraisal perspective and public discount conventions do not automatically apply to private finance.

<https://www.gov.uk/government/publications/the-green-book--2/the-green-book-2026>

### magenta-book

HM Treasury. Magenta Book: Central Government guidance on evaluation. 15 May 2026

Locator: Evaluation planning; test and learn; benefits management

Scope: A monitoring improvement is not by itself a causal impact estimate. Identification and context remain necessary.

<https://www.gov.uk/government/publications/the-magenta-book/magenta-book-central-government-guidance-on-evaluation-html>

### aqua-book

UK Government Analysis Function. The AQuA Book. current edition accessed 2026-10-10

Locator: Quality assurance of analysis

Scope: A quality framework is not a certification of a particular model. Evidence of executed checks is still required.

<https://www.gov.uk/guidance/the-aqua-book>

#### orange-book

HM Treasury. The Orange Book: Management of Risk, Principles and Concepts. 29 July 2026

Locator: Part I principles; Part II risk control framework

Scope: UK central government requirements are described in their scope. They are not asserted as duties for every organisation.

<https://www.gov.uk/government/publications/orange-book/the-orange-book-management-of-risk-principles-and-concepts>

#### nasa-se

NASA. NASA Systems Engineering Handbook. NASA/SP-2016-6105 Rev 2, 2016

Locator: Section 6.8 Decision Analysis; technical management processes

Scope: NASA engineering practice is a reference architecture. Transfer to a commercial organisation requires adaptation.

[https://www.nasa.gov/wp-content/uploads/2018/09/nasa\\_systems\\_engineering\\_handbook\\_0.pdf](https://www.nasa.gov/wp-content/uploads/2018/09/nasa_systems_engineering_handbook_0.pdf)

#### gao-schedule

US Government Accountability Office. Schedule Assessment Guide: Best Practices for Project Schedules. GAO-16-89G, 22 December 2015

Locator: Ten schedule best practices; schedule risk

Scope: A deterministic critical path is a model result. It is not a probabilistic completion guarantee.

<https://www.gao.gov/products/gao-16-89g>

#### gao-cost

US Government Accountability Office. Cost Estimating and Assessment Guide. GAO-20-195G, 12 March 2020

Locator: Technical baseline; assumptions; sensitivity; update with actuals

Scope: An earned-value metric cannot repair an invalid baseline or prove the quality of completed work.

<https://www.gao.gov/products/gao-20-195g>

#### wb-procurement-criteria

World Bank. Procurement Guidance: Evaluation Criteria. 2016 guidance

Locator: Life-cycle costing

Scope: Applicable procurement documents govern a tender. A generic cost example is not a legal award recommendation.

<https://thedocs.worldbank.org/en/doc/201591478724669006-0290022017/original/ProcurementGuidanceEvaluationCriteria.pdf>

#### doe-mv-plan

US Department of Energy, FEMP. Measurement and Verification Activities Required in the Energy Savings Performance Contract Process. current publication page accessed 2026-10-10

Locator: M&V plan and baseline conditions

Scope: A baseline must be defended for the actual project. The cited process does not validate illustrative inputs.

<https://www.energy.gov/cmei/femp/measurement-and-verification-activities-required-energy-savings-performance-contract>

### **gds-technology**

UK Government Digital Service. The Technology Code of Practice. 30 January 2025 catalogue page

Locator: Technology and business strategies; lifecycle

Scope: Government spend-control scope is explicit. This paper presents adaptable operating principles rather than universal mandatory controls.

<https://www.gov.uk/data-ethics-guidance/the-technology-code-of-practice>

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### **delivery-govs**

Government Project Delivery and Cabinet Office. Government Functional Standard: Project Delivery. Current publisher page updated September 2025

Locator: Standard purpose, structure and update record

Scope: UK government scope is retained; no universal enterprise duty or project acceptance is inferred.

<https://www.gov.uk/government/publications/project-delivery-functional-standard>

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### **delivery-sro**

Government Project Delivery and Cabinet Office. The Role of the Senior Responsible Owner. Current public guidance page accessed October 2026

Locator: Guidance purpose and intended governance roles

Scope: Government accountability arrangements require adaptation and do not assign an enterprise actor authority automatically.

<https://www.gov.uk/government/publications/the-role-of-the-senior-responsible-owner>

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### **delivery-gate**

National Infrastructure and Service Transformation Authority. Gate Review: Investment Decision. Current guidance page accessed October 2026

Locator: Purpose of investment-decision assurance and applicable review arrangements

Scope: An assurance review is not an author-issued certificate or a substitute for local approval and evidence.

<https://www.gov.uk/government/publications/gate-review-3-investment-decision>

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### **delivery-doe-schedule**

US Department of Energy. Planning and Scheduling. DOE Guide dated April 2022

Locator: Integrated planning, master schedules, baseline and control practices

Scope: Historical guide scope is explicit; applicable current DOE requirements are not asserted for an unnamed enterprise project.

<https://www.energy.gov/documents/planning-and-scheduling>

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#### delivery-doe-evm

US Department of Energy Office of Project Management. Earned Value Management. Current page accessed October 2026

Locator: About earned value management

Scope: The definition supplies no accepted-work evidence or validation of a particular baseline; no EVM result is computed by the companion app.

<https://www.energy.gov/projectmanagement/earned-value-management>

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#### delivery-doe-lexicon

US Department of Energy. Project Management Lexicon of Terms. Current public lexicon accessed October 2026

Locator: Traceability and project-control terms

Scope: A terminology reference supplies no actual dependency, task duration or completion guarantee.

<https://www.energy.gov/projectmanagement/project-management-lexicon-terms>

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#### delivery-gao-agile

US Government Accountability Office. Agile Assessment Guide. GAO public guide, September 2020

Locator: Requirements management and program monitoring chapters

Scope: Software and public-program context is retained; adaptive practice does not erase physical or contractual dependencies.

<https://www.gao.gov/assets/gao-20-590g.pdf>

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#### delivery-discovery

UK Government Digital Service. How the Discovery Phase Works. Current service manual page accessed October 2026

Locator: Understanding the problem, constraints and deciding whether to continue

Scope: Digital-service scope is retained and no discovery duration or effect is imported.

<https://www.gov.uk/service-manual/agile-delivery/how-the-discovery-phase-works>

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## PUBLICATION RECORD

### Methods, limitations and review

This edition uses publicly accessible primary sources. All worked numerical examples are illustrative, with frozen inputs and reproducible calculations. They represent no actual client, mandate or operating project.

Publication fields identify the fixed edition dated 2026-10-10. Independent assessment and release verification are recorded against that fixed edition separately; these fields do not assign a quality score.

2026-10-10: Substantive authoring initiated from the scoped delivery charter, with fictional canonical studies and explicit method limits; independent review remains pending.

2026-10-10: Added explicitly fictional computational boundary studies and revised canonical model. I.O precision policy. Independent assessment remains pending.

2026-10-10-method-alignment: Aligned declared arithmetic, equality and display-order explanations with the current canonical implementation. Illustrative numerical inputs are unchanged; independent assessment remains pending.