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RESEARCH & DECISION STUDIO

Capital with a long horizon

A durable financing structure is tested against cash-flow failure modes before headline returns.

Project finance and capital resilience

METHODS / EVIDENCE / WORKED STUDIES

ENGLISH EDITION / 2026-10-10

THE DECISION

Capital with a long horizon

A financing proposal should identify the cash-flow conditions under which obligations cannot be met, who controls the response and what evidence justifies the proposed margin. This study separates project value from financing resilience. It develops a cash-flow evidence architecture, period-specific coverage tests, reserve and covenant logic, and committee records that preserve assumptions after financial close. Its worked studies use explicitly illustrative annual schedules and the same deterministic calculation engine as the Capital studio. The schedules show how a positive project valuation can coexist with weak debt coverage, and why a temporary shortfall requires a different response from persistently inadequate operating cash. The study does not prescribe a universal leverage or covenant threshold. It gives sponsors, lenders and operators a reproducible way to challenge a proposal before a headline return becomes an institutional commitment.

Questions this study answers

- Which cash-flow failure modes can prevent dated obligations from being met?
- What evidence supports the defined operating cash perimeter and its stress ranges?
- Which financing constraints bind together, and who bears the cost of each remedy?
- What conditions, monitoring triggers and fallback decisions should a committee approve?

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

The financing question starts with failure

A financing decision tree that can refuse a high-return proposal

Separate project value from the structure that must survive

A capital proposal usually arrives with a compelling asset story: a service is needed, an operator can deliver it, and a long stream of receipts appears capable of supporting investment. None of those propositions determines a financing structure by itself. The asset might create economic value while receiving cash too late to meet a particular obligation. The financing might be repayable only because a sponsor has made a contingent commitment. The same physical asset might remain viable under one repayment calendar and fail under another. A committee should therefore begin by asking what must be true for each dated payment to be made, and which of those conditions the proposal can demonstrate.

The distinction is useful because value and survival aggregate time differently. A discounted valuation combines cash across the entire specified horizon. A payment obligation is met, missed or renegotiated when it becomes due. Positive cash late in the project cannot directly pay an early obligation unless someone has agreed to bridge the gap. Calling that bridge available is a separate claim about a facility, a reserve or a party's commitment. A financing model that reports a favourable present value while omitting the bridge has calculated a project result and left an implementation question unanswered.

This study proposes a failure-first sequence. Define the project cash perimeter, map obligations onto that same calendar, identify periods and mechanisms of inadequate cash, and then evaluate the proposed interventions. The sequence does not assume that every downside justifies less debt. A payment calendar can be changed, a commissioning risk can be borne by an appropriate party, or a temporary liquidity reserve can cover a specified interruption. The point is to make the intervention correspond to the mechanism. Reducing leverage without identifying the failure may consume sponsor capital while leaving the decisive timing risk intact.

Failure-first analysis also protects the distinction between a financing condition and an operating assumption. If the facility becomes repayable only when production reaches its designed rate before the repayment grace period ends, the committee needs evidence about ramp-up and a response to delay. A line labelled management case does not supply that evidence. Conversely, if the operating envelope is well established but the lender insists on an inflexible amortisation profile, the constraint may belong to the financing calendar. The team should be able to explain whether a proposed remedy changes production, moves obligations, introduces support or merely relabels the shortfall.

Evidence and scope

The World Bank PPP guidance connects bankability to confidence that the project company can service debt and to the allocation of risks affecting cash flows. It supplies a financing perspective, rather than a universal covenant threshold.

Evidence: *Considerations for Government*

There are several different questions concealed by the phrase can the project afford this. Economic viability asks whether the project's uses of resources are justified against the relevant alternative. Project cash valuation asks whether the defined unlevered cash stream meets the chosen financial hurdle. Debt capacity asks which obligations can be supported under the lender's conditions. Liquidity asks whether cash and committed access to cash are sufficient at each payment date. Sponsor return asks what remains for the sponsor after the applicable obligations and restrictions. A proposal can answer these questions differently without mathematical contradiction.

An analyst should resist trying to solve the distinction with a single composite score. Combining value, coverage and liquidity into one number allows a strength on one dimension to hide an unacceptable result on another. A large late receipt might compensate for an early deficit inside the score, even though the loan contract provides no mechanism for that compensation. A more defensible control separates feasibility conditions from preferences. The conditions determine which structures are admissible. Return, flexibility and other sponsor preferences then guide choice among the admissible alternatives.

The horizon is part of the argument, not merely a spreadsheet setting. A short model can omit a maintenance replacement or leave outstanding obligations beyond the displayed period. A long model can include speculative terminal cash that dominates the result. Neither choice is automatically wrong. The relevant question is whether the model includes

the obligations and benefits required for the decision, and whether the uncertainty attached to remote cash is treated honestly. A committee should see a bridge between the model horizon, asset life, contract life, debt maturity and the period during which the sponsor must remain committed.

The cash perimeter must also say whose money is being valued. An unlevered project stream should not be presented as an equity distribution stream. Cash available for debt service should not be treated as unrestricted sponsor cash. A reserve balance may be an asset of the project company while being unavailable for dividends. These distinctions are particularly important when a proposal uses the same familiar label, such as free cash, for different calculations. The control is an explicit reconciliation, with each transfer and restriction assigned to its purpose. An attractive amount without a defined owner and permitted use is not a decision-ready result.

A financing decision that can refuse the proposal

Evaluate the structure through separate feasibility conditions before comparing sponsor preferences. A failed condition returns the proposal to evidence gathering or structural redesign; it cannot be compensated by a higher headline return.

1. Define the project, cash perimeter, obligation calendar and decision authority.
2. Test whether the cash deficit is temporary, persistent, contractual or operational.
3. Identify a funded, permitted response with a named accountable party.
4. Retain the downside and the intervention together in the committee recommendation.
5. Approve only the specific structure supported by the evidence, with explicit monitoring and reopening conditions.

Different questions require different evidence

This decision map separates logical tests that an aggregate return metric would otherwise obscure.

Different questions require different evidence		
Question	Required evidence	A result that blocks approval
Does the asset justify commitment?	Defined alternative, cash perimeter and valuation basis	The project does not meet the chosen basis even before financing.
Can obligations be met on time?	Cash calendar matched to debt service and other required uses	A deficit has no committed funding response.
Who absorbs the interruption?	Support, reserve or contract mechanism with limits	The proposal relies on an unconfirmed party commitment.
What can the sponsor actually receive?	Waterfall, distribution restrictions and residual cash	The return presentation includes cash unavailable for distribution.
When must the decision reopen?	Specific variance signals and intervention authority	Material changes can occur without a required reassessment.

The illustrative studies in this paper deliberately keep the distinction visible. Their net project cash flows, cash available for debt service and debt obligations are supplied series. The calculation engine values the project series and separately tests the supplied coverage series. It does not infer a repayment schedule, establish the amount a lender would advance or calculate distributions through a legal waterfall. That boundary is an analytical advantage when studying a timing problem: changing an obligation can alter coverage without pretending that the underlying asset has created additional operating cash.

Consider two proposals with identical project cash flows and different obligations. If their project valuations are identical, that is expected under the model's stated perimeter. If one has inadequate coverage, the valuation result has not disproved the coverage concern. It has answered a different question. The committee should ask whether the weaker structure can be repaired at an acceptable cost and with credible commitments. It should also examine whether the repair introduces a new dependence, such as refinancing or support from a party whose ability to fund is exposed to the same adverse event.

A failure map is more useful than a catalogue of scary events. Each entry should connect a cause to a cash effect, a payment date, a responsible party and a response. Commissioning delay might defer revenue while debt service begins unchanged. Poor collection might create a cash deficit without reducing recorded sales. A maintenance outage might reduce service receipts while increasing expenditure. Each mechanism needs its

own evidence. An undifferentiated revenue haircut can be useful as an initial challenge, but it should not replace explanation of what is changing and how the proposed structure reacts.

The map should preserve the strongest case for approval as well. A robust payment contract, a well evidenced operating envelope or a credible funded reserve may make a structure acceptable despite visible stress. The analyst's responsibility is not to maximise pessimism. It is to distinguish confidence based on evidence from confidence based on convenience. An adverse scenario is useful only if it reveals a material dependency or intervention. A study that can reject every possible proposal because it always assumes catastrophic failure has supplied a mood, not a decision method.

The case for starting with return

A sponsor may reasonably begin with project value when screening a large universe of possibilities. A costly financing analysis is wasteful for an asset that is clearly unattractive. The failure-first thesis applies once a proposal is being structured or recommended for commitment. At that stage, the cost of discovering a timing defect after commitment can justify a closer cash test. The appropriate repair is a staged process: use a proportionate value screen to identify plausible assets, then make obligation and liquidity tests mandatory before approving a specific financing structure.

A model cannot create legal access to cash

This framework describes financial mechanisms. A reserve, guarantee or contract right must be confirmed in its applicable documents, with its limits, conditions and enforcement context. The paper does not infer that an account balance is available merely because the spreadsheet includes it. It also does not establish operational feasibility from a schedule of receipts. Engineering, commercial, environmental, legal and financing diligence remain distinct evidence requirements. Where those requirements conflict, the committee needs the conflict disclosed rather than averaged away.

What the study contributes and what it uses

Conventional primary guidance

World Bank financing guidance already distinguishes periodic coverage, stress interventions and protective cash arrangements.

Evidence: Key Issues in Developing Project Financed Transactions

Contribution and demonstrated decision advantage

This is a truthful contribution map, not a claim that established financing tools were invented here.

Contribution and demonstrated decision advantage			
Element	Status / origin	Specific advantage demonstrated	Practical limit
Periodic coverage and financing remedies	Conventional primary guidance	Retain weak repayment periods rather than aggregate them away	No universal acceptance threshold
Conditional retained-cash bridge	Author-owned synthesis of a bounded cash test	Same base opening amount can have different restoration dates	No source capacity, costs or dated availability
Unchanged-project / changed-service comparison	Author-owned controlled intervention design	Matching improved coverage can produce different hold/reject branches	No recipient consent or financing economics
Proposition, evidence, owner and exposure routing	Author-owned decision-record synthesis	Verified arithmetic cannot release unresolved access or terms	Fictional mandate and role conventions
Model-to-page claim bindings	Reproducible publication method	Readers can trace displayed numbers to frozen exact computations	Traceability alone is not support or acceptance

The study draws on established project-finance definitions and appraisal guidance. Its original contribution is the arrangement of controlled comparisons into an explicit decision trail: identify what changes, what the change repairs, which condition still fails and who may authorise the next exposure. The claimed advantage is demonstrated by the revised worked cases, not inferred from the number of frameworks or pages. Equal base protection with different restoration periods challenges a simplistic failure classification. Equal improved coverage with different project-value and recipient conditions challenges ratio-led approval. A balanced annual path with unresolved source dates challenges arithmetic-led implementation authority.

These are modest but useful demonstrations. They do not establish superiority across all institutions, empirical forecast accuracy or successful funding outcomes. The fictional committee policy is intentionally visible so a reader can disagree with it, change a condition and see which disposition changes. The framework is therefore inspectable and contestable. A conventional metric remains conventional; an original editorial arrangement remains original analysis. Neither status turns an

absent funding term or operating fact into evidence. The public source records retain their institutional scope, while the frozen examples retain their illustrative status.

Decision implications

- Approve a defined obligation calendar, with a cash perimeter and a funded response to its material failure modes.
- Keep viability, valuation, coverage, liquidity and sponsor distributions as separate questions.
- A stress case is useful when it changes the decision or clarifies a committed intervention.

DECISION ARCHITECTURE

02

An evidence architecture for cash flows

An input acceptance register and a missing-evidence stop rule

From observations to accepted inputs

A cash-flow forecast is an argument about how a service becomes money and how that money survives competing obligations. The evidence architecture should follow that argument. Begin with the physical activity, follow the right to invoice, establish the time and conditions of collection, then identify the expenditure required to keep the right alive. A headline revenue assumption conceals these transitions. A register that contains only a number, a source and an owner can look complete while omitting the very dependency that determines whether the number becomes usable cash.

The first analytical distinction is between a recorded event and an expectation. An invoice issued is an event. Its payment date may still be an expectation. A delivered unit can be verified without establishing that the customer accepted its quality or that the tariff applies to that delivery. The model therefore needs linked records rather than a universal category called actuals. For each material input, an analyst should state what has happened, what remains conditional and which cash-flow line would change if the condition were not satisfied. This exposes uncertainty without dismissing useful operational evidence.

Source quality is also specific to the question. A signed contract can establish a stated payment mechanism while offering little evidence of a counterparty's future liquidity. A technical design can establish planned capacity while offering little evidence of achievable utilisation. A demand study can identify prospective users while failing to demonstrate their willingness to commit. Treating these materials as substitutes allows apparently strong evidence to answer the wrong question. The acceptance register should name the proposition being supported before it names the document. Review then concerns relevance as well as authenticity.

Consider a conceptual service asset for which the sponsor presents an annual sales forecast. The forecast could rest on an accessible customer population, a share expected to use the service, an available operating window and an achievable selling price. Each assumption has a different failure mechanism. A capacity shortfall limits possible deliveries; weak customer uptake limits desired deliveries; a collection dispute delays receipts after delivery. Combining these mechanisms into a single cautious revenue estimate destroys the information needed to choose a remedy. The register should preserve them even if the public model uses a deliberately simpler cash schedule.

The distinction between sourced, assumed and derived information is not a hierarchy of professional respect. Assumptions are unavoidable in forward decisions. Their weakness lies in being disguised, unsupported by a range or unaffected by contradictory evidence. A well-labelled assumption with an explicit failure consequence can be more decision useful than a sourced historical average applied outside its domain. Derived values should retain their inputs and calculation rule. A reader should be able to move backwards from an output to the originating observations and the judgment connecting those observations to the future.

The perimeter of an observation matters as much as its precision. A recorded price may exclude taxes, rebates, transport or quality adjustments that affect the asset's receipts. A historical volume may refer to a wider region, a different service level or an unusually favourable period. Neither observation needs to be discarded automatically. Instead, the analyst should state the transformation required for use in this project. Where that transformation is judgment rather than measurement, the register should show it as an assumption. Quoting additional decimal places does not repair a perimeter mismatch.

Dependencies deserve an explicit place in the evidence record. The selling price may depend on availability, certification or a delivery point. The projected volume may depend on a connecting facility completing on

time. The cost estimate may assume that a particular source of labour, power or materials remains accessible. These dependencies can invalidate an input without changing the document that originally supported it. The record should therefore include a trigger for reopening the input. Evidence is not frozen forever merely because a committee once accepted it; its conditions can cease to hold.

Conflicting evidence should be retained in a disagreement register rather than averaged into an apparently neutral answer. Suppose the operator's capacity assessment and an independent engineering review disagree about sustained performance. Taking a midpoint can imply a level of confidence that neither party supports. The useful questions concern the operating conditions each assessment assumes, the test that could distinguish them and the financing exposure before that test can occur. A committee can condition approval on resolving the disagreement or price a bounded uncertainty. It cannot legitimately declare the disagreement resolved by arithmetic alone.

Negative evidence also requires interpretation. The absence of customer commitments may reflect an immature commercial process, a poor service proposition or buyers unwilling to take a long obligation. Those explanations produce different decisions. The sponsor should not be penalised merely because a project is early, but an early project should not inherit the evidence status of a mature contracted asset. The funding commitment can be staged around observable milestones. What matters is that the timing of capital exposure follows the timing of evidence, instead of assuming that later diligence will justify an irrevocable decision already taken.

The model should identify its most consequential evidence gaps by decision effect, not by the number of empty cells. A missing minor cost item may be immaterial to the investment choice; a missing collection lag can be central to liquidity. Sensitivity helps rank these gaps, provided the analyst does not treat a tested range as a measured distribution. An evidence gap becomes a stop condition when plausible values within the unresolved range change the recommendation or leave a dated obligation unfunded. This gives diligence a purpose: resolve the propositions that determine the decision.

An input owner should be accountable for meaning as well as delivery. Naming the commercial team as owner of revenue does not explain whether it attests to market access, tariff terms, customer commitments or collections. A more useful record separates preparer, source custodian and acceptance authority. The preparer assembles evidence; the custodian maintains the underlying record; the acceptance authority decides that the

input is sufficiently relevant for the present decision. These roles can overlap in a small organisation, but the overlap should be explicit. Responsibility should not disappear into a departmental label.

Version control is a substantive financial control when decisions depend on changing inputs. The committee package should identify which schedule, contract interpretation and model edition it considered. If a later update changes the ramp, operating perimeter or terminal assumption, the decision owner should receive a bridge explaining the change in economic meaning. Merely replacing the old workbook with a newer file prevents learning and can conceal scope drift. A retained decision record also allows monitoring teams to distinguish a forecast error from a deliberate change in the project they were asked to finance.

Evidence collection should protect the project's ability to act. A diligence process can become so comprehensive that it asks for information whose cost and delay exceed its value. The solution is to sequence questions around reversible decisions. A modest preliminary commitment may require enough evidence to justify the next investigation, while a binding financing commitment requires evidence about obligations that become difficult to unwind. The register should state the decision level for which each input is accepted. This avoids extending a preliminary finding into a stronger approval through repetition of the same source label.

The public paper and the transaction record have different disclosure purposes. A public analytical illustration should make its assumptions transparent while excluding confidential counterparty terms, personal information and private commitments. A transaction team may need those records for actual diligence, under appropriate controls. Public omission should not be confused with missing private diligence; equally, a statement that confidential evidence exists cannot be used as public verification. This paper's worked schedules are illustrative inputs and reproducible calculations. They demonstrate analytical mechanisms, not the performance or financing terms of an undisclosed client.

The acceptance decision should close with an explicit consequence. An input can be accepted for a stated use, accepted subject to a sensitivity boundary, held pending a discriminating test or rejected as irrelevant to the proposition. The reason should identify what the next analyst would need to change to obtain a different decision. A generic instruction to obtain more evidence is weak because it can never be satisfied conclusively. A precise instruction to validate the connection between an operating milestone and the first collectible invoice creates an actionable diligence task and a traceable financing condition.

Evidence and scope

The AQuA Book frames quality assurance around the production and assurance of analysis for decisions. Its verification and validation distinction supports checking both calculation correctness and fitness for the intended use; this paper applies that distinction to a cash-flow evidence register.

Evidence: The AQuA Book

Input acceptance register

A conceptual completed record illustrates the required reasoning. It does not represent a real project or an accepted financing assumption.

Input acceptance register			
Input proposition	Evidence status	Unresolved dependency	Acceptance and action
Deliveries can be sustained	Technical assessment supplied; performance remains prospective	Operating window and maintenance access	Accept for preliminary planning; require an operating test before commitment
Invoice produces collectible cash	Payment mechanism documented in the conceptual case	Acceptance, dispute and customer liquidity	Hold financing acceptance until collection timing is bounded
Cost covers the required service	Estimate reconciled to stated scope	Replacement and commissioning obligations	Accept with sensitivity; reopen if the technical perimeter changes
Connecting asset is available	Sponsor expectation only	A separate owner controls delivery	Treat as a gating dependency; seek evidence or stage exposure

The missing-evidence stop rule

Hold a binding financing decision when an unresolved proposition can change the recommendation or leave a dated obligation without an identified funding source. A sensitivity range can bound the problem; it cannot provide the missing evidence.

1. State the proposition and the decision it affects.
2. Identify the plausible unresolved range and the owner who can resolve it.
3. Test whether the financing conclusion survives that range.
4. Define the discriminating evidence or redesign the commitment to remain reversible.

A sparse register can be enough

An experienced sponsor may reasonably argue that collecting a formal record for every input adds cost without improving judgment. That objection is strong for immaterial inputs and reversible decisions. It weakens when team turnover, disagreements or binding commitments require others to understand precisely what was accepted. The register should be proportionate, but its core decision propositions should remain traceable.

Evidence cannot remove future uncertainty

An authenticated source can still be incomplete, stale or unsuitable for a different project. This framework does not certify contracts, engineering or market demand. It makes the basis of use visible and creates a disciplined reason to obtain specialist review where a proposition is material.

Decision implications

- Accept a proposition for a specified decision, not a document in the abstract.
- Preserve dependencies and disagreements that can change collection or funding.
- Make an evidence gap a stop condition when it can reverse the financing conclusion.

DECISION ARCHITECTURE

03

Construction has a different cash-flow logic

A sources-and-uses bridge with a commissioning cash test

Funding the interval before receipts

Construction transforms committed resources into an asset that may later produce receipts. During that transformation, the financing problem has a different shape from the operating problem. The project can consume cash while producing no collectible service revenue. Its principal uncertainties concern whether the required asset will be delivered, when it can operate, what completion will cost and which party must supply cash if the plan changes. A mature operating forecast is therefore an insufficient description of construction risk. The sources-and-uses bridge must survive the interval before operating cash becomes available.

A capital estimate is not the same as a funding requirement. An estimate can describe the value of planned work while excluding the timing of payments, financing costs, transaction expenses, commissioning expenditure or the liquidity needed to begin operations. The funding requirement follows cash obligations through time and includes resources

that must remain available rather than immediately spent. The analytical task is to reconcile the technical scope with the full funding perimeter. The bridge should make clear which items are construction work, which are enabling expenditure and which are cash protections against uncertainty.

Commitment and disbursement are separate events. A lender can commit subject to conditions that the project has not yet satisfied. A sponsor can declare an equity contribution while retaining discretion about when it is paid. A grant can be awarded but released only after eligible expenditure is demonstrated. The existence of these nominal sources does not establish cash availability at a contractor payment date. A credible funding bridge records conditions, release timing and the party responsible for satisfying them. The project should not use conditional resources as though they were already unrestricted balances.

The sequence of source contributions also affects exposure. If equity is spent before debt, the sponsor bears an earlier cash burden and lenders may retain greater protection against incomplete construction. If contributions move together, conditions for each draw can become mutually dependent. If an award reimburses completed work, another source must fund the interval. None of these arrangements is universally superior. The important question is whether the agreed sequence provides cash when needed and whether the parties whose contributions are delayed retain incentives compatible with completion. A waterfall of commitments is not automatically a workable waterfall of cash.

Milestone payments translate technical progress into financial obligations. A payment attached to an easily certified delivery can improve predictability, but it can also create a liquidity demand before the installed asset is usable. Conversely, retaining payment until commissioning can shift cash pressure to the contractor and increase the risk of underperformance if the contractor cannot finance the work. The model should follow the agreed milestone meaning rather than equating expenditure with a uniform percentage of physical completion. The technical adviser and financial analyst need a common account of what each milestone actually proves.

Completion itself has several meanings. Physical completion can mean that equipment is installed; contractual completion can require specified tests; commercial operation can require licences, connection, acceptance or staff readiness; financing completion can require documentation and compliance beyond technical operation. These boundaries should be reconciled before the cash bridge assumes revenue begins. A model that moves directly from the last construction payment to full operating cash

may omit a commissioning interval in which costs continue and receipts remain uncertain. The relevant test is the first period in which the asset can deliver, invoice and collect under the actual operating mechanism.

Schedule risk becomes a cash issue through mechanisms that should be stated separately. Delay can postpone receipts, extend site and supervision costs, increase financing expenditure, alter supplier prices or defer the release of committed funding. Some mechanisms may overlap. An analyst who applies a general cost uplift and also extends every underlying cost line can count the same burden twice. A schedule scenario should identify the event, the affected activities and each resulting cash consequence. The purpose is to construct a coherent altered path, not to accumulate unrelated penalties until the case looks sufficiently conservative.

The critical connection between schedule and financing is often controlled by an interface. The main asset may be complete while a grid connection, access route, water supply or customer facility remains unavailable. The project can then face payment obligations and operating-readiness costs without the planned receipts. An interface register should name the controlling party, the acceptance criteria and the remedy if that party misses its date. A promise by the project sponsor does not become operational control merely because the forecast incorporates it. Financial exposure should reflect the project's actual ability to influence the interface.

Contingency should respond to identified uncertainty while retaining an owner and a release rule. A contingency provision buried inside a broad estimate can be consumed by scope additions before it is needed for adverse conditions. A separate provision without a governance rule can be treated as spare money. The committee should ask which risks the allowance addresses, what expenditure would qualify and who can authorise its use. If the allowance is used to cover a deliberate scope enhancement, the record should show that the project's risk protection has changed and identify how the remaining uncertainty will be funded.

Cost-to-complete is a forward decision measure. Money already spent does not prove that the remaining commitment is justified, nor does a near-complete asset always imply a small remaining risk. The difficult work may lie in testing, integration or correcting defects. At a review point, the relevant questions are what is still necessary to achieve usable service, what cash is available for that work and whether completing remains preferable to stopping, redesigning or selling the unfinished position. This appraisal can be uncomfortable because it separates sunk commitment from prospective value, but avoiding it merely converts discomfort into an unmanaged funding obligation.

A completion undertaking can alter who funds an adverse event without removing the event itself. The analyst should examine the undertaking's trigger, scope, expiry, available resources and enforceability through appropriate legal advice. A sponsor statement of intent offers a different level of protection from a binding, funded and timely mechanism. The financing model should not assume an instantaneous cash injection merely because the transaction narrative mentions support. Where timing or capacity remains unresolved, the bridge should preserve that uncertainty and the committee should decide whether the resulting exposure is acceptable.

Drawdown controls need to preserve completion rather than merely document expenditure. Requiring proof that money has been spent can prevent misuse while still allowing the project to fund work that no longer leads to a viable asset. A useful review combines progress evidence, updated cost-to-complete, remaining sources and the implications of outstanding interfaces. The purpose is not to make every draw a complete reapproval of the project. It is to ensure that changes material to completion are recognised before additional irreversible exposure. Administrative compliance should not be mistaken for a current completion judgment.

Commissioning liquidity deserves its own bridge. Training, initial consumables, testing, defects, insurance, administrative readiness and early collections can create a cash demand after major construction payments have declined. The operating forecast should not assume that the eventual steady cash surplus funds these first requirements before receipts arrive. The bridge should show what balance enters commissioning, what claims can consume it and what evidence permits transfer to ordinary operating controls. This distinction also prevents a reserve intended for debt service from quietly becoming the source of unfinished construction expenditure.

The handover from construction to operations should transfer information as well as assets. Operating teams need the agreed performance envelope, maintenance obligations, defect arrangements, remaining commitments and the financing assumptions that depend on their actions. If the model assumes a particular ramp, the operator should know what capacity, staffing and customer-readiness conditions make that ramp possible. A handover pack that contains only manuals and completion certificates can omit these financial dependencies. The monitoring baseline should be established at handover, with unresolved items assigned to owners instead of disappearing into a declaration that construction is complete.

The financing decision at the end of this chapter is a commissioning cash test: can the defined project move from the next commitment through usable service and first collections with dated, available funding? If the answer depends on unverified completion, a conditional disbursement or support whose timing is uncertain, that dependency belongs in the recommendation. A positive long-horizon valuation can coexist with a failed commissioning cash test. The practical response may be to stage expenditure, change payment milestones, secure an interface or reduce scope. Treating all of these as requests for more debt ignores the cause of the gap.

Evidence and scope

The World Bank project-finance overview describes a project company and delivery relationships, and notes that a new-build project does not generate operating revenues during construction. The commissioning cash test here is an original decision framework built around that timing distinction.

Evidence: Project Finance: Key Concepts

Evidence and scope

The GAO Schedule Assessment Guide treats a reliable schedule as an integrated account of activities and dependencies. Its discussion of schedule risk supports connecting delay scenarios to affected work and cost consequences. It does not establish this paper's illustrative completion dates or costs.

Evidence: Schedule Assessment Guide: Best Practices for Project Schedules

A commissioning sources-and-uses bridge

This conceptual bridge identifies evidence required for cash availability. Values should be supplied from the transaction record before it is used to approve an actual draw.

A commissioning sources-and-uses bridge			
Cash use or source	Timing evidence	Availability condition	Challenge
Milestone payment	Contractual trigger and certification	Accepted milestone; undisputed payment date	Does certification prove readiness or only delivery?
Committed debt draw	Draw notice and release process	Conditions precedent satisfied	Can unmet conditions delay payment?
Sponsor contribution	Binding contribution schedule	Funds transferable when required	Is capacity verified and discretion removed?
Commissioning expenditure	Operating-readiness plan	Cash balance available before collections	Which costs continue if first receipts slip?
Reimbursement support	Eligible expenditure and award mechanism	Claim accepted and reimbursement released	What funds the gap before reimbursement?

Commissioning cash test

Proceed only when the next commitment can be connected to usable service and first collections through identified dated funding. An unresolved interface or conditional source should be treated as a financing condition with an owner and evidence requirement.

1. Reconcile technical scope, remaining expenditure and first collection conditions.
2. Place source releases and payment obligations on the same timeline.
3. Retain separate contingencies for the mechanisms they protect.
4. Test a coherent completion delay and identify the responsible funding party.

A strong contractor can simplify the bridge

A capable contractor with a well-defined completion obligation may reduce the sponsor's need to analyse every construction detail. This argument is strongest where responsibility, remedies and funding capacity are clear. It does not eliminate external interfaces, conditional source releases or the sponsor's commissioning requirements. A simplified bridge still needs to describe these residual exposures.

No construction finance engine is claimed

The public capital app accepts completed period cash schedules. It does not calculate drawdowns, interest during construction, contract milestones or completion guarantees. The construction analysis in this chapter is conceptual and must be converted into a project-specific schedule by qualified technical, financial and legal advisers before use.

Decision implications

- A committed source can remain unavailable at the payment date.
- Define completion through service, acceptance and collection as well as installed work.
- A commissioning cash test can fail while the project retains positive economic value.

DECISION ARCHITECTURE

04 Cash available is a defined perimeter

A CFADS reconciliation worksheet and boundary challenge

Defining what lenders can receive

Cash available for debt service is a defined analytical perimeter. The phrase sounds self-explanatory, but its usefulness depends on identifying which receipts have arrived, which operating obligations have been paid and which required expenditures remain ahead of lenders. The objective is to isolate cash that can actually be applied to the specified debt obligation during the specified period. A profitability measure cannot answer that question on its own. Nor can a balance in an account if part of that balance is restricted, belongs to another party or is needed to preserve the asset's ability to operate.

Begin with the distinction between earning and collecting. Accrual revenue can be recognised before the customer pays. The asset can therefore appear profitable while cash is tied up in receivables. An increase in activity can worsen this position if the project must fund materials, staff and other inputs before collection. The financing model needs a cash conversion mechanism, including the treatment of disputes, overdue balances and write-offs. Applying a fixed collection percentage to annual revenue may be acceptable for a bounded preliminary illustration; it should not conceal the timing exposure of an actual payment mechanism.

The next boundary is between a cost recognised and a payment made. Supplier credit can temporarily improve cash availability, but extending payment does not eliminate the obligation. If the project uses overdue suppliers as an informal financing source, apparent coverage may come at the expense of service continuity or contract compliance. The analyst should distinguish agreed working-capital terms from arrears. A cash-flow

statement that groups them together can make deterioration look like improved financial performance. Debt-service capacity should not be inferred from cash retained by failing to discharge obligations necessary to keep the asset functioning.

Maintenance expenditure raises a related timing problem. An asset can generate a temporary cash surplus by deferring work, yet lose reliability, useful life or contractual performance. The appropriate debt-service perimeter should reflect the maintenance required for the service and the forecast horizon. This is not an instruction to treat every proposed capital improvement as mandatory. It is a requirement to identify the technical consequence of omission. When a committee excludes a proposed item from required maintenance, it should know whether the excluded item preserves current service, expands service or merely improves optional efficiency.

Major replacements need a lifecycle view rather than an arbitrary annual average. Cash may be required in a concentrated period even when the operating margin looks stable. Reserving cash in advance can smooth funding but reduces what is distributable earlier. The model should show the distinction between expenditure, provision and restricted cash. An accounting provision does not itself make money available for the eventual replacement. A funded reserve does, subject to its access conditions. Treating both as equivalent can overstate the cash that remains available to lenders or sponsors at different points in the asset's life.

Tax and statutory payments should follow applicable obligations established by qualified advisers. A generic tax percentage on operating profit can be a useful transparent assumption in a conceptual model, but it does not establish the actual timing, deductions, incentives, withholding or transfer restrictions of a transaction. The cash perimeter must identify which tax payments precede debt service and whether refunds assumed in the model can be used when expected. The public app deliberately does not implement a tax engine. Its independently supplied cash-available schedule must be understood as an input whose construction belongs outside the simplified calculation.

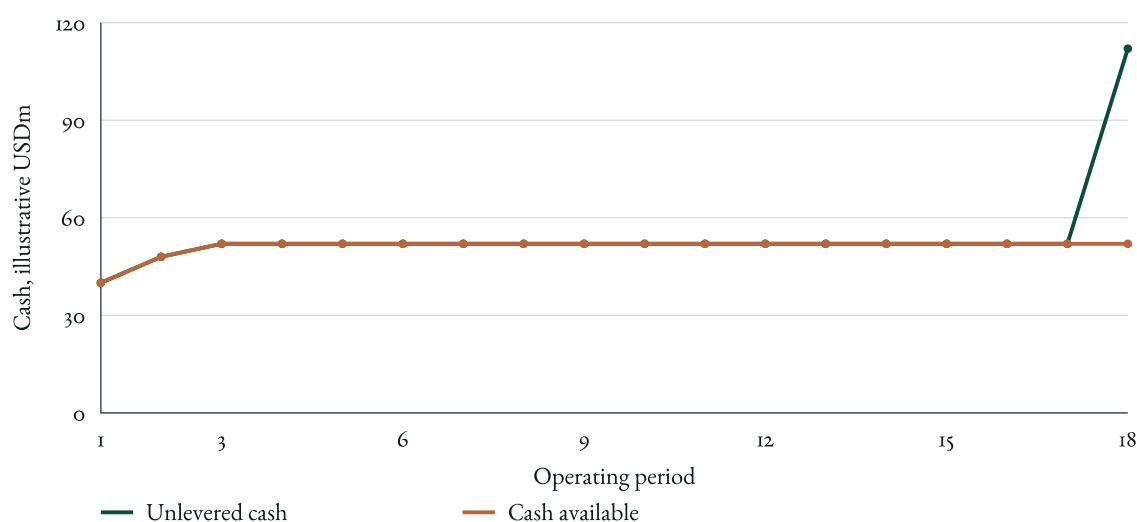
Working capital is often treated as a residual line, although it can encode several mechanisms. Inventory can rise because the project is building a necessary buffer, because demand is weak or because supply is unreliable. Receivables can rise because sales are growing, customers are paying late or invoices are disputed. Payables can rise because terms are favourable or because the project lacks cash. These situations have different implications

for resilience. A bridge from operating activity to cash should preserve the reason for movement, allowing the committee to judge whether a temporary cash benefit is sustainable.

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

Terminal cash and operating cash have different perimeters

The foundation illustration keeps the terminal residual in the unlevered valuation series while its cash-available series retains operating cash. The final divergence is an authored assumption that requires its own evidence in any transaction.



Original deterministic plot of frozen illustrative schedule outputs. Terminal cash is not automatically available for a service test. No actual residual value or operating forecast is asserted.

Restricted cash requires a control-based interpretation. Money held in a maintenance account, debt-service reserve or collection account may be legally or operationally unavailable for ordinary payments. A consolidated balance can therefore mislead the reader about immediate liquidity. The analyst should record the account purpose, permitted uses, access conditions and replenishment obligations. If a reserve can fund debt service during a stress period, that does not automatically make it part of recurring operating cash available. Combining the reserve with operating cash can conceal depletion and make a repeated shortfall appear to be normal coverage.

The financing perimeter can also differ from the accounting group. A sponsor may have cash elsewhere while the project company lacks permission or a binding right to receive it. A consolidated group can be solvent while a ring-fenced asset cannot meet its dated obligation.

Conversely, a project may receive support under a properly defined arrangement even when its own operating cash is temporarily insufficient. The analyst should keep operating cash, unrestricted project liquidity and available support distinct. That separation makes the source of repayment visible and prevents a silent change from project reliance to sponsor reliance.

The canonical time-resolution boundary is recorded in the calculation dictionary. Here the distinct diligence question is asset life: identify the acceptance event and operating-right endpoint relied upon by the project cash horizon. If the right ends before the forecast cash, remove or justify that cash before comparing financing alternatives. A payment calendar cannot restore an absent right to operate. This test protects the asset-value perimeter, rather than treating every horizon dispute as a short-term liquidity problem.

An auditable reconciliation should allow the reader to move from operating records to the debt-service perimeter without unexplained residuals. Start with collected operating receipts, deduct required paid operating costs, then identify taxes, working-capital movements and lifecycle expenditure according to the stated definition. Show adjustments separately where an item is excluded or restricted. The aim is not to assert that this ordering is a universal contractual convention. The aim is to make the convention selected for the transaction explicit, so legal documents, financial forecasts and monitoring reports can use the same meaning.

The reconciliation should also reveal where an input is judgement rather than direct measurement. Expected receipts may require an assumption about collections. Maintenance cash may depend on an engineering plan. Tax cash may depend on an interpretation. A well-designed bridge retains these references instead of replacing them with a single unexplained CFADS row. This helps specialists review the part they understand while showing the financing analyst where uncertainty enters. The committee can then condition its decision on the material judgments rather than treating the presence of a named financial metric as evidence that all underlying issues have been resolved.

There is a trade-off between conservatism and usefulness. If every uncertain operating item is deducted at its most adverse value simultaneously, the resulting schedule can cease to describe a coherent operating case. If uncertain expenditure is ignored, the schedule can overstate cash capacity. The practical solution is a documented base perimeter and separate mechanism-specific stresses. A severe combined case can then be examined deliberately, with its joint assumptions visible.

The committee should know whether it is viewing ordinary operating expectations, a prudent funding case or an exceptional survival case; each serves a different decision.

Cash leakage deserves attention because its classification can affect both coverage and governance. Management fees, related-party payments, discretionary expansion and distributions may be economically legitimate, yet their timing can compete with required service and lender obligations. The analyst should identify who authorises them and when they can be deferred. A fee that is contractually senior to lenders is different from an optional distribution even if both ultimately reach the sponsor group. Treating all sponsor-directed cash as subordinate can produce an inaccurate financing picture and invite disputes when monitoring begins.

The chapter's practical conclusion is a boundary challenge before a ratio challenge. Ask which cash is available, for what obligation, at what date and under whose control. Then reconcile the answer to the operating mechanism and the agreed financing definition. If the boundary remains unsettled, presenting a coverage ratio creates premature authority. If the boundary is clear, the ratio becomes a useful compressed statement whose underlying conditions can be challenged. The analytical discipline lies in preserving enough information to reverse that compression whenever the financing decision requires it.

Evidence and scope

The IFRS Foundation's cash-flow standard material distinguishes operating, investing and financing cash flows. That reporting distinction supports this paper's separation of cash movement from accrual performance. The standard does not prescribe the project-specific CFADS definition or the contractual payment priority proposed here.

Evidence: IAS 7 Statement of Cash Flows

CFADS boundary reconciliation

Complete this conceptual sheet before entering a cash-available schedule into the app. The columns specify questions and required evidence rather than invented transaction values.

CFADS boundary reconciliation			
Boundary item	Required evidence	Treatment question	Challenge consequence
Collected receipts	Invoices, acceptance and collections records	Has cash arrived and is it unrestricted?	Revenue without collection cannot fund the current date
Operating payments	Service plan and payable schedule	Are required obligations discharged or deferred?	Arrears can create temporary apparent coverage
Lifecycle expenditure	Maintenance and replacement plan	What preserves the assumed service envelope?	Omission can change technical viability
Taxes and statutory payments	Qualified transaction-specific assessment	Which payments precede service or restrict transfer?	Generic assumptions do not establish actual availability
Restricted balances	Account controls and permitted-use terms	Can the balance be applied to this obligation?	A reserve use must remain visible as depletion

Related measures answer different questions

These conceptual distinctions prevent a profitability, liquidity or account-control measure from silently replacing the defined debt-service cash perimeter.

Related measures answer different questions		
Measure	Useful question	Unanswered question
Accrual operating performance	Is activity economically productive under the accounting basis?	When do receipts arrive and required cash payments occur?
Operating cash movement	What cash entered or left through operations?	Which lifecycle or financing restrictions still apply?
Unrestricted liquidity	What balance can be spent now?	Is that balance recurring or the result of temporary support?
Defined cash available	What cash can meet the specified service obligation in the period?	Is the project attractive before financing?

A simplified cash perimeter may be appropriate

A preliminary screening model can reasonably use a compact operating cash schedule when a detailed accounting build would create false precision. The simplification should identify what is supplied independently and which exclusions could change the decision. It becomes inadequate when the financing conclusion depends on disputed working capital, maintenance, taxes or restricted accounts.

A definition must be transaction specific

This chapter supplies analytical questions, not an accounting opinion or a financing covenant definition. Actual cash availability depends on the operating perimeter, payment calendar, legal arrangements and jurisdiction. The app's supplied CFADS values do not validate those underlying conditions.

Decision implications

- Reconcile cash availability before relying on a coverage ratio.
- Keep recurring operating cash, reserve use and support distinct.
- Use the payment frequency and perimeter that the actual obligation requires.

MECHANISMS AND WORKED STUDIES

05 Debt service is a dated obligation

A repayment-profile comparison using the canonical capital app

The obligation calendar

Debt service is a sequence of obligations, not merely a total borrowing amount. Interest, principal, fees and any other included claims must be placed on the calendar and compared with available cash at the same dates. The sequence can make an otherwise viable asset difficult to finance or can accommodate a credible ramp. It can also move a problem into a later maturity rather than solve it. Analysis should therefore begin with the dated obligation profile and its governing terms. A familiar repayment label is insufficient if payment conditions, rates or maturity remain ambiguous.

Different repayment profiles redistribute principal through time. Equal-principal repayment retires an equal amount of principal in each specified repayment period, while interest follows the remaining balance under the stated rate and timing convention. A level-payment profile adjusts the principal component so the total scheduled payment is stable under a fixed-rate assumption. A sculpted profile aligns proposed service with a forecast cash pattern and a selected coverage constraint. These are

conceptual descriptions. A complete calculation requires starting balance, dates, rate conventions, fees and other terms that the public app does not infer from a supplied service series.

The distinctions matter most during transition. A service asset may have lower cash during commissioning and a stronger mature operating phase. Immediate heavy repayment can consume the cash needed to establish operations. Deferring principal can relieve this pressure, but interest or other claims may remain due and the remaining maturity must still support repayment. A grace period is therefore an allocation of timing risk with conditions, rather than a free improvement in viability. The committee should examine what evidence supports the later cash assumed to repay the deferred obligation.

The calculation dictionary states the common time-resolution limit. This chapter adds the financing-incidence test: retain the original investment and operating cash vector, then identify every changed service entry and the party asked to accept it. The post-intervention studies show that coverage can improve while project value stays fixed. A changed obligation therefore needs its own accepted terms and cost comparison; it cannot be described as a project cash improvement merely because the headline financing ratio rises.

Sculpting can improve alignment between forecast cash and service, yet the resulting alignment depends on the forecast's credibility. A profile that exactly fits an optimistic ramp can fail quickly when receipts slip. The technique also requires a policy about acceptable coverage, tails, maturity and constraints on later payments. Mathematical feasibility is only part of the decision. The committee should ask which cash assumptions are relied upon, how much margin remains and whether the shape concentrates repayment in periods exposed to renewal, replacement or market risk. Alignment to a fragile forecast is still fragile financing.

A balloon payment illustrates the difference between deferring and funding. Scheduled operating service can look comfortable when principal remains outstanding at maturity. The project then needs a credible source for the final obligation: accumulated cash, asset disposal, a contractual payment, sponsor support or refinancing. Each source has its own uncertainty and timing. The repayment profile should disclose the dependency rather than allow a low early service burden to stand as evidence of overall resilience. A strong operating period does not necessarily create a liquid asset or a willing refinancing market at the required date.

The distinction between a loan maturity and the asset's operating horizon is also material. Cash after maturity may contribute to unlevered project value while offering no direct protection against an earlier obligation unless it can be monetised reliably. A tail can provide recovery or refinancing flexibility, but its value depends on continuing rights, operating condition and access to cash. An extended project forecast should not silently increase debt capacity by treating distant receipts as available for near-term service. The service calendar and the cash calendar must remain separately visible even when summarised in a single committee chart.

Interest should be treated according to the applicable balance, reset and payment conventions. A floating-rate obligation can change during the loan life without any change in project revenue. A capitalised amount can increase future claims while relieving an immediate cash payment. Fees can be due at commitment, drawing or maturity. These mechanisms have different effects on liquidity and total financing cost. A generic interest assumption can obscure them, especially when the model also assumes refinancing. The simplified app therefore requires service to be supplied; it does not reconstruct a legal debt instrument from a borrowing amount.

The public worked comparison holds the project cash-flow schedule constant and changes the supplied debt-service schedule. This is deliberately narrower than proposing a new debt instrument. It isolates the proposition that the same operating project can support some obligation profiles more comfortably than others. The model retains a separate unlevered cash-flow valuation because payments to lenders are not used to reduce the cash-flow series being valued. The comparison does not estimate equity return or loan principal. It is a stress comparison of dated cash and externally defined obligations, with its illustrative assumptions published.

The service burden can change even when the asset's economic value remains the same. That observation is analytically useful because it prevents a positive valuation from becoming a universal permission to borrow. It also prevents a repayment problem from being treated automatically as proof that the physical project lacks value. The appropriate response depends on the mechanism: reduce obligation size, change timing, improve operating cash, introduce credible support or reconsider the asset. A financing analyst should explain which response addresses the identified mismatch rather than applying a larger reserve to every inadequate profile.

Repayment negotiation should retain the project's operating requirements. A service profile that leaves no room for maintenance or working-capital variation can appear efficient while making the asset less capable of generating the cash lenders rely on. Conversely, a sponsor can use a claim of operational flexibility to seek distributions that reduce lender protection. The boundary between necessary operating cash and discretionary uses should be established before negotiating service. Otherwise the parties can disagree about repayment capacity while actually using different definitions of the cash that remains available to them.

Prepayment and cash sweeps can introduce further timing choices. An optional prepayment may lower future obligations, but the project needs to consider the cost of surrendering liquidity and any applicable restrictions or charges. A mandatory sweep may protect lenders while reducing sponsor flexibility and the ability to fund future replacements. The model should show the trigger, eligible cash and treatment of subsequent obligations. A statement that excess cash repays debt is incomplete until excess cash is defined consistently with required reserves and the operating perimeter.

An obligation profile should be reviewed with a schedule acceptance record. The record names its source, the included claims, the date convention and whether amounts are fixed or contingent. It identifies assumptions requiring legal or treasury review. It also states what the model does not calculate. For this paper, the acceptance record is straightforward: annual debt-service inputs are illustrative exogenous schedules, and no implied principal balance is asserted. In an actual transaction, the acceptance record should reconcile the calculated schedule to executed or proposed terms and identify any unresolved interpretation.

The financing discussion should close with a temporal challenge. Which payment is hardest to meet, what makes it hard and what remedy changes that specific exposure? A larger average surplus is not an answer if it arrives after the difficult payment. A later refinancing assumption is not an answer if it remains uncommitted. A profile change can be valuable when it brings credible cash and obligations into alignment, but the change must be examined for newly concentrated risks. The calendar is the object of analysis, not an administrative detail appended after a return calculation.

Evidence and scope

The World Bank finance-structures guidance distinguishes corporate reliance from project financing and describes financing in relation to the project’s cash flows. This supports examining the proposed service profile separately from the asset’s unlevered value. It does not prescribe a repayment profile for these illustrative schedules.

Evidence: **Finance Structures for PPP**

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

Unchanged asset cash, heavier supplied service

Both schedules use the same illustrative initial and operating cash-flow inputs at the same discount rate. Debt service is supplied independently. The comparison isolates financing burden; it does not imply a loan balance or debt-sizing algorithm.

Unchanged asset cash, heavier supplied service				
Frozen schedule	First operating cash, USDm	First service, USDm	Project NPV, USDm	Minimum DSCR
Foundation	40.00	36.00	183.05	1.11
Heavier service	40.00	50.00	183.05	0.80

Profile choice and the question it creates

This original conceptual comparison identifies review questions. It does not compute or recommend a legal debt instrument.

Profile choice and the question it creates		
Profile choice	Intended benefit	Exposure to test
Equal principal	Visible retirement of principal	Early cash burden and operating ramp
Level payment	Predictable total service under stated terms	Cash timing and rate assumptions
Sculpted service	Alignment with forecast cash	Forecast credibility and later concentration
Deferred principal	Relief during transition	The funded source of later repayment
Balloon at maturity	Lower earlier obligations	Maturity funding and refinancing dependency

Accept an obligation profile for its calendar

A service profile should be accepted only after the committee can identify the weakest dated payment, the cash source intended to meet it and the effect of credible timing stress.

1. Identify exactly what is included in scheduled service.
2. Reconcile dates and frequency with cash availability.
3. Explain the weakest period and the mechanism causing it.
4. Test whether a proposed remedy shifts the obligation into another unverified dependency.

A simple level profile can be preferable

Complex sculpting can add model and negotiation burden while relying excessively on a precise forecast. Where cash is stable and timing risk is limited, a simple profile can offer a better monitoring and governance trade-off. The objection supports proportionate structuring; it does not remove the need to test actual payment dates and credible adverse cash patterns.

Profiles are compared conceptually

The app calculates coverage from supplied service. It does not derive annuities, amortisation, fees, sculpted repayment, balances or refinancing proceeds. The conceptual profile descriptions should not be confused with calculated financing terms. Actual repayment schedules require a separate validated debt model and legal reconciliation.

Decision implications

- Evaluate service timing separately from project valuation.
- Deferral requires a credible source for the later obligation.
- Use the simplified app to compare supplied schedules, while a transaction debt model derives actual terms.

MECHANISMS AND WORKED STUDIES

06

Coverage reveals the weak period

A minimum-coverage exhibit and period-specific intervention rule

Finding the payment with least room

A coverage ratio compresses a cash-flow relationship. The compression is useful when the reader knows the perimeter, period and obligation being compared. It becomes misleading when a favourable summary conceals the period in which cash is insufficient. Resilience analysis should begin with the sequence of coverage values, identify the weakest period and explain the mechanism producing it. A minimum is not a complete

financing judgment, but it directs attention toward the payment at which the project has the least room for error. The relevant remedy then follows the cause rather than the average.

Periodic debt-service coverage compares defined cash available with the service due in the same period. The ratio should retain the numerator's perimeter and the denominator's contents. If no service is due, the comparison is not an infinite demonstration of strength; the period simply does not provide an ordinary service-coverage observation. The public app excludes such periods from its minimum service-coverage calculation. This distinction matters for assets with a grace period or a debt-free operating tail. Cash in those periods can create value or liquidity, yet it should not inflate a summary of periods carrying repayment obligations.

Minimum coverage and average coverage answer different questions. The minimum identifies the narrowest periodic relationship under the specified schedule. An average can describe overall headroom but may blend a difficult ramp with a strong mature phase. If the difficult period occurs before later cash arrives, the average does not fund it. A committee should therefore resist a presentation that replaces the schedule with a favourable central value. The weak period should be named, its drivers explained and its funding source tested. The question is whether the project can meet the difficult date, not whether later prosperity makes the whole history look comfortable.

An unusually weak period can arise from distinct mechanisms. Low early receipts can indicate ramp-up timing; a major replacement can temporarily reduce cash; an increased service payment can reflect a repayment profile; a persistent margin shortfall can reveal an operating problem. The same minimum value can therefore require different responses. Delaying service may address a credible ramp, while a lifecycle reserve may address a known replacement. Neither necessarily solves a persistently inadequate operating perimeter. The coverage schedule should be accompanied by a mechanism annotation that allows the reader to distinguish these conditions before choosing a financing intervention.

Use the calculation dictionary for the common annual-boundary limitation. For coverage interpretation, the discriminating test is denominator reset: does the obligation change, or does only available cash change? The appended reprofile changes supplied service explicitly and requires recipient acceptance. The fixed stress changes CFADS before subtracting unchanged service. Mixing those mechanisms would understate the adverse payment gap and allocate an unaccepted concession to the recipient.

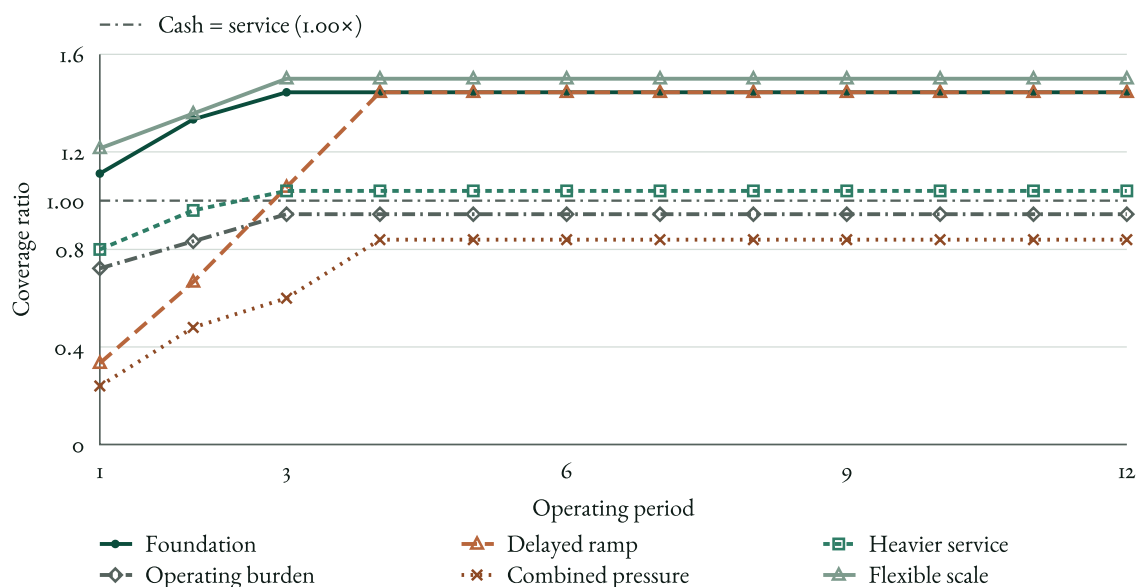
The illustrative foundation and delayed-ramp studies isolate this distinction. The delayed-ramp schedule preserves mature operating cash and the supplied service calendar, but reduces cash in the early operating periods. Its project valuation remains positive under the stated discount assumption while its minimum operating coverage is much weaker. That combination is not a paradox. Valuation discounts the full unlevered cash-flow series; periodic coverage examines a particular obligation relationship. The comparison provides a reason to investigate early funding and ramp credibility. It does not prove that the delayed-ramp project can raise financing or that a reserve of unspecified size would be enough.

The schedule should also reveal when a financing remedy restores alignment and when it merely shifts exposure. A deferred payment can improve the initial ratio while making a later period harder. A reduced service profile can improve coverage while implying a different financing commitment. A cash injection can meet a payment without changing the operating ratio. These effects should not be mixed into a single post-remedy measure. The committee needs to see the operating schedule, the revised obligation schedule and the funding source separately. Otherwise an intervention can appear to improve performance when it has only changed who pays.

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

Coverage depends on the period, not the horizon average

The illustrative curves select each positive-service period from the six canonical outputs. Their shape shows early ramp pressure and the effect of heavier supplied obligations. Later cash cannot make an earlier obligation disappear.



Illustrative annual CFADS/service ratios. The 1.00x line means cash equals supplied service, not a covenant. The foundation and delayed paths coincide from the mature ramp onwards; their solid-circle and dashed-triangle styles retain that overlap. Dash and marker distinctions support monochrome reading. Periods after supplied service ends are excluded.

Loan-life coverage takes a broader cash perspective, but its definition must remain precise. It compares a discounted measure of cash available over the relevant loan life with an obligation measure under the specified convention. The discount rate, included cash, treatment of reserves and balance date matter. A broad life measure can support an assessment of overall debt repayment resources while leaving a near-term cash shortage unresolved. The public app does not calculate loan-life coverage or an outstanding balance. Discussion of that concept here is therefore a boundary for specialist analysis, not a hidden additional model result.

The treatment of terminal cash deserves particular scrutiny. A disposal value or contractual end payment can contribute to an unlevered valuation even when lenders cannot rely on it for earlier service. It may also be subject to deductions, timing, condition or market uncertainty. Including terminal cash in a life-coverage calculation without explaining its availability can convert an assumption about residual value into a claim about repayment capacity. The analyst should state which obligations can

actually be met by that terminal source. Where the source is material, a valuation without it is a useful challenge, provided it is presented as a deliberate scenario rather than an assertion of actual outcome.

Ratio thresholds should come from the decision context, not from the prestige of a familiar number. A selected covenant or screening boundary can reflect lender preferences, project risk, reporting periods and remedies. The analyst should distinguish a negotiated requirement from an analytical warning level and a purely illustrative benchmark. This paper does not publish a universal acceptable DSCR. The worked values compare the supplied schedules. An actual committee should identify the relevant terms and explain why the margin is adequate for the specific evidence and uncertainty, rather than treating a generic industry rule as transaction proof.

The usefulness of a coverage chart depends on stable definitions through time. If monitoring begins to exclude costs that the original forecast included, a reported improvement can be a perimeter change. If service is reprofiled, a stronger ratio can reflect reduced near-term claims rather than improved operating cash. The monitoring bridge should separate changes in numerator, denominator and definition. This allows the committee to understand whether resilience improved, support was added or the original thesis was revised. A time series without a definition bridge can reward accounting changes while failing to reveal deteriorating cash generation.

Missing values should retain their meaning. A period without defined cash availability is an evidence gap, not a zero inserted for convenience unless zero is genuinely the assumption being tested. A period without debt service is a different condition. A negative cash period can be a real cash demand requiring funding. Software should not replace these distinctions with a convenient aggregate that silently drops difficult observations. The simplified app expects finite supplied numbers, so the author must resolve the input convention before computation. The public result cannot establish that the missing operational evidence was resolved merely because the engine accepted a numeric input.

Coverage should be tested together with service continuity. A project can increase apparent cash available by postponing maintenance, cutting essential staffing or reducing service quality. Such measures may weaken future receipts or breach performance requirements. A valid operating remedy should preserve the service envelope on which the forecast relies, or explicitly revise that envelope and reappraise the asset. The committee

should ask whether the proposed improvement is a genuine cash-efficiency change, a temporary deferral or a reduction in the service being financed. Coverage alone cannot distinguish these possibilities.

The practical intervention rule is period specific. Identify the weak period; state whether it is driven by cash, service or definition; identify any available funded protection; then test whether the remedy remains credible under a coherent adverse case. This avoids both complacency and automatic rejection. A weak early period can be manageable when an independently funded, timely and sufficient mechanism addresses it. A strong minimum can still be unpersuasive when the cash schedule is unsupported. The ratio is an entry point to a financing decision, not a substitute for the evidence architecture established earlier.

Evidence and scope

The World Bank financing-issues guidance distinguishes debt-service coverage for a specified period from loan-life coverage. This supports retaining periodic weakness alongside a broader resource measure. It does not supply a universal acceptance threshold or validate the illustrative inputs used in this paper.

Evidence: Key Issues in Developing Project Financed Transactions

Evidence and scope

IFC's project-finance publication defines debt-service coverage using cash available for service in the relevant period and distinguishes project economic viability from financing considerations. Its historical context is retained; it is used for conceptual definitions rather than current market terms.

Evidence: Project Finance in Developing Countries

Periodic coverage

Periodic debt-service coverage = defined cash available during the period / defined debt service due during the same period. A period without service does not supply an ordinary coverage observation. The formula requires an agreed perimeter and aligned timing.

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

Positive value can coexist with a weak ramp

The schedules are illustrative. Their mature operating cash and service calendar are held constant; early available cash changes. The app reports unlevered NPV and minimum periodic coverage independently.

Positive value can coexist with a weak ramp				
Schedule	Initial-period CFADS, USDm	Supplied service, USDm	Unlevered NPV, USDm	Minimum DSCR
Foundation	40.00	36.00	183.05	1.11
Delayed ramp	12.00	36.00	127.24	0.33

Weak-period intervention rule

Select a remedy only after identifying the weak period and its causal mechanism. Review the revised calendar and any new dependencies alongside the original schedule.

1. Separate operating cash weakness from a heavy obligation or a definition change.
2. Identify the dated cash or support source available for the weak period.
3. Test the mechanism-specific remedy while retaining service continuity.
4. Show whether exposure disappears, is funded or moves to a later period.

The minimum can overstate a manageable exception

A minimum ratio can give disproportionate attention to a brief, anticipated and fully funded shortfall. A broader repayment resource measure may better explain lender recovery. This is a strong objection to using the minimum as an automatic rejection rule. It is not a reason to omit the period; the presentation should show the funded protection and its conditions.

Annual observations compress timing

The annual app verifies the supplied cash/service comparison. It does not validate a covenant definition, the right to draw protection or the recipient acceptance of a different service calendar. The calculation dictionary gives the single shared time-resolution statement; the intervention and completed committee sections retain those separate acceptance conditions.

Decision implications

- Explain the weakest period before presenting an average.
- Separate operating coverage from funded liquidity protection.
- Treat loan-life and threshold concepts as transaction-specific specialist work.

MECHANISMS AND WORKED STUDIES

07

Protection can bridge a finite service life

Distinguish recurring coverage weakness from a conditionally fundable finite annual payment life.

What protection can and cannot do

A funded reserve can create time to respond. It can meet a dated obligation when ordinary operating cash is temporarily insufficient, reduce the need for an emergency request and allow an asset to pass through a credible transition. Its value depends on the event it is intended to cover, the cash placed in it, access conditions and the path to replenishment. A reserve does not by itself increase the operating cash generated by the asset. If a recurring shortfall consumes the reserve faster than it can be restored, the reserve delays the financing problem rather than resolving it.

The word reserve can refer to different arrangements. An accounting provision recognises an expected obligation under an accounting basis. A cash account contains money, potentially with restrictions. A committed liquidity facility promises funding subject to its terms. A sponsor undertaking creates another type of contingent source. These arrangements should not share a single model line merely because each is described as protection. The committee should identify the source, control, release process, cost and conditions. A promise to fund later should not be presented as cash already deposited and available at the payment date.

The purpose of the reserve should be specific. A debt-service reserve protects payment timing; a maintenance reserve funds defined lifecycle obligations; an operating buffer can absorb fluctuations in receipts or expenditure. Combining these purposes can create competing claims during stress. If the same balance is assumed to support debt service and a required replacement, both uses cannot consume the same cash independently. The funding bridge should identify priorities and residual exposure. The analytical point is simple but consequential: money held for several purposes is still a limited resource, and its adequacy depends on which demands can arrive together.

Initial funding changes the capital requirement. Cash placed in protection must come from equity, debt, operating receipts or another permitted source. Its use can reduce funds available for construction or distributions, and debt-funded protection can itself increase obligations. Protection should therefore retain its funding incidence. The original project app does not size a reserve. The appended auxiliary diagnostic separately traces a conditional annual retained-cash balance from the unchanged CFADS and service rows. It identifies a required opening amount only under explicit ordering, retention and cost omissions, with no accepted account terms or fundable source.

A temporary ramp shortfall has a plausible path toward restoration if later operating cash is sufficiently strong and can be retained. That path still requires evidence. The future surplus may be needed for maintenance, working capital or other required payments, and distribution rules may prevent retention. A reserve analysis should show what replenishes the balance, when replenishment occurs and which events can interrupt it. A statement that the reserve will be restored from future cash is incomplete until future cash is reconciled to those competing claims. Restoration should not be assumed simply because the mature operating forecast looks favourable.

A recurring coverage shortfall does not by itself establish that a finite opening balance cannot cover a finite service life. It establishes that the stated operating cash does not fund each payment unaided. Whether protection is depleted depends on the whole obligation calendar, its opening amount, available cash and competing uses. If deficits continue without a finite endpoint and without later surplus or another source, any fixed balance can eventually be exhausted. The supplied studies instead have a finite repayment life and positive cash afterwards. That distinction must be resolved before choosing an operating change, a service change or upfront protection. Each response has its own cost and authority questions; none is logically necessary merely because the mature coverage ratio remains below payment equality while service is due.

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

The delayed-ramp and operating-burden schedules provide a useful counterexample to classifying protection from the minimum ratio alone. Under the explicit annual retained-cash convention developed below, their required base opening protection is the same: USD36.00m. The delayed path restores that opening target in period 6; the operating-burden path restores it in period 14, after supplied service ends. A later restoration date and prolonged depletion are different exposure characteristics, even with

the same opening amount. This arithmetic supports a conditional finite-life funding comparison. It establishes neither available funding nor permitted access and does not turn protection into recurring CFADS.

Access conditions can make a funded balance unavailable precisely when it is needed. A draw may require notice, certification, lender consent or a defined event. A balance may be held in a currency different from the obligation or in an account whose transfer is constrained. These conditions should be reflected in the dated liquidity test. A reserve is useful protection only to the extent that it can be used for the relevant payment on time. The analyst should ask the legal and treasury teams to verify access rather than assuming that cash labelled reserve has universal liquidity.

Replenishment rules affect later cash control. A project may be required to restore a depleted reserve before making distributions or optional payments. That rule can protect future service but alter sponsor returns and operating flexibility. If the replenishment claim competes with required maintenance, the project may need a defined priority and a revised cash plan. A model that restores the reserve automatically without subtracting the cash from other uses creates money by convention. The balance movement and the funding source should be shown as a bridge, with the competing uses visible to the decision maker.

The trigger for reserve use should distinguish ordinary timing from deterioration. A scheduled replacement or seasonal collection pattern can be anticipated and funded. A sudden customer default or persistent operational shortfall may indicate that the original financing thesis has changed. The response should therefore include diagnosis, not merely a draw instruction. The committee should know whether the reserve is doing its planned job, cushioning an exceptional event or being used to postpone a necessary restructuring. Monitoring should preserve that distinction so repeated draws cannot become an unremarked substitute for operating performance.

Reserve sizing should follow the identified mechanism and calendar. A selected multiple of service can be a negotiated convention, but it does not establish adequacy for every cash-flow pattern. The relevant exposures might include a collection delay, an outage, a ramp gap or a replacement period. Their duration and interaction determine how a separately modelled balance would behave. An analyst should test draw, depletion and restoration paths under coherent scenarios, with all source and access conditions stated. The public app does not perform that balance simulation, and this paper does not present an invented reserve size.

Opportunity cost should be considered without treating liquidity as idle failure. Restricted cash can lower distributable funds or require greater initial capital. Yet the protection can have decision value if it preserves service through a plausible interruption and reduces dependence on difficult emergency funding. The trade-off belongs in the committee's preference judgment. A sponsor seeking faster distributions and a lender seeking greater payment assurance may value the same reserve differently. The analytical task is to show the incidence, not to assert that every added reserve improves the structure or that every retained balance is economically wasteful.

A reserve can also change incentives. Ready access to protection may reduce urgency to correct a recurring operating problem; tightly controlled access may create excessive delay during a real liquidity event. Governance should therefore combine clear permitted uses, prompt decision authority and a diagnosis requirement after material draw. The operator should know that drawing protection does not erase responsibility for addressing the cause. The financing parties should know that withholding access can itself damage the asset. A useful rule balances payment continuity with the need to preserve credible operational and financial accountability.

The restoration test should state both its target and its deadline. Restoration during continuing repayment, restoration after the final supplied payment and intentional exhaustion at the end of a funded exposure are different decisions. A committee can deliberately fund a whole finite service calendar without requiring the opening target to return while obligations remain. It must then accept the duration of committed support and its incidence explicitly. Conversely, a policy requiring replenishment during repayment would reject a path that restores only in the debt-free tail. The policy changes the decision; it does not change the balance arithmetic. A positive terminal project receipt must not be used in this restoration test unless the available-cash perimeter actually includes it.

The practical conclusion is to classify the shortfall before selecting protection. Temporary timing, a known lifecycle event, a recurring operating deficit and a contingent external interruption require different funding and governance responses. A reserve is most intelligible when its purpose, source, availability, depletion and restoration are all shown. That record allows the committee to assess what time has been bought, what decision must occur during that time and what happens if the decision is not successful. The existence of an account then becomes a defined financing mechanism instead of a reassuring label.

Evidence and scope

The World Bank credit-enhancement guidance discusses third-party support and mechanisms that can change financing risk allocation. This paper uses that general distinction to keep externally supported liquidity separate from operating cash. The guidance does not validate a reserve size or support commitment for these illustrative cases.

Evidence: Third Party Risk Mitigation and Credit Enhancement

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

Temporary ramp and persistent burden

This illustrative exhibit prints supplied cash and service, not a reserve simulation. The later cash relationship is important to diagnosing whether ordinary operations could contribute to restoration after a separately funded draw.

Temporary ramp and persistent burden				
Schedule	Early CFADS, USDm	Mature CFADS, USDm	Mature service, USDm	Minimum DSCR
Delayed ramp	12.00	52.00	36.00	0.33
Operating burden	26.00	34.00	36.00	0.72

Reserve specification and restoration sheet

A conceptual completed sheet demonstrates the decisions an actual reserve model must resolve. No balance or adequacy conclusion is invented.

Reserve specification and restoration sheet		
Specification	Conceptual treatment	Required challenge
Purpose	Meet a defined service payment during a credible collection delay	Keep maintenance and unrelated uses separately funded
Source	A contribution deposited before exposure	Verify funding and its effect on the capital requirement
Access	Release for the stated payment after a defined notice	Check that process and currency permit payment on time
Restoration	Retain identified later surplus after required uses	Test competing claims and adverse operating paths
Escalation	Diagnose a draw beyond the expected pattern	Decide whether the thesis requires restructuring or ongoing support

Depletion and restoration decision

Choose among conditional upfront protection, changed operations and changed service only after tracing the full supplied obligation life. Record the restoration policy, funding source, access condition and stop authority. Recurring weak coverage can coexist with a finite annual funding requirement; it does not establish an obligation to restructure.

1. Trace every cash and service period, including the debt-free tail.
2. Distinguish required opening protection from funded and permitted protection.
3. State whether restoration is required during repayment or afterwards.
4. Hold the proposal if source, access, incidence or the dated payment test is unresolved.

Protection can support a deliberate restructuring

An institution may rationally prefer service reprofile or operating improvement to tying up upfront protection for most of the repayment life. That preference can reflect funding cost, source scarcity, restricted access or an explicit replenishment policy. The annual balance alone does not select the cheaper or permissible response because those facts are absent. The alternative should therefore be tested as a changed commitment, with its own recipient and authority conditions. It should not be presented as the inevitable remedy to every recurring coverage shortfall.

Canonical app and auxiliary bridge have distinct boundaries

The canonical capital app computes project cash and coverage from supplied schedules; it does not simulate reserve accounts or access conditions. The separate annual retained-cash bridge below traces conditional opening protection, depletion and later restoration from the exact supplied project case. That annual calculation does not establish that its opening amount is funded or accessible on a dated payment deadline. An actual adequacy decision still requires dated receipts and obligations, competing cash uses and verified funding and legal availability.

A traced conditional annual bridge

The auxiliary annual bridge uses the unchanged canonical project fixtures as its source. It binds the exact source input hash, the supplied annual labels, CFADS and service rows before any computation. The source project investment and terminal project receipt are not opening protection and are not copied into the retained balance. The diagnostic begins immediately before the first supplied annual operating payment and spans the complete source calendar. Its narrow question is how much available opening cash would avoid unpaid annual service if the entire annual CFADS entry were available at that boundary and every later surplus were retained.

Those conventions are deliberately stronger than a real liquidity demonstration. They omit collection dates, account restrictions, source activation, fees, taxes, return on the retained balance, interest on protection, distributions, other obligations and replacement claims outside stated CFADS. A balance result is therefore a conditional cash conservation result. Its practical use is to identify a candidate amount and

the assumptions that must be replaced with dated evidence. It cannot certify reserve adequacy under a financing document. It also cannot measure the financing cost of tying up the balance, because the ownership and permitted uses of that cash have not been supplied.

The required opening amount is the greatest cumulative deficit of CFADS minus supplied service over the calendar, bounded below by zero. A supplied opening amount can instead be tested directly. Each row records opening balance, available CFADS, service, draw, retained surplus, closing balance and unpaid service. Cash conservation requires opening balance plus available CFADS to equal paid service plus closing balance. The restoration period is the first period after depletion in which the closing balance again reaches the original supplied opening target. No NPV, IRR, project payback or downside project valuation is returned by this engine. Those quantities remain with the separate project app.

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

Base and correctly stressed protection compared

Illustrative amounts are USDm. The same service calendar is retained in each base/stress pair. All surplus is retained and no protection costs or competing uses are supplied.

Base and correctly stressed protection compared			
Source path / CFADS basis	Required opening	First target restoration	CFADS-based minimum coverage
Delayed / base	36.00	6	0.33
Burden / base	36.00	14	0.72
Delayed / fixed CFADS stress	48.80	12	0.27
Burden / fixed CFADS stress	115.20	17	0.58

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

The delayed base case consumes USD24.00m and USD12.00m in the early deficit periods. It begins replenishing when supplied CFADS first exceeds service and restores USD36.00m by period 6. The burden base case consumes USD10.00m, then USD6.00m, then USD2.00m per remaining service period at the mature supplied level. Its balance reaches USD0.00m at the last supplied payment. Positive cash in the debt-free tail then restores its opening target. The burden therefore exposes the source for longer and provides no replenishment while the remaining service calendar continues. A source with a shorter permitted life could reject it even though the annual opening requirement matches the delayed case.

Illustrative. The stress comparison applies the declared CFADS factor 80.0% before subtracting unchanged service. In the delayed path, first-period CFADS becomes USD9.60m and service remains USD36.00m, producing a USD26.40m deficit. Applying the factor to an already netted cash deficit would also reduce the payment obligation and answer a different question. The required opening rises to USD48.80m, followed by a much later restoration. The burden stress requires USD115.20m and has a still longer restoration interval. Neither stressed requirement can be replaced by the common base requirement without changing the declared adverse case.

Illustrative. Holding opening protection at USD36.00m while applying the fixed CFADS stress creates unpaid service of USD12.80m in the delayed path and USD79.20m in the burden path. The diagnostic records those unpaid amounts rather than allowing the balance to become negative or pretending that service was met. Later positive cash does not retrospectively make the earlier payment timely. The underfunded delayed case can restore its smaller opening target earlier than the fully protected stressed case precisely because it failed to pay part of the earlier obligation. That apparently better restoration date is therefore an adverse accounting consequence, not evidence of a stronger financing structure.

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

Choose the exposure policy before choosing protection

For the completed fictional case later in this study, the Chair requires coverage of the declared stressed annual payment path before implementation can return for decision. That selects the delayed conditional requirement USD48.80m rather than the base amount USD36.00m. It does not establish that such cash is fundable or available. A policy accepting only the base case would have to acknowledge the unpaid stressed service; the committee cannot silently rename the adverse case after the funding source is found.

An upfront balance can be sufficient but unattractive

The annual diagnostic deliberately does not choose among protection and a service change. If retained protection costs more than a consensual reprofile, a reprofile can be preferable. If a recipient will not accept different dates, upfront protection may be the only proposed alternative that preserves the supplied payments. If protection is restricted until a technical acceptance event occurring after payment, neither arithmetic result is usable. These are distinct adverse answers with different owners. The new balance test improves the comparison by eliminating an incorrect necessity inference, while leaving the institutional choice conditional on those missing facts.

Decision implications

- Classify the shortfall before selecting a reserve.
- Treat funding, access and restoration as separate conditions.
- Trace the complete obligation life: recurring weak coverage can require finite upfront protection without logically requiring an operating or service change.

MECHANISMS AND WORKED STUDIES

08 Revenue stress is more than one price cut

A revenue mechanism map and transparent scenario fixtures

How service becomes collectible receipts

Revenue stress should describe how the service loses collectible cash. A single reduction in a headline revenue line can be useful for a transparent screening calculation, but it cannot explain every failure mechanism. Fewer units delivered, a lower tariff, reduced availability, delayed collection and a disputed adjustment can produce similar cash totals through different paths. They imply different remedies and different parties able to act. The financing analyst should preserve this mechanism map before aggregating it into a cash schedule. Otherwise the downside becomes a number whose meaning cannot guide a decision.

Volume begins with the distinction between capacity and use. Technical capacity defines a possible operating envelope under stated conditions. Demand defines what users want and are willing to pay for. Accessible demand depends on connections, competing services, eligibility and commercial arrangements. Delivered volume adds actual operational

performance. A forecast can therefore fail even when the engineering capacity is correct. The analyst should identify which transition the revenue model assumes and what evidence supports it. Financing based on theoretical capacity alone can expose the project to a commercial gap that additional equipment does not solve.

The value of customer commitment depends on its scope. An expression of interest can indicate engagement without requiring purchase. A volume commitment can contain conditions about availability, quality, access or price. An enforceable payment obligation can still depend on the payer's resources and the process for dispute resolution. The financial model should represent the cash mechanism supported by the arrangement, while legal advisers assess the obligation itself. Calling revenue contracted does not answer every demand, performance or collection question. The committee should know precisely which uncertainty the contract reduces and which uncertainty remains.

Tariff stress can affect cash directly or through changes in use. A higher price can improve receipts per delivered unit while reducing uptake or causing customers to seek alternatives. A lower price can support demand while leaving insufficient contribution to cover required costs. The analyst should not assume that price and volume change independently if the commercial mechanism links them. In a preliminary scenario, independence can be stated as a simplifying assumption. A financing case that materially relies on customer response requires evidence about the relationship and a sensitivity range consistent with the service and customer context.

Indexation should be examined as a mechanism with timing, conditions and limits. A tariff may adjust to a cost or inflation measure after a lag, at specified dates or subject to approval. It may compensate only part of the operating perimeter. The project can therefore face higher payments before receipts adjust. The model should identify the index, frequency, lag, caps and the party controlling approval, without assuming that a contractual reference guarantees immediate cash recovery. Where indexation is material, an adverse case should test both the amount of adjustment and the period over which the project funds the mismatch.

Availability-based revenue changes the source of demand exposure but can create performance exposure. A payment linked to service availability may reduce dependence on actual user uptake while requiring compliance with measurable standards. Deductions, acceptance, reporting and dispute processes can affect the amount and timing of collection. The project should therefore map the operational actions needed to earn the payment. Financing analysis should not replace demand uncertainty with

an assumption that availability payments are automatically collected in full. The relevant evidence moves from customer use toward performance, measurement and payer obligations.

The time-resolution boundary appears in the calculation dictionary. The interface test here is conditional use: can protection be drawn for the actual shortfall mechanism under the agreed purpose and account terms? A source that is large enough but reserved for technical completion cannot be assumed available for operating service. The completed case keeps source capacity, permitted use and timed access as separate evidence objects so the failure of one is visible.

Concentration affects the response available to the project. A service dependent on a narrow customer or payer base can lose a large part of receipts when a single relationship deteriorates. Diversification can reduce that exposure, but it may require different service specifications, commercial expenditure or working capital. The model should not assume replacement customers can appear immediately after a lost commitment. A commercial mitigation plan needs an operating path, lead time and evidence. A broad addressable market is not automatically a funded substitute for a specific payer whose cash is missing at the debt-service date.

Revenue can also depend on a chain of performance outside the project's direct control. A logistics asset may need connecting infrastructure; a service facility may need a customer's upstream activity; an energy asset may need transmission or purchase acceptance. A revenue stress should identify whether the project can restore the dependency or merely wait for another party. Contractual risk allocation can alter who bears the financial effect, but the service interruption can remain. The committee should examine both the compensation mechanism and its collection timing. An eventual entitlement may not meet a near-term operating or lender payment.

The ramp should connect commercial readiness to operational readiness. An asset can be technically available before customers complete their own preparations, and customers can be ready before the asset passes acceptance tests. A forecast that assumes full use from the first operating period may require coordination evidence rather than a general market growth argument. The illustrative delayed-ramp study changes early cash while preserving later cash and service. It does not identify a measured demand trajectory. Its purpose is to demonstrate how an otherwise attractive long-horizon series can encounter a financing gap when early receipts arrive differently from the assumed calendar.

Pass-through should be assessed from both sides of the contract. A cost that can be charged to a customer may still be subject to verification, approval, caps or disagreement. A customer may be legally obliged to pay but economically unable or commercially unwilling to continue using the service on revised terms. The analyst should therefore separate entitlement, invoicing and collection. This is not a presumption that pass-through fails. It is a requirement to identify what would make it work and which delay or limit the cash schedule must absorb. A label such as reimbursable cost is not a complete cash mechanism.

Stress combinations should be economically coherent. A demand decline can reduce variable operating expenditure while leaving fixed obligations intact. A price adjustment can change volume. An outage can reduce delivered units and trigger deductions simultaneously, but some deductions may overlap with the lost payment. The analyst should document these links and avoid counting the same lost receipt repeatedly under different names. A combined stress can be severe without being arbitrary. Its usefulness depends on explaining the joint event and how each affected cash line follows from that event.

Mitigation should change the mechanism causing the shortfall. Commercial diversification can address customer dependence; improved collection administration can address avoidable delay; performance investment can address availability deductions; restructured tariff terms can address a mismatch between costs and receipts. A reserve can fund an interval while these actions occur, but it does not replace them. The committee should ask who owns each action, what cash or time it consumes and what evidence would demonstrate success. A mitigation described only as management attention cannot be included as an assured cash improvement.

The revenue decision should retain an affordability perspective when users or public payers bear the consequence of adjustment. A financing structure can restore project coverage by raising charges or securing compensation while transferring pressure to another party. That may be a legitimate policy or commercial choice, but it should be explicit. The asset's collectible revenue depends in part on the sustainability of that party's obligation. The analytical perimeter therefore includes incidence as well as project receipts. A financier should not treat contractual protection as the end of the analysis when the protected revenue mechanism undermines the service's continued use or payer capacity.

The practical output is a revenue mechanism map linked to the cash schedule. Each material source of receipts has a quantity, pricing, performance, invoicing and collection path. Each stress has a causal event,

affected link and response owner. The simplified model can then receive a coherent cash schedule with clear assumptions and sensitivity. When a downside result is presented, the committee can ask what changed in the project and what decision follows. This preserves the explanatory power that a blanket revenue cut cannot provide on its own.

Evidence and scope

The World Bank risk-identification guidance distinguishes demand, construction, operating and financial mechanisms. This paper adapts that separation into an original revenue map. The source does not provide measured probabilities, forecast receipts or customer evidence for the illustrative schedules.

Evidence: Identifying Risks

Revenue mechanism and response map

This original conceptual map helps a committee identify which link needs evidence and which action can affect it.

Revenue mechanism and response map			
Mechanism	Cash effect	Evidence to seek	Response boundary
Demand or access	Fewer wanted or reachable units	Customer readiness, commitment and alternatives	Capacity expansion does not create willingness to pay
Tariff or adjustment	Changed receipts per delivered unit	Pricing terms, approval and customer response	An entitlement is distinct from collection
Availability or quality	Lost service and possible deductions	Acceptance and performance measurement	Operational remedy must preserve the service envelope
Collection delay	Receipts move after required payments	Invoice, acceptance, dispute and collection dates	Liquidity protection buys time; it does not resolve disputes
External interface	Service cannot produce planned receipts	Control, completion and compensation mechanism	The project may lack authority to restore the dependency

Revenue stress specification

Complete a coherent scenario before entering changed cash into the app. This conceptual record shows a delayed customer-readiness mechanism, without claiming actual volumes or payment terms.

Revenue stress specification		
Specification	Illustrative conceptual case	Required evidence before actual use
Event	Customers become ready later than the asset	Readiness milestones and controlling parties
Held constant	The stated mature operating cash expectation	Evidence that the delay does not destroy later demand
Changed link	The path from available service to collected receipts	A dated collection and operating-cost bridge
Response	Stage commercial mobilisation and fund the interval	Funding source, timing and measurable milestones
Failure boundary	Later uptake remains unsupported	Reappraise mature receipts; do not call the case merely delayed

<i>A broad cut can be enough for screening</i> A blanket reduction is transparent and can quickly reveal whether a preliminary financing structure has little margin. That is useful when mechanism detail is not yet available. The result should remain a screening stress. It cannot identify a probability, choose a remedy or establish that an actual revenue mechanism has been modelled correctly.	<i>No demand or tariff estimator is supplied</i> The app accepts net cash and cash available; it does not estimate customer demand, willingness to pay, tariffs, indexation, payment deductions or collections. Those mechanisms require evidence and a separately defined commercial model. The public cases are explicit cash-schedule assumptions.
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Decision implications

- Separate quantity, price, performance and collection mechanisms.
- Test how contractual protection becomes cash at the required date.
- Make mitigation alter the causal link rather than merely rename a stress.

MECHANISMS AND WORKED STUDIES

09 Cost stress can arrive before revenue

A margin-to-cash bridge and cost sensitivity table

Preserving service while funding costs

Cost stress is not simply an increase in an annual operating total. It can arrive through price escalation, minimum staffing, energy demand, maintenance requirements, supplier terms, replacements or inefficient ramp-up. Some costs change with delivered volume, some persist when revenue falls and some occur before the associated receipts. The financing analyst should identify these behaviours under the service envelope being financed. A cost schedule becomes decision useful when it explains which obligations can adjust, which cannot and what a proposed saving would do to future service and cash.

Fixed and variable are context-dependent descriptions rather than permanent labels. A staffing complement may remain fixed within an operating range but change when service hours or technical scope change. Energy can contain both a standing charge and a usage component. Maintenance can respond to usage while also requiring time-based work. The cost model should identify the relevant range and the decision that could change it. Treating all costs as proportional to revenue can overstate the cash relief from weaker demand. Treating all costs as immovable can understate genuine operational flexibility.

Ramp-up can create an unfavourable cost-to-receipt relationship. The asset may need trained staff, readiness systems and minimum utilities before commercial utilisation becomes substantial. These expenses support the ability to serve, yet they can arrive before cash from service. A credible ramp model therefore follows required readiness costs separately from volume-driven expenditure. The financing question is whether the project has funded that interval. Assuming mature margins from the start can conceal the cost of reaching the mature operating state, even when the eventual business model is plausible.

Price escalation and consumption changes should remain distinct. A higher energy bill can arise from a market price change, greater delivered activity, lower efficiency or a change in technical scope. Each explanation produces a different response. A contract adjustment may address price;

an operational change may address consumption; a design correction may address efficiency. The model should preserve the unit quantity and price logic where the issue is material. If the public cash schedule compresses them, the scenario note should state which mechanism it represents and which other mechanisms are held constant.

Procurement choices affect operating exposure over the lifecycle. A cheaper component can require more maintenance, consume more inputs or need earlier replacement. A more expensive component can provide reliability or efficiency, but the benefit requires evidence and compatibility with actual operations. Financing analysis should therefore reconcile acquisition choices with the maintenance and replacement assumptions in the cash schedule. It should not count a claimed lifecycle saving while using the lower acquisition cost of a different option. The technical baseline and commercial estimate need to describe the same asset before cost sensitivity has a stable meaning.

Supplier payment terms can create temporary liquidity without reducing economic cost. A delayed payment can retain cash in the current period while increasing later obligations or weakening a supplier's willingness to continue service. Advance payment can secure price or delivery while increasing early funding needs. The committee should see both price and timing. A cash-saving proposal based on stretching payments should state whether terms are agreed, whether interest or penalties arise and whether service continuity is affected. The analysis should not present a breach of payment obligations as an ordinary efficiency improvement.

Maintenance deferral needs an engineering consequence. Some work can be rescheduled without materially changing service; other work protects safety, reliability or asset life. The financing model cannot determine this distinction from expenditure labels. Qualified technical review should identify the minimum programme supporting the assumed performance envelope and the consequences of deviation. A stress response that reduces maintenance should be evaluated for its effect on later availability, costs and rights. Otherwise the model can improve immediate coverage by consuming the technical condition on which future repayment depends.

Replacement cycles can create cash concentrations that annual averages hide. A mature asset may generate stable operating receipts while requiring a substantial renewal at a particular point. Funding a reserve in advance changes earlier cash availability; funding at the event changes that period's coverage and liquidity. The analyst should state how the replacement plan relates to operating life and terminal value. A forecast

that claims continued service after omitted renewal can overstate value. A forecast that deducts renewal and also assumes a fully funded reserve pays it may double count expenditure unless the account bridge is explicit.

Contingency in operating cost should have a defined purpose just as construction contingency does. A general allowance can help preliminary planning, but its presence should not excuse an unsupported baseline. The analyst should identify what uncertainty remains in consumption, price, maintenance or scope and how the allowance responds. A sensitivity case can then test a mechanism directly. If every cost line already uses an adverse estimate and an additional generic contingency is applied, the committee should know that the case stacks protective assumptions. It should not be presented as a neutral central forecast.

The operating-burden study supplies lower positive available cash throughout the mature phase while retaining a finite service calendar. Its recurring coverage shortfall is real within that stated cash perimeter, yet it does not prove an unbounded funding need. A conditionally sufficient opening balance can cover its finite annual payments under the retained-cash assumptions. Such protection does not create the missing recurring margin and ties up funding until much later restoration. The committee must compare that exposure with a changed operating perimeter or proposed service calendar. The study deliberately leaves source capacity, funding cost and recipient consent unresolved, so this is a comparison of conditional arithmetic and decision dependencies rather than a financing recommendation.

The app's mechanical operating downside is another deliberately limited stress. It reduces future net cash and supplied cash available by a defined proportion of their absolute values while retaining service inputs. This is not a simulation of cost pass-through, variable-cost relief or a measured probability. It is a reproducible sensitivity that exposes how the cash schedule responds to a transparent rule. The author must interpret the result within that boundary. A negative stressed valuation can motivate more detailed analysis without proving that an actual cost event of that magnitude will occur.

Operational mitigation should carry a cost and an implementation path. A plan to reduce input consumption may require capital expenditure, training, procurement changes or downtime. A plan to renegotiate supply may depend on counterparty agreement. An efficiency promise cannot be included as guaranteed cash merely because it is operationally desirable. The committee should ask what evidence demonstrates feasibility, when the saving begins and what service consequences occur during

implementation. The model should include the resources required to obtain the saving, rather than presenting a benefit detached from its enabling expenditure.

The incidence of cost protection should remain visible. Fixed-price supply, indexed tariffs or contractor responsibility can shift some exposure to another party. That party's performance and capacity then become relevant. A supplier unable to absorb an adverse change can fail, seek renegotiation or reduce quality, affecting the project despite formal protection. The analyst should not assume every allocated cost risk disappears from the service system. Contractual allocation and operational resilience are related but different questions. A financing decision needs both, especially where a critical input has few substitutes.

The useful monitoring bridge follows quantity, unit price, timing and scope. It distinguishes spending more because service grew from spending more because input prices rose or efficiency deteriorated. It also identifies delayed expenditure and changed technical requirements. This bridge gives managers a causal diagnosis and lets financiers judge whether variance threatens the original cash thesis. A total cost variance without these distinctions can encourage the wrong remedy, such as cutting volume-supporting expenditure when the real issue is a supplier price adjustment or an unplanned technical defect.

The chapter's decision is to accept a cost perimeter that preserves the specified service and then test coherent mechanisms around it. Savings that change the service should trigger a revised appraisal, not merely an improved coverage output. Payment deferrals should remain dated obligations. Persistent pressure should be met by an explicit operating, capital or financing response. The analytical objective is a credible cash path through the lifecycle, rather than the lowest possible number on an operating-cost line.

Evidence and scope

The GAO Cost Estimating and Assessment Guide connects an estimate to a technical baseline, documented assumptions, sensitivity and updates with actual information. This supports reconciling operating cost to the asset and testing mechanisms explicitly. The guide does not provide this paper's illustrative cost inputs or market prices.

Evidence: Cost Estimating and Assessment Guide

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

Persistent operating pressure and a mechanical downside

All amounts are illustrative USDm. The operating-burden study supplies a lower recurring cash schedule; the downside column is the canonical app’s mechanical rule applied to that schedule. Both remain explicitly assumed cash schedules.

Persistent operating pressure and a mechanical downside				
Study	Mature CFADS	Mature service	Unlevered NPV	App downside NPV
Foundation	52.00	36.00	183.05	98.44
Operating burden	34.00	36.00	35.46	-19.63

Cost-to-cash variance bridge

This conceptual diagnostic preserves the cause of a variance and the financing consequence. Actual values require operating and supplier evidence.

Cost-to-cash variance bridge			
Variance cause	Evidence required	Cash consequence	Response to test
More service delivered	Usage and output records	Variable expenditure can rise with receipts	Check contribution and capacity
Higher input price	Supplier terms and market basis	Payments rise before or without tariff recovery	Review pass-through and timing
Lower operating efficiency	Consumption and technical diagnosis	Required inputs rise for the same service	Cost the technical remedy
Deferred required work	Maintenance plan and unpaid commitments	Current cash improves while future claims remain	Reconcile service risk and later funding
Changed scope	Approved technical change and estimate	Baseline economics change	Reappraise the asset and financing perimeter

A large operating buffer can simplify analysis

A strong cash margin may make precise modelling of small cost items unnecessary for a preliminary decision. Detailed estimates can create unwarranted precision when scope is still evolving. The objection supports focusing on decision-material mechanisms. It does not justify omitting lifecycle obligations or assuming that every cost falls with revenue.

No price or engineering estimate is inferred

The public app accepts net cash schedules. It does not estimate unit costs, escalation, staffing, maintenance, replacement or efficiency. Its downside is a transparent mechanical sensitivity. Real operating-cost acceptance requires a technical baseline, commercial evidence and appropriate specialist review.

Decision implications

- Specify the operating range before calling a cost fixed or variable.
- A deferred payment or maintenance item remains an exposure.
- Include the cost and timing required to obtain a promised saving.

MECHANISMS AND WORKED STUDIES

10

Currency mismatch changes incidence

A currency exposure worksheet without invented hedge quotations

From denomination to payment

Currency mismatch changes who bears the cost of moving between receipts and obligations. A project can sell in one currency, purchase inputs in another and repay finance in a further denomination.

Converting all lines into a common presentation currency makes comparison possible, but it does not remove the underlying exposures. The financing analysis should first map the currency in which each cash amount is earned, payable, held and transferable. Only then should it translate the amounts for reporting. A common reporting unit is a display convention; a common payment currency is an economic and treasury condition.

The distinction between denomination and settlement can be material. A contract can state a foreign-currency price while requiring payment in local currency using a specified conversion basis. A receipt can be foreign-currency denominated yet delayed, disputed or restricted. The obligation's amount may adjust using an exchange reference whose date differs from the project's conversion date. The analyst should record these details rather than assigning an exposure solely from the currency printed in a contract heading. The actual cash path determines whether changes in exchange rates affect the project, customer, supplier or public payer.

Translation risk and transaction cash risk answer different questions. A reported value can change when accounts are translated, even if the cash paid under a fixed local-currency contract is unchanged. A foreign-currency service obligation can require additional local cash when the conversion relationship changes, even if accounting profit remains stable under another convention. Financing resilience concerns the cash required

to meet the obligation. Reporting consequences can also matter, especially for covenants or sponsor decisions, but they should be shown separately. The committee should know which mechanism the sensitivity is intended to test.

A natural match depends on amount, timing and availability as well as currency. Receipts in the same denomination as debt service can reduce conversion exposure, but they may arrive after the payment date or remain unavailable for transfer. The source can also be exposed to operating or customer risk. A match described only as foreign-currency revenue can therefore be incomplete. The analysis should identify the payment calendar, account controls and operating conditions required for the cash to fund service. A matching label should not be presented as a guarantee that every payment is protected.

Costs can create a partial natural offset that changes with operating activity. A project earning foreign-currency receipts and paying foreign-currency variable costs may retain a margin in that currency, while local staffing and taxes create another exposure. The offset depends on how quantities, prices and contractual terms respond. If receipts fall while fixed foreign-currency obligations persist, the apparent match can weaken. The analyst should examine the residual cash available after required operating uses, rather than comparing gross revenue with debt. A large gross receipt in the right denomination is not the same as sufficient unrestricted cash for service.

Tariff adjustment can allocate exchange exposure to users or a public payer, but its design needs scrutiny. An adjustment may have a lag, a cap, a review process or a political and commercial affordability constraint. Even when the formula is clear, collection can remain delayed. The financing model should distinguish the amount entitled from the cash received. It should also state whether the project funds the mismatch during the adjustment interval. Protection that operates only after an adverse move can still leave a near-term liquidity gap, and a larger user obligation can affect demand or payer capacity.

Convertibility and transferability are separate from the exchange price. A project may have enough local cash to buy the required currency at the modelled rate but face limitations on conversion or transfer. These issues depend on actual arrangements and jurisdiction, requiring appropriate legal and treasury review. The public paper does not assert the existence of controls in any particular market. It identifies a question that a transaction must answer before treating local cash as available for foreign obligations. A rate sensitivity alone cannot establish that the payment can be executed when required.

The location and control of balances can change exposure. Cash retained in a particular account may be denominated appropriately but subject to restrictions on use. A project may need approval to move money between entities or purposes. A balance held as protection can lose part of its intended function if the relevant obligation changes denomination or its timing shifts. The account map should therefore be reconciled to the currency map and service calendar. This prevents the committee from counting protection whose availability depends on a transfer the project has not established.

Treasury protection should be examined as an actual arrangement with scope and cost. A proposed contractual or financial mechanism may cover a defined amount and period, leaving other flows exposed. It can introduce fees, collateral, counterparty conditions or termination consequences. The committee should obtain qualified advice and current terms where such protection is contemplated. This paper offers no hedge quotation, counterparty recommendation or execution instruction. A placeholder assertion that currency risk will be managed is not enough to support a funding decision; the intended mechanism needs evidence and a cash-incidence bridge.

Long horizons can make protection incomplete in time. An arrangement covering an initial period may leave later service dependent on renewal or market access. The project should not assume continued availability at unchanged terms merely because the first arrangement can be obtained. The financing recommendation should identify the uncovered tail and the decision needed before current protection expires. A shorter financing tenor can reduce some exposure while creating refinancing dependence. The trade-off is therefore between distinct calendar risks, rather than a universal preference for the longest possible loan or the shortest protection period.

Exchange stress should preserve the operating mechanism. A weaker receipt currency can increase the local cost of foreign obligations, but it may also affect import costs, tariff adjustments, demand or competing supply. A scenario should state which of those relationships is included and which is held constant. A mechanical translation of the debt line can be useful to isolate transaction exposure; it should remain clearly labelled as an isolated sensitivity. A complete case requires coherent assumptions about the cash system, not a claim that every line moves independently in the most adverse direction.

Currency incidence is a governance question when protection transfers costs to another party. A sponsor may prefer foreign-currency finance while users pay in local currency. A public guarantee or adjustment can

then move the adverse effect to a government or customer. That can be a deliberate allocation, but the committee should understand its affordability and support capacity. An arrangement that protects lenders by making another party's obligation unsustainable can threaten the continuity of the underlying service. Financial protection should be considered alongside the institution or customer expected to bear it.

Monitoring should retain original currencies before consolidation. A reporting pack expressed entirely in the presentation currency can obscure whether a variance arose from operational quantity, unit price, conversion or payment timing. A useful bridge retains the local and foreign amounts, the contractual conversion basis and the settlement date. It also separates changes in cash from changes in translated reporting value. This information allows managers to act on operating issues and treasury specialists to assess the residual exposure. Without it, exchange movement can become a catch-all explanation that conceals unrelated deterioration.

The public capital fixtures use a common illustrative monetary unit and do not contain an exchange-rate engine. Their cash schedules can demonstrate the consequence of supplied changes in cash available or service, but they cannot identify the source of a currency shock. The transaction team should create the currency and treasury bridge outside the app, validate it and then supply a coherent schedule if a simplified comparison is useful. The resulting app output must remain tied to that schedule's assumptions. A calculated coverage value cannot verify exchange access, contractual adjustment or protection terms.

The chapter's decision is a residual-exposure acceptance. Identify each receipt and obligation currency, trace conversion and settlement, recognise real matches and name the unmatched dates or amounts. Examine who bears the residual exposure and what evidence supports any protection. Then determine whether the project can fund a coherent adverse path without relying on an unverified future arrangement. The aim is not to eliminate every uncertainty. It is to ensure that the parties accept a specific currency mechanism and its limits, rather than mistaking a translated forecast for a protected financing structure.

Evidence and scope

The World Bank risk-allocation guidance identifies currency mismatch and interest-rate variation as financial risks that can affect debt-service affordability. This paper develops an original currency cash-path framework around those mechanisms. The source does not provide current exchange rates, protection pricing or terms for a transaction.

Evidence: **Risk Allocation**

Currency cash-path worksheet

A conceptual completed record demonstrates the distinctions to preserve.
No country, exchange rate or treasury product is assumed.

Currency cash-path worksheet			
Cash line	Denomination and settlement	Timing and control	Residual question
Service receipts	Local-currency invoice in the conceptual case	Collection follows acceptance	Does cash arrive before the foreign service date?
Imported operating input	Foreign-currency payable	Supplier terms govern settlement	Can price or timing be passed through?
Debt obligation	Foreign-currency service amount	Payment date fixed by terms	What cash can actually be converted and transferred?
Protective balance	Currency and account purpose specified	Access conditions remain to be verified	Does it match the obligation and remain available?
Tariff adjustment	Conversion basis defined in the hypothetical terms	Approval and collection can lag	Who funds the interval and bears affordability pressure?

Currency protection and its boundary

This conceptual comparison shows why a claimed match or protection needs a complete cash-path test.

Currency protection and its boundary		
Claimed protection	Useful effect	Boundary to verify
Receipt and service share a denomination	Can reduce conversion exposure	Residual margin, receipt timing and account access
Tariff adjusts for currency movement	Can transfer some cost incidence	Lag, cap, approval, demand and collection
A funded balance is held	Can meet a defined payment	Currency, access and depletion
A proposed treasury arrangement exists	May cover a defined amount and period	Current terms, counterparty obligations and uncovered tail

Accept the residual exposure

Approve currency assumptions only after the committee can state the unmatched cash, its controlling party and the evidence supporting a response. A common reporting currency is not evidence of a cash match.

1. Retain original denomination, settlement basis and dates.
2. Test the cash available after required uses rather than gross receipts.
3. Identify protection scope, costs and conditions with qualified advisers.
4. Make the uncovered tail and incidence explicit in the recommendation.

Full matching can impose excessive cost

Trying to match every future flow can reduce flexibility, add transaction cost and create new conditions. A sponsor with adequate diversified resources may choose to retain a defined exposure. That can be rational if capacity and authority are established. The decision should be an explicit acceptance of residual risk, not an assumption that exposure disappears through translation.

No treasury or jurisdictional conclusion

The paper supplies no exchange-rate forecast, hedge price, product recommendation or legal conclusion about convertibility. The canonical app uses supplied common-unit cash schedules. Actual currency management requires transaction-specific treasury, legal and operating evidence.

Decision implications

- A reporting currency does not eliminate cash exposure.
- A natural match requires residual cash, aligned dates and access.
- State the cost, scope and uncovered tail of proposed protection.

MECHANISMS AND WORKED STUDIES

11 Interest risk and refinancing are separate

A refinancing dependency register and interest scenario comparison

Two calendars of financing risk

Interest risk changes the cost of carrying an obligation. Refinancing risk concerns the source available to repay or replace an obligation at maturity. They can interact, yet they should remain distinct in a financing decision. A loan with a stable current payment can still depend on uncertain future refinancing. A floating-rate loan can create near-term pressure even when it amortises fully within the asset's operating rights. The committee

should identify the event that changes the cash claim and the event that requires new capital, rather than grouping both under a broad interest-rate sensitivity.

A rate assumption needs a convention. The applicable reference, margin, reset date, payment period and balance basis determine what cash becomes due. A projected rate path is an assumption about future conditions, while a fixed contractual component can be established from terms. The analyst should keep them separate and record where qualified treasury or legal interpretation is needed. An annual percentage alone does not fully define a debt-service schedule. This paper's capital app therefore takes debt service as an independent supplied series instead of deriving obligations from a loosely specified borrowing rate.

The balance on which interest accrues can change through drawdowns, repayments, capitalisation or other permitted claims. A cost increase during construction can require additional funding and affect later obligations even before operating revenue begins. A deferral can reduce current cash payments while increasing future claims. The model should show these pathways in a validated debt calculation where they are material. A simple service series can compare the outcome of different paths, but it cannot establish whether the path conforms to proposed terms or whether principal remains outstanding after the final supplied period.

The calculation dictionary records the annual convention. For the equity decision, test the funding mandate: is opening protection a newly contributed amount, a restricted project balance or a contingent promise? Those sources create different cost and incidence. None should be inserted as project operating cash to improve CFADS-based coverage. The bridge results identify a required amount conditionally; the completed committee record deliberately leaves its fundable source unresolved.

Refinancing dependence begins with the maturity funding source. If scheduled operating cash does not retire the full obligation, the project needs another source at the required date. A refinancing assumption can be plausible without being committed. It may depend on operating performance, lender appetite, market access, remaining rights, collateral condition or public policy. The model should distinguish a signed available source from an expectation that a source will later appear. This distinction is central to resilience because the project's willingness to refinance does not establish another party's willingness to provide capital when needed.

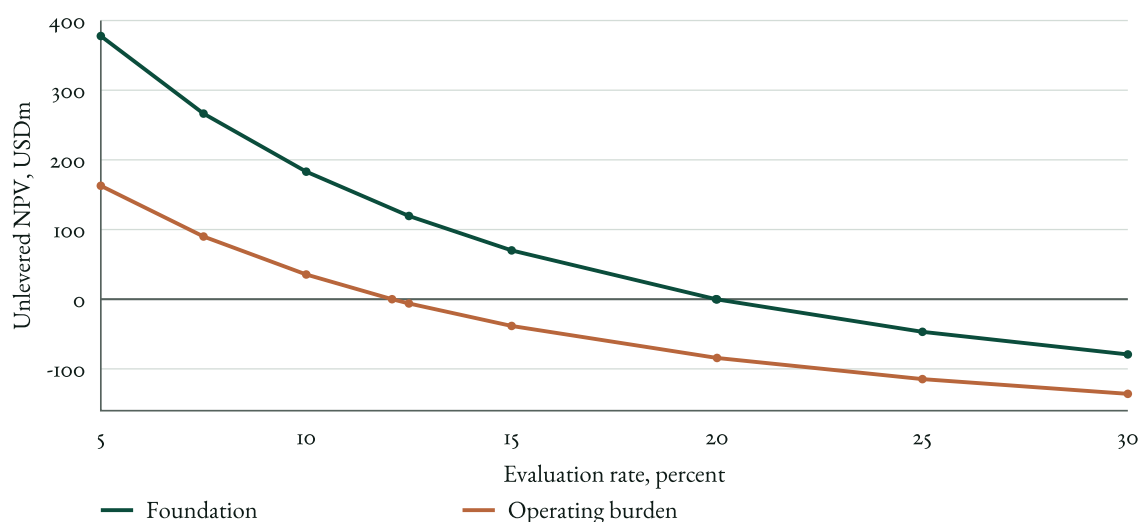
An expected reduction in risk after construction can support a refinancing thesis, but the path to that state must be defined. Completion, reliable operations, collections and stable rights may improve the evidence available to a future lender. Outstanding defects, unresolved interfaces or a weak commercial ramp can prevent the anticipated transition. The committee should state the milestones on which the refinancing expectation depends. Monitoring can then assess whether the project is becoming the asset the future financing case assumes. A statement that refinancing follows completion is too broad when completion itself has several meanings.

The remaining operating horizon affects future financing options. A refinancing lender needs to consider cash and rights after the new obligation begins, not merely the fact that the asset operated successfully before it. Renewal conditions, major replacements, terminal arrangements and changing demand can reduce the useful tail. A favourable historical period does not automatically support a long new tenor. The refinancing record should identify the rights and technical condition that remain at the intended date. It should also show whether a proposed payment relies on terminal value rather than continuing cash generation.

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

Rate sensitivity holds the cash path constant

The illustrative curves select the positive-rate region of the canonical sensitivity output for contrasting cash paths. They show valuation sensitivity and a crossing without changing the supplied operating or service schedule. The full canonical sweep remains available in the model files.



Original deterministic plot of frozen illustrative sensitivity outputs. The plotted evaluation rate is not a forecast financing rate; the chart does not simulate refinancing.

Market access can be cyclical or institution specific, but this paper assigns no probability to a future financing window. The relevant discipline is to ask what happens if expected capital is unavailable or available only on materially different terms. The response might include retaining cash, reducing distributions, staging investment, arranging support or using a different initial maturity. Each response changes current incidence or flexibility. The committee should see those changes as alternatives with costs and conditions. A refinancing assumption without a fallback can transform an operating project into a bet on future capital access.

Refinancing proceeds and gains should not be treated as ordinary operating cash. New borrowing can create a source at maturity while also creating a new obligation. A gain from revised terms may accrue to sponsors, users or public payers according to the applicable arrangement. The financing model should distinguish the transaction itself from the asset's cash generation. Counting a refinancing receipt in project value while also treating the asset's underlying cash as unlevered can mix

analytical perimeters. The public capital fixtures avoid this issue by calculating unlevered values from supplied project cash and comparing independent service inputs.

The terms of an initial facility can constrain refinancing or prepayment. Charges, consent requirements, security release, intercreditor arrangements and other conditions may affect timing and cost. The analyst should obtain appropriate legal and treasury review rather than assume that a lower market rate can immediately replace the existing facility. A refinancing case should include the resources and process required to complete the change. The point is not to presume that refinancing is undesirable. It is to recognise that switching financing is a governed transaction with obligations, rather than a frictionless update to a discount-rate cell.

Interest protection can reduce a defined rate exposure while leaving refinancing dependence intact. A mechanism covering scheduled interest does not provide maturity principal. Conversely, a future refinancing expectation does not protect current service from adverse resets before maturity. The committee should separate the protected amount and period from the remaining claim. This allows the proposed structure to be judged as a set of mechanisms with different boundaries. A single description such as rate risk managed is inadequate if it hides a large obligation whose source remains contingent on a later financing transaction.

Optionality has value when it is genuinely available to the project. The ability to repay early, retain liquidity or choose among funding sources can improve response to changing conditions. Yet optionality may come with price, consent or performance conditions, and a formal option can be unusable if the project lacks cash. The analyst should identify what action the project can actually take, who authorises it and what it costs. A model that assumes management always chooses the favourable path should show the information and resources required at that decision date.

Monitoring a refinancing thesis requires leading conditions rather than only a countdown to maturity. The project should retain evidence about operations, remaining rights, technical condition, liquidity and unresolved lender concerns. The committee should identify the decision date at which a fallback must be activated if progress is inadequate. Waiting until maturity to discover that terms are unavailable can eliminate options that required earlier cash retention or negotiation. The financing record should therefore state both the intended refinancing path and the point at which continuing to rely on it becomes an explicit new decision.

The practical recommendation should state the structure's dependence on capital access in plain language. A fully amortising obligation, a maturity funded by retained cash and a maturity expected to be refinanced have different exposure. The committee can accept any of these in an appropriate context, but it should know which it is accepting. Interest sensitivities should then be applied to the actual obligation mechanism, and refinancing alternatives should be assessed for their conditions and incidence. A lower current service burden is useful only when its later consequence is understood and deliberately funded.

Evidence and scope

The World Bank risk-allocation guidance identifies interest-rate variation as a financial risk for debt-service affordability. This paper separates that recurring-payment mechanism from an original analysis of maturity funding and refinancing dependency. No current rate path, lender appetite or treasury protection price is inferred from the guidance.

Evidence: Risk Allocation

Refinancing dependency register

This conceptual completed record exposes the difference between an expected future source and an available commitment.

Refinancing dependency register			
Dependency	Conceptual evidence status	Failure consequence	Decision or owner
Completion and stable operation	Future milestone in the conceptual case	The intended lower-risk asset is not established	Technical and operating owners supply milestone evidence
Remaining service rights	Expiry and renewal require reconciliation	A future lender may lack a sufficient cash horizon	Legal and commercial teams define the remaining perimeter
Maturity funding	Refinancing expected; no commitment claimed	Principal source remains contingent	Committee defines fallback and activation date
Transaction permissions	Terms require specialist review	A proposed refinancing can be delayed or costly	Treasury and legal owners reconcile conditions
Fallback resources	Cash retention or support requires an explicit choice	Options can disappear before maturity	Decision owner approves incidence and timing

Rate exposure and maturity exposure

The table specifies distinct questions rather than claiming measured likelihood or actual financing terms.

Rate exposure and maturity exposure			
Exposure	Cash event	Useful test	Insufficient substitute
Rate variation	A recurring payment changes under its convention	Dated service under coherent reset assumptions	An expected later refinancing
Maturity principal	A balance requires funding at a defined date	Available source and fallback conditions	Protection limited to current interest
Refinancing transaction	New capital replaces an existing obligation	Terms, permissions, costs and remaining cash horizon	A favourable operating history alone
Protection expiry	A defined arrangement ends before exposure	Uncovered tail and renewal decision	Assuming unchanged future availability

A maturity source must have a status

A committee should identify whether maturity is funded by scheduled retirement, retained cash, committed support or expected refinancing. Where a source is expected, define the milestone evidence and the point at which a fallback must be chosen.

1. Separate current rate mechanics from the final funding claim.
2. State the source status and the conditions needed to make it available.
3. Assess remaining rights and technical obligations at the financing date.
4. Define an earlier decision trigger that preserves fallback options.

Refinancing can be a rational staged strategy

Initial financing can reasonably bridge construction or an early phase while later capital reflects improved operating evidence. Requiring the original facility to cover the entire horizon can impose unnecessary cost or constrain access. The staged strategy is strongest when transition milestones, fallback resources and remaining rights are explicit; it is weakest when lower current payments conceal an unsupported maturity source.

No interest or refinancing engine

The public app does not calculate floating-rate resets, balances, protection settlements, refinancing proceeds or prepayment charges. It compares supplied schedules. Actual financing terms and their cash consequences require a separate validated debt model and qualified treasury and legal review.

Decision implications

- Interest variation and maturity funding are distinct exposures.
- Expected future access should retain its contingent status.
- Activate fallback decisions early enough to preserve usable options.

MECHANISMS AND WORKED STUDIES

12 Debt sizing must satisfy constraints together

A binding-constraint map that exposes infeasible structures

A structure must work as a whole

Debt sizing is a constrained choice rather than a search for the largest amount a favourable forecast can support. Coverage, leverage, maturity, remaining operating rights, liquidity, contribution timing and permitted distributions can interact. A structure can satisfy each condition in a different standalone case while failing to satisfy them together in a coherent project. The committee should therefore examine a common cash and obligation perimeter, identify the conditions that bind and understand the trade-off required to relax them. A single maximum-debt output can conceal the assumptions and institutional choices determining that maximum.

The first constraint is the service relationship over time. A proposed debt amount matters through the obligations it creates, but those obligations depend on terms and profile. Lower early service can improve ramp coverage while increasing later concentration. A longer maturity can spread service while relying on a longer cash horizon or continued rights. The sizing process should retain the resulting calendar rather than presenting a borrowing amount without its profile. The public capital app does not derive an amount from coverage. It compares externally supplied schedules, which makes the distinction between a financing proposal and a calculation especially important.

Leverage is a separate definition and decision. A ratio can use different debt and capital perimeters, and an amount of required sponsor contribution can reflect more than the construction estimate. Reserves, fees, contingency and operating-readiness cash can affect the funding requirement. The committee should state what counts in the leverage

measure and which source funds each requirement. A structure can meet a headline capital ratio yet lack unrestricted commissioning cash. Conversely, a larger sponsor contribution can improve funding availability while failing to resolve a technical or commercial viability problem.

Tenor should be reconciled to the asset's rights and credible cash horizon. A long-lived physical asset does not automatically possess long-lived commercial rights, operating approvals or demand. A maturity beyond the reliable forecast horizon can increase dependence on distant assumptions. A shorter maturity can increase current service or refinancing dependence. The committee should assess the alternatives through their mechanisms. The aim is not to favour the longest available tenor, but to align dated obligations with supported cash while preserving a credible residual position if the project encounters adverse conditions.

The operating tail can provide protection, but only when it remains useful. Cash after loan maturity can support recovery or a future transaction if rights, service condition and transferability permit it. A tail containing an unfunded major replacement or an uncertain renewal is different from a continuing mature cash stream. A sizing analysis should identify what the tail contributes and whether that contribution is already used elsewhere in the recommendation. Treating the same residual value as support for debt, a terminal valuation and a sponsor exit without explaining the shared dependency can multiply confidence without multiplying resources.

Liquidity requirements can compete with initial debt capacity and distributions. A funded buffer may improve response to timing stress while increasing the initial funding need. An obligation to restore that buffer can consume later cash. A profile that appears feasible before protection is funded may require more equity or reduced service afterward. These interactions should be solved together. Adding a reserve at the end of a completed sizing exercise can invalidate earlier assumptions about capital sources and sponsor returns. The financing bridge should show the whole structure after required protections, rather than treating protections as independent accessories.

Distribution restrictions affect incentives and sponsor willingness to commit. Retaining cash can improve lender confidence while reducing near-term equity receipts. A sponsor may respond by proposing a different scale, a lower contribution or another financing route. The committee should recognise this as an institutional trade-off rather than assume that all parties share a single objective. A structure that is resilient for lenders but unattractive to necessary sponsors may not be executable.

Equally, a structure that maximises early sponsor receipts can weaken the service asset. Sizing should expose these preference boundaries instead of hiding them in an optimisation target.

Construction funding creates another joint constraint. A theoretically supportable operating obligation can be irrelevant if sources cannot fund the interval to completion. Conditional debt draws, delayed support and uncertain contingency can make the project unable to reach the cash-generating state. A sizing exercise should begin from a defined completion and commissioning bridge. If a proposal reduces equity by increasing operating debt but the debt cannot be drawn for required early uses, the funding plan may fail despite improved nominal sources. Amount, permitted use and release timing should be accepted together.

Support can relax a constraint while creating another obligation. A guarantee may improve lender confidence, but its scope, trigger and fiscal or sponsor incidence must be examined. A subordinated source can provide completion funding while adding later claims. A grant can reduce recoverable capital while imposing eligibility or performance conditions. The committee should identify which constraint the support changes and what new requirements arise. An apparent increase in debt capacity is not a free gain if protection transfers an unbounded burden to a party whose ability or authority remains unverified.

The binding constraint can change across scenarios. Coverage may bind in the expected operating case, liquidity in a delayed-ramp case and maturity funding in a shortened-rights case. A proposal accepted because it satisfies the first constraint can fail when the second becomes relevant. The analysis should therefore retain a constraint map across coherent cases. This does not mean designing the structure around every imaginable adverse event. It means making the committee's accepted exposure explicit, with evidence, protections and a response when a previously nonbinding condition becomes decisive.

An infeasible proposal should be diagnosed before it is rejected or enlarged. If cash is persistently insufficient under the required service perimeter, changing repayment timing may not create a sustainable structure. If the problem is a temporary commissioning interval, credible staged funding may help. If the operating right ends too soon, additional capital cannot automatically extend it. If sponsor capacity is the constraint, a nominal equity increase is not a solution without a fundable source. The committee should identify the mechanism and consider an alternative that changes it, rather than adjusting ratios until the model shows compliance.

Iteration should leave a record of trade-offs. A financial team can test many profiles and assumptions quickly, but the final proposal should explain why selected changes are credible. Reducing a contingency, increasing terminal value or delaying maintenance can produce numerical feasibility while weakening the evidence basis. A change log should distinguish structural redesign from assumption relaxation. The committee should know whether the financing plan improved because obligations became better aligned or because protective assumptions were removed. Without that record, the iterative model can become a device for selecting the story that passes rather than testing the project that exists.

The stopping rule should reflect decision materiality. Detailed optimisation is not useful while a major commercial or completion proposition remains unresolved. The team can identify an indicative feasible region and the evidence required to refine it. Once the material perimeter is accepted, a validated debt model can derive profiles under stated constraints. The public app remains a comparison tool for supplied cash and obligations. It cannot certify the feasible region, derive leverage or determine an acceptable covenant. Those choices require transaction-specific terms and the judgment of the relevant financing parties.

The practical output is a binding-constraint map with alternatives. For each condition, state its source, the case in which it binds, the remedy proposed and the new condition created by that remedy. This map makes the recommendation reviewable even when the financing model is complex. It allows a committee to ask whether the proposal is internally feasible, supported by evidence and acceptable to the parties expected to act. The final amount becomes a consequence of those choices rather than an authoritative answer detached from them.

Evidence and scope

EPEC structures PPP work around preparation, procurement and delivery; project identification includes appraisal and affordability.

Evidence: [EPEC Guide to Public-Private Partnerships](#)

Binding-constraint map

This original conceptual map makes interacting requirements visible without deriving a maximum debt amount.

Binding-constraint map			
Constraint	What can make it bind	Proposed response	New question created
Periodic service	Cash and payment calendar do not align	Reprofile or reduce obligations	Is later repayment credible and funded?
Initial funding	Sources cannot meet commissioning uses	Stage exposure or secure timely contribution	Are release conditions and capacity verified?
Liquidity protection	Required balances consume available capital	Increase funding or redesign protection	Who bears cost and restoration claims?
Operating rights and tail	Supported cash horizon is too short	Change maturity, rights or scope	Does refinancing dependence increase?
Sponsor participation	Required incidence is unacceptable or unfunded	Rebalance sources or reconsider scale	Does the new structure preserve service and incentives?

Joint feasibility acceptance

Treat the proposed capital structure as feasible only when the same defined project satisfies its required cash, calendar, source and control conditions together. A remedy should identify the constraint it relaxes and the new dependency it creates.

1. Freeze a common technical, commercial and cash perimeter.
2. Map the conditions that bind in each coherent scenario.
3. Separate redesign of obligations from relaxation of unsupported assumptions.
4. Record the preference and funding incidence of the chosen feasible alternative.

A simple leverage ceiling can improve governance

A clear ceiling can reduce negotiation cost and constrain excessive debt, especially where detailed forecasts are uncertain. It can be a useful policy or screening rule. Its simplicity does not establish commissioning liquidity, repayment alignment or sponsor capacity. A ceiling should complement a cash and source test rather than replace it.

No debt-sizing optimisation is presented

The canonical app does not derive debt capacity, leverage, amortisation or a covenant-constrained profile. The chapter supplies a decision map. A transaction-specific sizing result requires a validated debt model, accepted financing terms and evidence about sources and rights.

Coverage improves; the decision can still be held

The intervention studies change only the independently supplied annual service entries. Every initial investment, operating project cashflow, CFADS entry, terminal project receipt, period label and discount assumption is held equal to its source fixture. They are separate frozen inputs to the existing capital app, not changes to the app algorithm. This design tests a specific proposition: a changed payment calendar can improve CFADS-based coverage without improving unlevered project value. It does not assume a financing agreement has been amended or that the recipient accepts the new payments.

The nominal service comparison is intentionally narrower than debt sizing. Service can contain principal, interest and other contractual payment components. The fixtures provide no decomposition, loan amount, rate, security, seniority, amortisation agreement or refinancing term sheet. Moving a nominal amount between annual periods changes recipient timing even if its displayed total is preserved. Reducing the nominal total changes what the recipient is offered. Neither operation demonstrates equal financing economics, a stated reduction in principal or a fundable debt amount. The missing recipient conditions are retained as decision blockers instead of being inferred from the higher coverage output.

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

Post-intervention project outputs

Illustrative USDm and coverage ratios. Each changed service profile is recomputed through the unchanged project app. Unlevered project value and project cash stress remain separate from service coverage.

Post-intervention project outputs					
Proposed calendar	Base minimum coverage	Fixed-stress minimum		Project NPV	Stressed project NPV
Delayed reprofile	1.25	1.00		127.24	53.79
Burden service reduction	1.25	1.00		35.46	-19.63

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

For the delayed alternative, the early proposed service entries are USD9.6om, USD19.2om and USD30.4om. Each later repayment period supplies USD41.42m to displayed precision. The author-declared nominal target remains USD432.0om across the finite service life; floating-point inputs represent the repeated later amount to their frozen precision. This removes the early annual payment deficits under both the base and fixed

CFADS stress conventions. It also increases the later supplied payment relative to the source profile. The recipient must evaluate that changed timing and any agreed price or security; nominal preservation is not acceptance.

Illustrative. The delayed reprofile achieves base minimum coverage $1.25\times$ and fixed-stress minimum $1.00\times$, while project NPV remains USD127.24m. The completed fictional committee therefore labels it ARITHMETICALLY ELIGIBLE / TERMS HELD. It can return as a potential alternative to upfront protection, but implementation remains held because the original payment recipient has provided no acceptance evidence. A source of protection declining the earlier bridge does not itself authorise this different calendar. The Chair requires a verified recipient response, complete service definition and dated payment record before comparing the alternatives' economics. A refusal ends this branch rather than prompting the analyst to declare the recipient indifferent.

Illustrative. For the burden alternative, proposed annual service begins at USD20.80m, then USD24.00m, then USD27.20m through the remaining repayment periods. The author supplies the profile at the declared CFADS proportion, producing the same displayed base and stressed minimum coverage as the delayed reprofile. Its nominal service target falls from USD432.00m to USD316.80m. The USD115.20m nominal difference is a proposed reduction in total supplied service, not a demonstrated write-off of loan principal. No recipient consent, compensation or replacement financing is supplied. The coverage result therefore describes the changed hypothetical obligation, rather than resilience under the original payment promises.

Illustrative. The fictional Chair also requires stressed unlevered project NPV at least USD0.00m for this comparison, independently of payment coverage. The burden alternative retains stressed project NPV USD-19.63m because service edits do not change project cashflows. It fails that expressly chosen analytical condition despite meeting the selected annual coverage comparison. Its branch is REJECT THE UNCHANGED OPERATING PROPOSAL / TERMS ALSO UNRESOLVED. The decision does not reject every possible restructured operation. A differently justified scope, cost, revenue or investment proposal would require new project inputs and a fresh appraisal. It rejects the claim that improving service coverage alone has repaired the displayed stressed project-value weakness.

Completed fictional alternative routing

These statuses are decisions within the authored illustration. They do not record a real committee or recipient response.

Completed fictional alternative routing			
Branch	What changed	What remains missing or failed	Owner / consequence
Delayed upfront protection	Conditional stressed opening cash	Source capacity, permitted access, cost incidence and dates unresolved	Protection Review Lead; HOLD implementation
Delayed reprofile	Annual service dates and amounts	Recipient acceptance and financing economics unresolved	Payment Verification Officer; TERMS HELD
Burden lower service	Nominal service reduced	Stressed project-value condition failed; recipient acceptance absent	Model Committee Chair; REJECT unchanged proposal
Operating redesign	No new fixture supplied	No tested new cash mechanism	Technical Appraisal Lead; prepare a distinct proposal only under a new mandate

The comparison makes the decision advantage concrete. An analyst focusing only on the improved minimum coverage could treat both proposed calendars alike. The unchanged project-value output and the retained recipient conditions separate them. The delayed branch has positive stressed project value under the supplied method but unaccepted payment terms. The burden branch additionally fails the fictional stressed-value condition. Their action records therefore differ even though their displayed coverage matches. This is the study's synthesis in use: preserve the causal input that changed, the proposition it repairs and the distinct condition that still controls exposure.

The proposed lower-service branch also demonstrates an incidence question. If the recipient accepts a lower payment total, the project is relieved only because another party accepts a different economic claim or a separately funded compensation mechanism exists. The annual app cannot allocate that consequence without the financing terms. The committee should not celebrate improved coverage while leaving that party unnamed. In the fictional routing record the Payment Verification Officer owns recipient evidence, while the Chair owns the institution's appraisal condition. Those roles prevent a technically correct calculation from being silently promoted into a complete decision.

Decision implications

- Test constraints against the same defined project and calendar.
- A remedy can relax a condition while creating another obligation.
- Explain why a final structure is credible, not just numerically compliant.

GOVERNANCE AND APPLICATION

13

The cash waterfall is a governance mechanism

A waterfall specification and covenant interpretation questions

Who can use the money and when

A cash waterfall allocates control over limited money. Its ordering determines which claims can be paid, which balances must be protected and when sponsors may receive distributions. The schedule is therefore a governance mechanism as well as a modelling convention. The financing team should reconcile the order to applicable terms and operating needs. A formula can route cash perfectly while implementing the wrong priority. The committee needs to know who authorises each use, what triggers a change in control and what happens when cash cannot satisfy every claim.

The starting pool must be defined before priorities are applied. Gross collections, unrestricted balances and cash available after required operating expenditure are different pools. A waterfall that begins after essential expenses assumes those expenses have already been handled elsewhere. A waterfall that begins with gross receipts needs to include them in its order. The model and financing documents should identify the same boundary. Otherwise an apparently complete payment sequence can omit a required claim or deduct it twice. The first governance question is what money enters the mechanism and under whose control.

Required operating payments should be distinguished from discretionary uses. The asset needs certain expenditure to maintain the service on which financing depends. It may also have optional expansion, sponsor fees or improvements whose priority depends on terms and choice. Classifying a use as operating does not automatically establish its seniority; classifying it as discretionary does not establish that it can legally be deferred. The financial analyst should obtain appropriate interpretation and retain

unresolved questions. The waterfall should implement an accepted perimeter rather than settle legal or technical disputes by spreadsheet ordering.

Reserves introduce a balance obligation in addition to a payment obligation. Funding or restoring a reserve uses cash now to protect a later purpose. The model should distinguish the target, actual balance, permitted draw and replenishment rule. A shortfall in the target can change distribution permissions even when current service is paid. The committee should see whether the structure can restore protection from identified cash. An automatic replenishment entry without a funding subtraction creates a false sense that the reserve remains intact regardless of operations.

Mandatory service and optional prepayment should remain separate. Paying an obligation due under terms is different from using surplus cash to retire debt early. A sweep can improve future lender exposure but reduce liquidity or sponsor flexibility. The definition of sweep cash should account for required operating needs and protected balances under the agreed mechanism. If a model treats all residual money as excess without that reconciliation, it can sacrifice resilience while appearing to reduce leverage. The decision should state what future obligations the retained or prepaid cash is intended to address.

Distribution conditions can act as a warning mechanism. Restrictions may depend on financial tests, reserve status, defaults, reporting or other defined events. The analyst should distinguish a warning, a lock-up and an event requiring a different remedy. These categories can have very different cash and control consequences. The public paper does not define a universal covenant structure. It provides a specification process that asks what event matters, how it is measured, who confirms it and which payment permissions change. A threshold label without an action is incomplete governance.

Timing of tests matters when distributions precede later obligations. A project can appear compliant at a reporting date while committing cash that is needed for a known future replacement or service payment. A forward-looking distribution test can address some of that exposure if its terms and assumptions are accepted. The committee should identify the calendar over which cash must remain available. It should also know whether the test relies on forecast receipts, actual balances or both. A permission based on unsupported future collections can release protection before uncertainty is resolved.

Cure mechanisms require resources and authority. A sponsor contribution can restore a ratio or balance under specified terms, but the project should not assume that an unverified sponsor will always contribute. A waiver can permit an action without changing the underlying cash shortage. A revised obligation can alter the calendar while creating a new repayment dependence. The model should record the source and consequence of each cure. The committee should recognise whether resilience improved, an exception was granted or a finite support resource was consumed. Calling all responses cured can conceal materially different conditions.

Control arrangements should be designed for timely action. A collection account may help preserve payment priority, while approval processes can create delay during stress. Decision authority should be clear enough that the project can pay permitted essential uses and apply protection when conditions are met. The operating team needs to know which actions remain within its authority and which require escalation. A waterfall described only in lender language can fail operationally if it does not support the daily service requirements or if no accountable person can interpret a trigger when the payment date approaches.

Related-party claims deserve a transparent place in the sequence. Management, development, supply or service fees may be legitimate and contractually required. Their affiliation does not establish that they are subordinate or optional. The model should identify the payment basis, priority and deferral conditions, with appropriate review. The committee should also understand how these claims affect sponsor incidence and operating cash. A structure that shows sponsor distributions as restricted can still transfer cash through other permitted claims. Governance therefore needs a complete use-of-cash perimeter rather than a narrow focus on dividends.

Monitoring should compare actual cash routing with the specified mechanism. A report that shows service paid but omits reserve depletion, unpaid suppliers or permitted exceptions can conceal weakening protection. The operating record should identify receipts entering the pool, required uses, balance movements, discretionary uses and outstanding claims. Variance should explain whether cash generation changed or routing changed. This allows the financing parties to detect a shift in priorities before it becomes an unexplained shortfall. A waterfall can only perform its governance function if actual activity is reported in the same structure.

Scenario testing should include a cash insufficiency path. When the pool cannot meet all claims, the model should show the unpaid or deferred item rather than forcing the waterfall to balance through an unexplained negative account. The committee should identify the consequence of that item remaining unpaid and the party authorised to act. This exposes whether a financing structure preserves service during stress or protects a payment while allowing the asset to deteriorate. A complete downside is not merely a lower distribution output; it is an account of what cash control permits and what obligations remain unresolved.

The waterfall should preserve flexibility where flexibility is valuable and explicitly acceptable. Excessively rigid control can impede a small operating adjustment whose cost prevents a larger failure. Excessively broad discretion can allow cash to leave before known obligations are funded. The trade-off should be considered with the operating model and reporting quality. An accepted delegation can define permitted uses, documentation and escalation boundaries. The aim is a mechanism that responds coherently to the asset's needs while maintaining the protections on which financing relies, rather than either unrestricted discretion or blanket approval for every payment.

The chapter's output is a waterfall specification with interpretation questions. It states the pool, required uses, protected balances, service, optional actions, distributions and control triggers. Each unresolved priority has an owner and required evidence. The finance model then implements the accepted specification and exposes the consequences of insufficiency. This sequence keeps the spreadsheet from becoming an unauthorised contract interpreter. It also gives monitoring teams a stable structure for explaining actual cash and allows the committee to approve a defined allocation of control.

Evidence and scope

The Orange Book connects risk management with objectives, governance, treatment, monitoring and decision responsibilities. This paper applies that governance principle to cash-control triggers and escalation. The source does not prescribe this paper's payment priority or replace transaction-specific interpretation of financing terms.

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

Conceptual waterfall specification

This illustrative conceptual order is a specification exercise. It is not an executed agreement or a recommended universal priority. A transaction must reconcile its actual terms and service needs.

Conceptual waterfall specification			
Stage	Question to resolve	Control or evidence	Insufficiency response
Starting pool	Which collected cash and balances enter?	Account ownership and permitted-use record	Exclude unavailable funds; identify the gap
Required service operation	Which uses preserve the accepted asset?	Technical plan and obligation review	Escalate a service-threatening unpaid claim
Protected balances	What funding and restoration is required?	Reserve purpose, target and access terms	Show depletion and restoration dependency
Dated financing claims	What service is due and when?	Validated schedule and accepted terms	Identify funded support or an unresolved default exposure
Optional uses and distributions	What permissions and forward tests apply?	Authorised decision and compliance evidence	Retain cash or obtain a defined exception

Trigger, measurement and action

An original conceptual control table separates a reported condition from the action it authorises.

Trigger, measurement and action			
Condition	Measurement boundary	Potential action	Question before implementation
Protection depleted	Actual permitted balance and purpose	Restrict discretionary use; diagnose cause	What terms govern replenishment and access?
Service cash weak	Accepted cash perimeter and dates	Escalate a funding or profile decision	Is the problem temporary or persistent?
Reporting incomplete	Required evidence and delivery date	Hold a decision dependent on that evidence	Who can verify and authorise release?
Exceptional support proposed	Source, capacity, trigger and timing	Approve a bounded contribution or transition	Does support change the financing thesis?

Cash-control acceptance

Approve the mechanism only when the starting pool, priorities, permissions and insufficiency responses are defined and reconciled to operating needs and applicable terms.

1. Define the cash pool and distinguish restricted balances.
2. Reconcile each required claim with the accepted technical and legal perimeter.
3. State the event, measurement and authority for every material control change.
4. Test an insufficient-cash path without hiding unpaid obligations.

A rigid waterfall can obstruct useful action

Detailed cash controls can slow an operator's response and impose administrative cost. This is a strong objection where operating decisions are frequent, small and well governed. The response is proportionate delegated authority with evidence and escalation, rather than removing the visibility of cash uses on which financing protection depends.

No legal priority is established

This chapter is a conceptual governance specification. The capital app does not calculate account balances, covenant actions, sweeps, distributions or cure rights. Actual priority and permissions require transaction-specific legal interpretation, an operating perimeter and a separately validated waterfall model.

Decision implications

- Define the starting pool before ordering claims.
- A trigger needs a measurement, authority and action.
- Show unpaid obligations explicitly when cash is insufficient.

GOVERNANCE AND APPLICATION

14

A downside is not a probability

A scenario evidence protocol and prohibited inference list

Keep calculation and likelihood separate

A deterministic downside answers what the specified schedule does under a specified change. It does not answer how likely that change is. The distinction is central to honest financing analysis. A severe case can expose a weakness, identify a funding need or test an intervention without having a measured probability. Calling the case probable requires a separate evidence basis. The committee should retain separate columns for the

event description, plausibility reasoning, numerical assumptions and any supported likelihood. This prevents a transparent stress from acquiring empirical authority through a familiar label.

A base case also has an epistemic status. It can represent an expected operating path, a planning convention, a lender's selected funding basis or a sponsor's preferred proposal. These uses should not be interchangeable. A case chosen for financing prudence may deliberately differ from an unbiased expectation. A case used for operating planning may contain stretch objectives. The author should state what the case is intended to do and what evidence supports its material inputs. A label such as realistic does not define a forecast method or establish that adverse conditions have been adequately considered.

Scenario plausibility comes from mechanism coherence and relevant evidence, not merely from numerical severity. A delayed ramp can be plausible if customer or operating readiness depends on unresolved milestones. A sustained margin pressure can be plausible if required input costs lack pass-through. A combined case can be plausible if a common event affects several parts of the system. The analyst should explain that chain. Combining the worst independent value of every line can create a severe hypothetical schedule while offering little insight into an event that could actually occur. Its usefulness should be described accordingly.

Empirical likelihood requires an appropriate population, measurement and inference. Historical outcomes from different assets, contractual structures or jurisdictions may not describe this project. A small or selected sample can be especially weak for rare failures. The committee should ask what is counted, how comparable it is and what uncertainty remains in the estimate. This paper supplies no empirical failure distribution. Its frozen studies are deliberately authored illustrative schedules. Their calculated outputs can be reproduced exactly, while the future likelihood of the corresponding project events remains outside the evidence claimed here.

Sensitivity is useful for identifying decision dependence. Moving a discount assumption while holding cash constant can show whether valuation is sensitive to that chosen input. Changing an operating cash schedule can show whether coverage or value has little margin. Neither exercise automatically yields a probability. The analyst should distinguish an input range chosen for exploration from a range justified by evidence. A committee can use the exploration to prioritise diligence even when the probability is unknown. The conclusion is that the decision depends on the unresolved input, not that the explored value has been measured as likely.

The public app separates a rate sweep from its mechanical operating downside. The rate sweep holds the cash schedule constant and changes the valuation rate. The operating downside applies a specified rule to future cash and supplied cash available while retaining service inputs. These tests answer different questions. The first examines valuation dependence on a preference or rate assumption; the second examines a cash-pattern change. A result from either should retain its method label. Describing a lower valuation caused by a higher rate as an operating loss would confuse the event and the analytical perimeter.

The combined-pressure fixture changes the initial outflow, early ramp, mature operating cash and supplied service together. It is a deliberate stress study, not a claim that those changes share a measured correlation. The inputs are published so the reader can challenge whether the combination is useful for a particular decision. The case demonstrates how several adverse assumptions can interact in an otherwise simple cash system. It does not establish an actual construction overrun, customer delay or loan term. Its role is to identify what a committee would need to fund or redesign if a similarly shaped path were considered credible.

Correlation should not be inferred from scenario grouping. Putting several changes in the same fixture states that they are being tested jointly. It does not estimate statistical dependence among them. A probability model requires distributions, dependence assumptions and evidence or a transparent basis for expert judgment. A simulation can propagate those assumptions but cannot create the missing basis. The committee should know whether a combined result is an intentionally severe test, a coherent causal event or a probability-weighted estimate. These categories can all be useful, but they justify different conclusions.

Reverse stress can help when the committee wants to understand the failure boundary. Rather than choosing a broad downside and observing the result, the team can identify which conditions would cause the specified obligation or decision test to fail, then investigate whether those conditions are credible. This is a decision method, not a feature calculated by the public app. It should retain the accepted cash definition and response mechanism. A failure boundary can guide evidence collection and monitoring even when no reliable probability exists. It should not be described as a measured tolerance without a validated calculation and input basis.

Scenario ownership improves accountability. The operator may be best placed to describe an outage path; commercial teams can explain collection or demand mechanisms; treasury specialists can define rate and currency conventions; technical advisers can examine completion and

replacement. The financial analyst assembles a coherent cash path but should not silently replace specialist judgment with arbitrary multipliers. The committee should identify who accepted each mechanism and where disagreements remain. This makes a scenario reviewable and prevents the authority of a polished model from hiding the absence of responsible input owners.

Decision language should match the evidence. A result can support the statement that a supplied schedule produces a specified valuation or coverage value. It can support the inference that a dated cash gap needs a funded response within that illustration. It cannot by itself support a claim that a real project will fail, that financing will be available or that a protection is legally effective. The committee package should state the strongest supported conclusion and the conditions under which it would change. This restraint makes the analysis more useful because the reader can distinguish calculation from judgment.

Scenario review should preserve adverse evidence instead of negotiating it away. A sponsor may reasonably challenge assumptions that are inconsistent with the actual service or contract. The response should be to correct the mechanism and show the revised result. A challenge based solely on discomfort with the output should not justify replacing an input. The record should state the reason for a change, the supporting evidence and the decision effect. This allows a committee to understand whether a downside became less severe because knowledge improved or because the proposed tolerance was reduced without explanation.

Monitoring should convert scenarios into observable conditions where possible. A delayed-ramp scenario can identify readiness milestones; a collection scenario can identify invoice acceptance and overdue cash; a cost scenario can identify quantities, prices and required work. The scenario assumptions should not remain detached from operations after approval. When a leading condition moves, the team can revisit the relevant cash path before the service date becomes threatened. This preserves the original analytical purpose: identify an event, understand its cash consequence and make a decision while response options remain available.

The practical protocol is to publish the case purpose, changed inputs, held constants, mechanism, evidence status, decision consequence and prohibited inferences. A reviewer can then reproduce the output and assess whether the assumed path is relevant. No single case label should carry all of that meaning. The committee should accept uncertainty explicitly where it cannot be measured, choose a funded response where

warranted and refuse unsupported claims of probability. A downside gains authority through traceable assumptions and coherent reasoning, rather than through an invented likelihood.

Evidence and scope

The Green Book links options appraisal with risk, uncertainty and later monitoring and evaluation. This paper applies that separation to scenario purpose and decision dependence. The UK public-appraisal framework is not treated as a universal private financing standard or a source of probabilities for the illustrative cases.

Evidence: The Green Book

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

Canonical sensitivity and stress method

Sensitivity holds every cash flow constant while moving the discount rate; the operating stress changes future cash flows and CFADS by 20%. First undiscounted recovery uses exact canonical decimal cumulative cash balances and within-period interpolation. Later deficits do not erase the first recovery.

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

Joint adverse assumptions without invented likelihood

The combined-pressure study is a deliberately authored illustrative fixture. Inputs change together; no empirical correlation, probability or actual transaction is claimed. Its output must be read with the full published cash schedule.

Joint adverse assumptions without invented likelihood					
Study	Initial cash outflow, USDm	Early CFADS, USDm	Supplied service, USDm	Project NPV, USDm	Minimum DSCR
Foundation	-240.00	40.00	36.00	183.05	1.11
Combined pressure	-288.00	12.00	50.00	12.49	0.24

Scenario evidence protocol

A scenario is admissible for a stated decision when its mechanism, inputs, held constants and evidence status are visible. A probability claim requires an additional justified inference basis.

1. State whether the case is a plan, financing basis, isolated sensitivity or joint stress.
2. Record the causal event and each affected cash link.
3. Separate exploratory ranges from empirically supported ranges.
4. Publish the decision consequence and the inferences the result cannot support.

Judgment can be valuable without measured likelihood

An experienced team may recognise plausible failure mechanisms before sufficient comparable data exist to estimate probability. Refusing all such cases would weaken decision preparation. The appropriate response is transparent judgment, scope and sensitivity. The case can support a preparedness decision while its likelihood remains unknown.

Deterministic outputs are not risk distributions

The app contains no empirical probability model, correlation estimator, Monte Carlo simulation or reverse-stress solver. Its frozen cases and sensitivities are reproducible deterministic calculations. Any probability or failure-boundary analysis requires separate evidence and a validated method.

Decision implications

- A severe case does not have a probability merely because it is quantified.
- Joint changes state a scenario, not statistical correlation.
- Convert the scenario into observable conditions and an explicit decision.

GOVERNANCE AND APPLICATION

15

Capital resilience can conflict with equity return

A sponsor-lender comparison with an explicit preference boundary

Make the trade-off explicit

Capital resilience can conflict with the timing and size of sponsor returns. Restricting distributions, funding reserves, reducing obligations or staging commitment can improve the ability to meet service while changing equity incidence. The parties should understand this trade-off before treating resilience as a universally shared objective. A financing proposal

needs both an acceptable cash path and participants willing and able to fund it. The analytical task is to make the trade-off explicit, distinguish project value from sponsor cash and identify the preference boundary at which the proposed structure ceases to be executable.

Unlevered project value concerns the asset's cash before financing under the stated perimeter and valuation assumption. Equity return concerns cash contributed and received by equity holders after financing and other required uses. These are different cash-flow series. A project IRR cannot be relabelled as an equity IRR because the structure includes debt. The public capital app computes values and admissible returns from its supplied unlevered series; its coverage inputs are independent. It does not calculate sponsor distributions or equity returns. This boundary is essential when interpreting the illustrative studies.

Leverage can change the allocation of gains and losses without changing the underlying service asset. It can reduce the sponsor's initial contribution under a complete funding plan while introducing service obligations and control conditions. The effect on equity depends on the full calendar, financing cost, distributions, reserves and contingencies. A broad statement that more debt improves equity return is inadequate for a particular structure, especially where early cash is restricted or downside support is required. The committee should ask which sponsor cash series supports the claim and whether all commitments are included.

Reserve funding can shift cash from an early distribution into a protected purpose. The sponsor may receive less cash initially while benefiting from continuity if the reserve prevents a financing interruption. The trade-off depends on the purpose, funding source and future restoration claims. A sponsor can prefer another arrangement, such as a different scale or a verified contingent contribution, but the proposed alternative should be examined for timely availability and incentive effects. The financing team should not portray protection as free or treat sponsor reluctance as evidence that protection has no decision value.

Distribution lock-ups can preserve cash during uncertainty while altering the sponsor's planning. An equity holder may rely on proceeds to fund other commitments. The committee should understand whether the sponsor can absorb a delayed distribution and whether that dependence threatens its ability to meet future project obligations. A resilient project structure can still face sponsor-capacity problems if contributions depend on cash from the same project. The source acceptance record should therefore assess funding capacity separately from a sponsor's expected return. Willingness to invest and ability to fund adverse timing are related but distinct propositions.

The sponsor's time preference matters when comparing alternatives. A larger project with more distant cash can have a higher unlevered value under one discount assumption while requiring more initial commitment and exposing capital for longer. A smaller project can preserve flexibility but deliver a different service scope. The public flexible-scale fixture illustrates a different commitment and cash profile; it does not establish technical equivalence to the foundation asset. The committee should avoid using its favourable coverage as proof that scaling down preserves every benefit. Scope, service and financing consequences must be appraised together.

Optionality can be valuable when uncertainty is resolved through operation. Staging capital can allow the sponsor to learn about demand, cost or performance before extending exposure. Yet a stage can lose economies of scale, delay benefits or create an asset that cannot perform the required service independently. The analysis should identify whether each stage has a coherent operating and funding perimeter. A nominally flexible plan can remain effectively irreversible if later expenditure is necessary to make the initial investment useful. The committee needs to understand the actual decision option, not merely the existence of several budget phases.

Sponsor and lender objectives can align around service continuity while diverging over residual cash. Lenders may prioritise dated payment and protection; sponsors may value distributions, growth and flexibility. Users and public payers may prioritise affordable reliable service. The financing package should show how the proposed rules affect each party. An arrangement that shifts every adverse effect to users or public support can preserve private returns while weakening the wider service system. A capital-resilience decision should therefore consider incidence beyond the project company's ratio, while retaining a clear boundary about what the financing model actually measures.

The sponsor's incentives after commitment deserve attention. A structure that leaves little capital at risk or rewards early cash extraction can alter effort toward long-term service. A structure that imposes excessive restrictions can discourage necessary investment or make participation unattractive. The committee should examine the actual rights, responsibilities and cash consequences with appropriate advisers. This paper does not infer behaviour from a single leverage number. It proposes an incentive review that asks what action each party can take, what cash it receives and what loss it bears when the service or financing thesis deteriorates.

Downside support should be included in sponsor incidence. A proposal can present attractive expected distributions while assuming that the sponsor supplies cash during stress. If that support is a meaningful obligation, the expected-return presentation should not omit its scope and capacity requirements. A deterministic downside contribution is not a probability-weighted cost unless a separate justified likelihood exists. It is still an exposure the sponsor may need to fund. The committee should show the required resource under the scenario and ask whether the sponsor can meet it while retaining other commitments.

Value-for-money and affordability perspectives can challenge a financing proposal from outside the equity series. A privately attractive arrangement can require public payments or user charges that are difficult to sustain. A socially valuable asset can lack adequate collectible cash without an explicit support decision. The analysis should preserve these distinct conclusions. Improving sponsor return does not establish public affordability; improving coverage does not establish social value. A financing committee should understand which institutional objective it is deciding and which other approvals are required, instead of allowing a strong metric in one perimeter to answer every question.

Preference boundaries should be written plainly. A sponsor can state that a proposed commitment is acceptable only with a specified distribution path or exposure limit, while a lender can state that its proposed service requires defined protection. The team can then examine whether an overlapping structure exists. If not, the response may be to redesign scope, bring another source, revise expectations or stop. Concealing the gap through an optimistic cash assumption does not create agreement. A documented boundary helps negotiations focus on real trade-offs rather than contesting a model whose inputs have been adjusted to please every party.

The illustrative comparison should therefore be read as an options prompt. The smaller commitment has its own supplied cash and service profile, and the foundation retains a different outflow and operating series. Their project values and coverage can be reproduced, but the result does not choose the better actual asset. The committee would need service benefits, technical feasibility, commercial evidence and sponsor incidence for that choice. The analytical value is to show how reducing commitment can change the cash margin, while keeping the cost of lost scope and any remaining dependencies visible for further appraisal.

The chapter's decision framework asks whether the proposed resilience protections are funded, accepted and incentive compatible. It records which party bears each restriction or contribution, what cash series

supports a return claim and what alternative changes that incidence. A complete recommendation may accept a lower near-term sponsor return to preserve a credible long-horizon service, or may prefer a different scale or financing route. The judgment should be explicit. Capital with a long horizon is useful when it supports a defensible operating and institutional choice; the horizon is not itself a reason to demand unlimited patience from every participant.

Evidence and scope

OECD's infrastructure-governance guidance links project selection with evidence, funding and affordability for budgets and users. This paper uses that public perspective to challenge a financing recommendation whose private cash measures omit incidence on other parties. It does not infer an actual project's social value or affordability.

Evidence: Infrastructure governance

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

A smaller commitment is a different option

The schedules are explicitly illustrative and are not asserted to provide technically equivalent service. Values compare the supplied unlevered cash series; no equity-return or debt-capacity result is implied.

A smaller commitment is a different option					
Study	Initial outflow, USDm	Mature CFADS, USDm	Supplied service, USDm	Project NPV, USDm	Minimum DSCR
Foundation	-240.00	52.00	36.00	183.05	1.11
Flexible scale	-180.00	42.00	28.00	161.08	1.21

Who bears the protection

The original conceptual matrix records incidence rather than asserting a universal preferred structure.

Who bears the protection			
Mechanism	Potential resilience benefit	Sponsor or wider incidence	Acceptance question
Funded reserve	Resources for a defined interruption	More initial funding or less early distribution	Is purpose and restoration worth the funded cost?
Distribution restriction	Cash remains available before uncertainty resolves	Delayed sponsor receipts	Can the sponsor meet its own commitments?
Reduced obligation	More room in the service calendar	Different funding source or lower initial finance	Is replacement capital credible?
Staged asset	Learning before further commitment	Possible scope loss, delay or higher unit cost	Does each stage provide usable service?
Public or user support	Additional collectible cash or protection	Budget or customer burden	Is the transferred incidence affordable and authorised?

Sponsor-lender preference boundary

Approve a structure only when its protections have a source and the required participants accept their incidence. Return claims should be based on the correct cash perimeter.

1. Separate unlevered project cash from actual equity contributions and distributions.
2. Include required protection and downside support in the incidence record.
3. Identify sponsor, lender and wider-service preference boundaries.
4. Reappraise alternatives that change scope rather than assuming technical equivalence.

Resilience can be overpriced

Retaining excessive capital or imposing inflexible restrictions can reduce useful investment and sponsor participation. A sponsor can reasonably prefer a defined exposure over expensive protection. This is a strong argument for proportionate safeguards and alternative comparison. It does not justify omitting the exposure or relabelling project returns as equity returns.

No sponsor return is calculated

The app's IRRs and NPVs belong to the supplied project cash series. It does not compute equity contributions, distributions, tax effects, reserve incidence or support probabilities. Actual sponsor returns and wider affordability require additional defined models and evidence.

Decision implications

- Project value, equity return and wider affordability use different perimeters.
- Protection has a source, cost and incidence.
- A smaller commitment changes an option; it does not prove equivalent service.

GOVERNANCE AND APPLICATION

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Support changes obligations as well as risk

A support-incidence matrix and approval conditions

Protection has a provider and a boundary

Financial support changes the party or source expected to bear an exposure. It can make a service financeable when ordinary project cash is insufficient or when a risk cannot be accepted by the proposed private participants. It can also introduce conditions, contingent liabilities and incentives that require their own decision. The analysis should therefore begin with the exposure being addressed, then specify who supplies support, what triggers it, when cash arrives and what claims follow. A support label is not evidence that an adverse event disappears or that all project obligations are protected.

An upfront contribution differs from a contingent promise. A grant or equity contribution can fund defined uses before exposure, subject to eligibility, release and control conditions. A guarantee can promise payment after a specified event, with a process that may affect timing. A liquidity facility can provide funds under its terms while creating repayment or replenishment claims. The financing model should preserve these distinctions. A dated gap can remain even when eventual compensation is expected. The committee needs to know whether support prevents the gap, funds it when it occurs or reimburses another party after it has already funded the interval.

The supported obligation should be precise. Protection of a public payer's contractual payment is different from protection of project debt or construction completion. A mechanism covering a defined amount may leave operating costs, fees or later periods outside its scope. The project should identify the beneficiary and the conditions for a valid claim. An assumption that a broad guarantee protects every cash-flow failure can

materially overstate resilience. The appropriate legal and institutional teams should assess scope, while the model implements the accepted interpretation and retains unresolved conditions as dependencies.

Timing is often the most important bridge from protection to usable cash. A claim can require notification, evidence, a waiting period or a determination. Those steps may be appropriate, yet the project still has to meet operating and lender obligations during the process. A separate liquidity source may be needed until support is released. The analyst should not assume instantaneous payment unless the actual arrangement establishes it. The committee should see who funds the interval and what happens if the claim is disputed or takes longer than the planning assumption.

Support capacity requires evidence about the provider, not merely the recipient's need. A sponsor undertaking can exceed the sponsor's readily available resources. A public commitment can require authorisation, budget treatment or administrative action. An institutional product can have eligibility and approval conditions. The public paper does not assert that any source is available to an actual project. It asks the transaction team to establish capacity, authority and timing before treating support as an accepted source. A provider's reputation can inform diligence, but it does not replace the specific commitment the cash schedule relies upon.

Cost incidence should remain visible. A support mechanism can require fees, reserves, contributions, counter-guarantees or later claims. Even an apparently concessional source uses resources that have alternative purposes. The model should identify who pays those costs and when they reduce available cash. Support should not be added after valuation or sponsor-return analysis as though it were free. Where costs or conditions remain unresolved, the committee should state that the supported structure is conditional. The protection's benefit and its incidence belong in the same decision record.

Public support requires a fiscal perspective in addition to the project perspective. A guarantee can improve private repayment confidence while creating an obligation for a government if the defined event occurs. An off-balance-sheet presentation does not erase that cash consequence. The relevant public authority needs to assess authorisation, exposure, monitoring and affordability under its applicable framework. This paper offers no fiscal risk estimate or legal conclusion. It preserves the analytical boundary: a better project ratio can transfer risk to a public balance sheet rather than eliminate risk from the service system.

Subordinated capital can provide resources and alter payment priority, but subordination does not necessarily mean that claims disappear. Interest, repayment, conversion or other rights can affect later cash and sponsor incidence. A financing model should reconcile the source's actual terms to the waterfall and forecast horizon. A source counted as equity for one purpose may remain a cash claim for another. The committee should avoid relying on classification labels without a terms bridge. The analytical question is what cash becomes available now and what obligations or control rights arise later.

Guarantee triggers should connect to the risk allocation the committee intends to accept. An unconditional promise can weaken incentives or create excessive exposure; an excessively narrow trigger can leave the intended failure unprotected. The parties should define the event, evidence, calculation and claim authority. The model should not settle these choices by inserting a support receipt wherever a negative cash balance appears. Doing so creates a circular protection: the model pays because the model needs cash. A real mechanism needs an independent trigger and a provider authorised to act under it.

Support can change behaviour before any payment is made. If a private party expects losses to be absorbed elsewhere, its incentives to prevent or correct the event can change. If a provider can withhold support unpredictably, the beneficiary may underinvest in useful service. Governance should therefore consider monitoring, conditions and residual capital at risk. This is an analytical incentive question, not a claim that a particular guarantee produces measured moral hazard. The committee should identify who controls the relevant action and who bears the financial consequence under the supported structure.

Additionality should be stated as a counterfactual decision argument. A source may claim to enable investment that ordinary finance would not support, or to improve a service whose benefits exceed collectible cash. The team should explain what changes because support exists and what would happen without it. A support mechanism that merely increases distributions under an otherwise viable structure presents a different public or institutional rationale. The committee should evaluate the stated objective rather than assume all mobilisation is inherently sufficient justification. The project's financing improvement is a result to examine, not the full purpose of the support decision.

Exit and expiry conditions require a long-horizon view. A temporary guarantee can help during construction or ramp-up while leaving later obligations exposed. A grant-funded asset can still need ongoing maintenance or renewal. A liquidity facility can expire before a stress path

restores cash. The model should identify the transition away from support and the conditions that make it credible. Where continued support is expected, that expectation should retain its status and incidence. A long operating forecast should not silently extend a source beyond the period for which it has been established.

Support monitoring should track obligations as well as disbursements. The provider needs to know what exposure remains, whether conditions are being met and which events could trigger a claim. The recipient needs to know what cash is available and what claims or restrictions follow use. A shared record can improve coordination, but each institution retains its own authority and objectives. The financing team should not assume that an approval by one party satisfies the governance requirements of another. The public version can explain the mechanism without disclosing private terms or confidential capacity evidence.

The practical decision is a support-incidence acceptance. Identify the failure being addressed, the beneficiary, provider, trigger, cash calendar, costs, residual exposure and expiry. Then test whether the supported structure remains coherent when the source is delayed, limited or unavailable under the stated conditions. If support is essential, its unresolved status should be a financing condition rather than an optimistic note. The committee can approve an authorised and bounded transfer of risk. It should not approve the fiction that protection has no provider obligation, price or institutional consequence.

Evidence and scope

The World Bank government-guarantees guidance discusses contingent public obligations, fiscal prudence and the costs of providing support. This supports examining public incidence alongside project financing benefit. It does not establish guarantee pricing, authorisation or fiscal capacity for any actual project in this paper.

Evidence: [Government Guarantees](#)

Evidence and scope

The World Bank guarantee-mechanisms page identifies unclear triggers, inadequate pricing and fiscal exposure as design issues. The page is under publisher enhancement, so this paper uses it only for conceptual questions about scope and control. Current product terms or availability are not inferred.

Evidence: [Guarantee Mechanisms in PPPs](#)

Support-incidence specification

A conceptual completed sheet illustrates a payment-support mechanism. It does not describe an actual guarantee or claim that a provider has accepted the obligation.

Support-incidence specification		
Element	Conceptual specification	Evidence before acceptance
Risk addressed	Delay or failure of a specified payer obligation	Accepted risk allocation and payment perimeter
Provider and beneficiary	Named roles required in an actual transaction	Capacity, authority and beneficiary eligibility
Trigger and process	Independent event, evidence and claim procedure	Legal and operational reconciliation
Cash timing	Expected support arrival shown separately from service due	Funded bridge during a claim process
Costs and residuals	Fees, limits, expiry and later claims retained	Treasury, fiscal and sponsor incidence review

Support is a set of different mechanisms

The original conceptual table preserves source timing and the obligation that follows use.

Support is a set of different mechanisms		
Mechanism	Potential contribution	Continuing question
Upfront grant or contribution	Funds eligible uses before exposure	Release conditions, purpose and lifecycle funding
Payment guarantee	Protects a specified payment mechanism	Trigger, beneficiary, claim timing and provider exposure
Liquidity facility	Funds a defined cash interval	Access, repayment and expiry
Subordinated source	Adds resources with a different priority	Later claims, classification and control
Sponsor undertaking	Allocates a defined responsibility	Capacity, authority, timing and enforceability review

Approval conditions for support

Treat support as an accepted source only when its scope, capacity, authority, timing and incidence are established for the decision. Retain a separate bridge when support arrives after the protected payment.

1. Specify the exact exposure and intended beneficiary.
2. Verify provider resources and authority through appropriate evidence.
3. Reconcile independent triggers, process and cash arrival.
4. Show cost, residual risk and the transition at expiry.

Support can correct a real financing mismatch

A project can create valuable service while facing risks that private parties cannot reasonably manage or collectible cash that does not capture wider benefits. Bounded support can therefore be justified. The strongest objection to this chapter would be that excessive procedural caution blocks useful investment. The response is proportionate evidence and clear incidence, not an assumption that every protection is immediately available or costless.

No guarantee or fiscal model is supplied

The app does not calculate support payments, eligibility, claim delays, fiscal exposure, guarantee fees or legal enforceability. The chapter supplies a specification and incidence framework. Actual support acceptance belongs to the authorised parties and requires appropriate financial, legal and public-sector review.

Decision implications

- Support moves a defined exposure and can create another obligation.
- A claim entitlement and timely liquidity are different protections.
- Show public, sponsor and provider incidence alongside project benefit.

GOVERNANCE AND APPLICATION

17

Contracts and models must describe the same project

A contract-to-model challenge sheet for advisers

The same project in words and numbers

Contracts and models should describe the same project. A model assumes when work completes, when service earns payment, how costs adjust, what happens during interruption and what cash remains at termination or expiry. Agreements define rights and obligations that can support or contradict those assumptions. Reconciliation should occur through a

proposition-level challenge sheet rather than a broad statement that the project is contracted. The committee needs to know which model assumption has been checked, what interpretation was accepted and which conditional event still controls the cash consequence.

The technical perimeter is the first reconciliation point. A contract can procure a defined asset or service while the financial model assumes a broader performance envelope. An omitted connection, enabling facility or operating requirement can create expenditure or delay outside the headline agreement. The analyst should reconcile the scope of each delivery and operating relationship to the asset described in the cash forecast. A fixed-price promise for a limited scope does not cover every use in the financing bridge. The challenge sheet should identify who owns each interface and how completion is demonstrated.

Completion language should be connected to receipts. A physical delivery milestone, acceptance test, licence or commercial-operation definition can each determine a different obligation. The model should not assume that the final contractor payment establishes the right to invoice customers. Legal, technical and commercial reviewers should identify the event that produces usable service and collectible cash. Where the events differ, the commissioning bridge should include the interval. The contract-model reconciliation then becomes a direct test of funding adequacy, rather than a document-review exercise detached from the financial calendar.

Payment entitlement should be mapped through measurement, invoicing, acceptance and collection. An agreement can define a tariff or availability payment while retaining deductions, disputes or conditions. The model should implement the accepted mechanism and state where assumptions remain about timing or performance. It should also preserve the distinction between a claim that can eventually be pursued and cash available at a service date. A payment promise is useful evidence, but its operational path matters. The committee should know whether the forecast relies on full compliance, prompt acceptance or unresolved counterparty capacity.

Adjustment provisions require a terms bridge. A cost or currency pass-through can have a reference basis, lag, approval, cap or threshold. Applying a general index to model revenue may not implement the actual arrangement. The reviewer should identify what adjusts, when it adjusts and who bears the interval. If the provision covers only part of the cost perimeter, the residual should remain visible. A model can be mathematically precise while applying the wrong adjustment boundary.

The reconciliation should therefore show a small transparent worked mechanism in the transaction record before its result is embedded in the full forecast.

Performance remedies can change cash and incentives differently. A deduction can reduce a payment; a damages claim can create a contingent receipt; a correction obligation can require expenditure; termination can change the entire horizon. The model should not treat every remedy as immediate compensation restoring the base case. The analyst should identify trigger, measurement, limit, timing and responsible party with appropriate advisers. A remedy may be legally important while offering limited short-term liquidity protection. Its financial role should be described within that boundary rather than counted as cash whenever the model experiences a loss.

Liability limits and exclusions can leave residual exposure with the project. The existence of a contractor, supplier or operator does not mean that every loss is passed to that party. The challenge sheet should identify which assumed recovery is supported, what limits apply and whether the counterparty has resources to meet it. The public paper discloses no private contract and offers no legal interpretation of actual terms. It identifies the question a financing team must resolve before treating compensation as an accepted source. A generic reference to contractual protection is insufficient for a material cash assumption.

Termination assumptions are especially prone to perimeter confusion. An agreement may define compensation under particular causes, dates and conditions. The model may contain a terminal value intended to represent asset disposal or continuing service value. Those are not automatically equivalent. The analyst should identify which event produces each assumed receipt and what obligations or deductions precede the amount available. The committee should understand whether terminal cash is a contractual source, a valuation assumption or an illustrative residual. A single closing cash-flow line should not quietly combine incompatible end states.

Operating rights and renewal should be reconciled to the forecast horizon. A model can extend cash beyond the period for which rights have been established, perhaps on an assumption about renewal or continued use. Such an assumption may be relevant, but it should retain its status and conditions. The financing calendar should identify which obligations rely on that later cash. A physical asset's remaining life does not itself establish a right to earn revenue. The transaction review should examine the actual perimeter of service, access and transfer, with appropriate legal and commercial judgment.

Counterparty performance remains a separate evidence question. An accepted obligation can establish what a party is required to do while leaving uncertainty about its ability or willingness to perform. The financing model should not collapse legal entitlement and operating availability into the same confidence statement. The relevant review includes technical capacity, resources, incentives and response options. Where the project depends on a critical counterparty, the committee should identify the fallback if performance fails. A model that continues the base cash after a counterparty interruption needs an explicit restoration or substitution mechanism.

Changes after approval require a reconciliation update. A contract amendment can alter scope, milestones, price, adjustments or remedies. A revised model can reflect a change that has not been accepted in documents. The team should maintain a bridge showing the proposition, old basis, new basis and decision effect. This avoids a situation in which the legal team and finance team each work correctly on different projects. The committee should know which edition it approved and what change requires further authority. Version labels matter because they preserve the meaning of the commitment, not merely because they organise files.

The challenge sheet should distinguish express terms, specialist interpretation and analyst assumption. A reviewer can point to a clause that expressly describes a payment event. Applying that clause to a disputed situation may require interpretation. Estimating the time to collect after that event may remain a financial assumption. These categories should be visible in the model ledger. A confident paraphrase of a clause should not convert all downstream timing into contractual fact. The practical benefit is that each unresolved question reaches the adviser or decision owner able to address it.

Public communication should retain the analytical mechanism while respecting disclosure boundaries. An illustrative contract map can explain completion, payment, adjustment and termination questions without publishing confidential terms or identifying a client. A private transaction record can contain the exact documents under appropriate controls. The public paper's source cards are public institutional guidance, and its scenarios are authored examples. Readers should not infer that a concealed executed agreement supports the illustrations. The distinction preserves both privacy and epistemic honesty: public claims should be supported by the public evidence actually available to readers.

The committee decision should close the material reconciliation gaps or condition exposure on their resolution. A document-review conclusion such as generally bankable is less useful than a list of accepted propositions

and remaining cash dependencies. The recommendation should identify the model line affected, the relevant event, the owner and the evidence required. If a gap can change completion funding, service cash or maturity resources, it should have a clear decision consequence. The model then becomes an implementation of accepted assumptions and terms, while the challenge sheet preserves the reasoning that gives those inputs authority.

Evidence and scope

The World Bank infrastructure-finance guidance describes the contractual complexity of project finance and its reliance on project cash flows. This paper uses that relationship to motivate a proposition-level contract-to-model reconciliation. The source does not validate any executed agreement, remedy or cash-flow assumption in these illustrations.

Evidence: Infrastructure Finance

Contract-to-model challenge sheet

This conceptual completed record contains no private clause or actual client term. Its value is the link between an accepted proposition and the cash assumption affected.

Contract-to-model challenge sheet			
Model proposition	Term or evidence to reconcile	Unresolved question	Decision consequence
Receipts begin after completion	Delivery, acceptance and commercial-operation events	Which event permits invoicing and collection?	Fund the commissioning interval or hold exposure
Costs adjust with receipts	Adjustment reference, frequency and approval	What residual and lag remain?	Test the cash mismatch rather than assume full pass-through
Interruption is compensated	Trigger, remedy, limit and collection process	Is compensation timely and collectible?	Retain liquidity and residual operating exposure
Terminal cash is available	Expiry, termination or disposal basis	Which end state does the receipt represent?	Keep alternatives separate and challenge reliance
Forecast rights continue	Operating, access and renewal perimeter	What later cash remains conditional?	Reconcile tenor and maturity funding

A term does not establish every downstream assumption

The original conceptual table prevents the evidence status of a clause from spreading automatically to interpretation and collection timing.

A term does not establish every downstream assumption		
Status	What it can establish	What remains
Express term	A stated obligation or mechanism in the reviewed document	Its application, conditions and performance
Specialist interpretation	An accepted reading for a specified situation	Scope limits and unresolved disputes
Financial assumption	A selected cash or timing path for analysis	Sensitivity and evidence needed for acceptance
Verified event	A documented occurrence such as acceptance or collection	Its relevance to later expectations

Material reconciliation gaps have consequences

Hold or condition a commitment when an unresolved term or interpretation can alter completion funding, collectible cash or maturity resources. The model should implement an accepted proposition, not decide the proposition by formula.

1. Name the model line and the event it assumes.
2. Distinguish express terms, interpretation and financial timing assumptions.
3. Assign each gap to the competent reviewer and acceptance authority.
4. Preserve the edition and update the decision when terms or scope change.

Complete reconciliation can be impractical early

An early project may lack final documents, and detailed clause-level review before scope is stable can consume resources unnecessarily. A preliminary mechanism map can be sufficient for a reversible planning decision. The final binding commitment still needs the material propositions resolved or an explicit condition preserving the ability to stop.

No private agreement or legal opinion

The chapter contains conceptual questions and public source guidance. It does not publish private agreements, determine enforceability or interpret a specific transaction. The app does not implement contractual deductions, remedies, termination or renewal. Those matters require appropriate specialists and an accepted transaction model.

Decision implications

- Reconcile propositions and cash events rather than merely counting reviewed documents.
- Keep express terms, interpretation and collection assumptions distinct.
- A changed agreement or model can require a changed commitment decision.

GOVERNANCE AND APPLICATION

18

The committee should receive a decision package

An investment and credit committee memo template

From analytical outputs to a bounded commitment

A committee package should let an authorised decision-maker choose a bounded exposure. The central question is what can be committed now, under which conditions, with what consequence if the underlying proposition changes. A large model, document list and presentation can supply useful material without answering that question. The recommendation should state the choice, the evidence supporting it and the unresolved dependencies that retain a decision consequence. An analytical team has not finished its work merely because every discipline has submitted a report. It must connect those reports to the authority being requested.

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

This chapter follows the completed fictional case CR-DELAYED. Its Model Committee Chair authorises a maximum USD1.00m diligence exposure during the initial pre-service gate, for source verification, dated-cash reconciliation and recipient-term review. Implementation expenditure and financing commitment remain HOLD. This limited information-purchase mandate is separate from the project fixture's initial investment and from the conditional opening protection amount. No unprovided diligence expenditure is inserted into the project appraisal. The record states that omission instead of pretending that the fixture prices every decision cost. The named roles and deadlines below are authored conventions, not a real institution or agreement.

The investment thesis should be expressed as a causal chain. A service need supports a defined operating proposition; that proposition requires a delivery system; the system produces cash under specified rights and conditions; that cash supports obligations and the capital objective. Each link has different evidence. The committee should be able to see where a technical conclusion ends and a commercial assumption begins. A list of positive attributes conceals weak connections. A causal thesis makes the dependencies available for challenge and allows later monitoring to ask whether the original basis still holds.

The recommended structure should follow from the identified problem. If construction uncertainty governs the exposure, completion funding and conditions deserve prominence. If collection timing governs service reliability, the liquidity bridge deserves prominence. If operating rights constrain the horizon, maturity and end-state assumptions deserve prominence. A structure should not be defended simply because it resembles a familiar transaction. The package should explain the mechanism by which each material term responds to a particular risk, while showing residual exposure. That explanation prevents a long list of protections from substituting for a coherent financing judgment.

Interpret the base case through the evidence supporting its inputs. For demand, cost, contracts and debt capacity, the committee package should identify accepted facts, selected assumptions and conditional propositions, then explain the cash perimeter that connects them to present value and coverage. The calculation supplies the result of those specified inputs; the underlying evidence determines how much reliance the committee can place on it. A favourable result therefore belongs at a defined link in the decision chain. The recommendation should show which unverified input could change that result and which condition protects the institution while the input is tested.

The downside section should use mechanisms that can change the decision. Repeating a base case with arbitrary reductions can demonstrate mathematical sensitivity, but it may miss the relevant failure path. A delayed receipt, unfinished interface, unrenewed right or change in operating burden can require a different response. The package should identify what changes, what is held constant and which obligation becomes difficult. It should then connect the analytical result to an action that is operationally and institutionally available. A downside without an action owner is a description of exposure, not a control over it.

The recommendation should distinguish conditions precedent from ongoing obligations. A condition precedent prevents a commitment or use until a specified matter is accepted. An ongoing obligation governs

conduct after the exposure exists. They offer different protection. A promised future study cannot resolve a fact on which the institution is relying at the moment of commitment unless the remaining exposure is intentionally bounded. The package should identify the event that closes each condition, who can accept it and whether acceptance requires fresh committee authority. Vague conditions can create an appearance of caution while leaving the original gap unresolved.

Evidence gaps should retain their importance after being assigned. A register with an owner and due date can organise work, but the committee still needs to understand the consequence if the answer is adverse or late. Some gaps affect confidence around an otherwise robust choice; others determine whether the project can operate or pay. The record should separate those cases. An unresolved matter should not become immaterial merely because it appears in a long appendix. The package can prioritise it by showing the proposition affected and the point at which exposure would become difficult to reverse.

Risk allocation should be represented as a relationship between obligations and capabilities. Naming a party in a contract or register does not establish that the party can control the cause, meet the cost or provide cash at the relevant date. The package should connect the assumed allocation to authority, resources and response options. It should also identify interfaces where several parties depend on one another. A committee can then judge whether the structure concentrates risk with a capable party, divides it sensibly or leaves an important residual with the project. Counting allocated risks alone provides little basis for that judgment.

The funding recommendation should contain a sources-to-uses reconciliation appropriate to the decision stage. A preliminary package may show a range and the work needed to refine it. A binding commitment should implement accepted scope, timing and terms in a transaction model. The committee should see the difference between committed resources, conditional resources and assumed future receipts. A total that balances through an unidentified plug does not explain who will fund the project when the plug is needed. The recommendation should make the residual requirement visible and state whether the institution is being asked to bear it.

The committee should receive the strongest competing explanation. A positive project thesis can survive a serious counterargument, but only if the analysis addresses the mechanism rather than the tone of the criticism. A competing delivery option, smaller initial scope, shorter financing horizon or balance-sheet approach may offer greater flexibility. The

package should identify the circumstances in which that alternative would dominate. If the recommendation still stands, the reason should be explicit. This is especially useful when the proposal depends on a forecast far beyond the reliable evidence horizon. A committee can accept uncertainty while preserving the ability to learn and change direction.

The record should distinguish analytical confidence from the institution's willingness to bear exposure. A team can conclude that a proposition is poorly evidenced while the committee deliberately accepts a bounded speculative commitment. Conversely, a well-evidenced proposition can fall outside the institution's mandate or risk capacity. Those are different judgments and should not be merged into a single score. The package should show the state of evidence and the rationale for the chosen exposure separately. Doing so keeps later performance from rewriting what was actually known or intentionally accepted at approval.

The authority map should route each material variance to monitoring, correction, a waiver, suspension of further use or a return to committee. Set that route before the variance occurs. The accepted transaction model and documents should connect materiality to the affected mechanism and obligation, then name who can act, what evidence is needed and the response deadline. The route is useful only if it can deliver a decision while the corrective option remains available. Where the normal committee cycle is too slow, the package should identify an authorised interim response or hold exposure pending the required decision.

The package should leave an audit trail of accepted editions. Technical reports, commercial assumptions, terms and calculations can change during negotiations. A model hash alone is insufficient if the referenced scope or agreement belongs to a different version. The approval record should identify the coherent set of documents and assumptions that informed the decision. Later amendments should show which proposition changed and whether the change requires renewed authority. The purpose is not administrative perfection. It is preserving the meaning of the commitment when several teams continue developing the project after the committee has acted.

The closing recommendation should remain short enough to use. It can state the proposed exposure, accepted basis, material conditions, residual risks, competing option and return-to-committee triggers. Supporting chapters and annexes can carry the evidence. The decision-maker should not have to reconstruct the recommendation from dispersed qualifications. A package is effective when a reader can trace a material

condition to the proposition it protects, and trace an adverse change to the authority that will respond. That clarity converts analytical effort into a decision system while preserving the limitations of the underlying work.

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

Completed illustrative committee decision record

CR-DELAYED is a completed fictional decision record. D denotes an assumed first annual service boundary; its calendar date is not established. A uniform fictional business-day calendar is used only to make the gate and activation logic inspectable.

Completed illustrative committee decision record		
Decision field	Recorded entry	Evidence / status and authority
Current disposition	DILIGENCE ONLY; implementation and finance HOLD	Model Committee Chair owns acceptance and stop
Maximum exposed amount	USD1.00m; no automatic renewal	CR-MANDATE: fictional policy; stop at cap or deadline
Permitted use	Source verification, dated receipts and payments, recipient review	Diligence Coordinator logs uses; no construction or financing draw
Diligence interval	D minus 30 to D minus 10 assumed business days	CR-CALENDAR: fictional relative convention; actual D unresolved
Annual analytical requirement	Conditional stressed opening USD48.80m	CR-BRIDGE-STRESS: reproduced arithmetic only; funding unresolved
Alternative	Delayed service reprofile; terms held	CR-REPROFILE: reproduced app output; CR-RECIPIENT unresolved
Stop rule	Cap exhausted, evidence gate missed, invalidated cash perimeter or unacceptable terms	Chair stops authority; no implementation discretion delegated

Approve a bounded choice

Approve only the exposure described in the recommendation and only on its accepted evidence basis. Conditions should protect unresolved material propositions with a clear acceptance event and authority.

1. Name the commitment perimeter before presenting results.
2. Link each condition to the cash or operating proposition it protects.
3. State the strongest competing choice and when it wins.
4. Preserve the accepted editions and the route for material changes.

A concise package can hide complexity

A short recommendation can suppress important qualifications if it replaces access to the evidence. The committee should receive concise reasoning with traceable supporting records and sufficient time for challenge. The aim is an intelligible choice with inspectable support, not brevity as a substitute for diligence.

Authority remains institution-specific

Apply this conceptual record through the institution's governance, accepted documents and reviewed transaction analysis. It establishes no committee mandate, delegated power or financing approval. Numerical triggers must be transaction-specific; the framework supplies no universal threshold, interpretation of an executed covenant or assurance that a reported ratio is compliant. These common authority boundaries govern the monitoring design as well as the initial recommendation.

An evidence trail with a consequence

CR-DELAYED evidence/status register

VERIFIED ARITHMETIC refers only to the frozen illustrative model and diagnostic. UNRESOLVED denotes case materials deliberately absent from the fiction.

CR-DELAYED evidence/status register			
Evidence ID	Specific object	Status	Accountable role
CR-MODEL-DELAYED	Exact original project fixture and live app outputs	VERIFIED ARITHMETIC	Model Assurance Analyst
CR-BRIDGE-BASE	Annual retained-cash base path and restoration	VERIFIED ARITHMETIC	Model Assurance Analyst
CR-BRIDGE-STRESS	CFADS-stressed annual path and unpaid-service controls	VERIFIED ARITHMETIC	Model Assurance Analyst
CR-SOURCE	Source capacity, permitted draw and account access	UNRESOLVED	Protection Review Lead
CR-TIMING	Collection, payment and usable-cash timestamps	UNRESOLVED	Payment Verification Officer
CR-INCIDENCE	Fees, carrying cost, competing uses and loss bearer	UNRESOLVED	Finance Appraisal Lead
CR-RECIPIENT	Accepted revised service definition and terms	UNRESOLVED	Payment Verification Officer

At the start of the fictional diligence interval, the Model Assurance Analyst verifies the unchanged delayed project file and the appended bridge lineage. The base and stressed requirements are not competing

estimates from different assumptions left unspecified: the latter changes CFADS by the declared fixed factor while preserving service. The analyst records both and recommends the stressed amount for the Chair's selected exposure policy. This is a completed arithmetic finding. It is not a completed source-capacity finding, because the case deliberately supplies no funding offer, bank access record or account-use agreement.

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

At the evidence gate D minus 10 assumed business days, the Protection Review Lead has no accepted source and access evidence, and the Payment Verification Officer has no dated collection/payment reconciliation. The Finance Appraisal Lead also has no agreed carrying cost or loss-bearer record. The Chair therefore retains HOLD and terminates the limited mandate at its cap or gate, whichever arrives first. The verified annual balance is retained for future comparison, but it supplies no authority to commit implementation capital. The record is completed because it identifies the unresolved objects, owners and resulting action, rather than claiming that an unanswered worksheet has satisfied diligence.

The reprofile branch does not automatically replace failed protection. The Model Assurance Analyst has reproduced its improved coverage and unchanged positive stressed project value. The Payment Verification Officer still lacks recipient acceptance and a complete financing-price comparison. The Chair records TERMS HELD for that branch as well. If a recipient refuses the proposed later payments, the branch stops. If terms are later accepted, it returns for a new bounded decision with an updated date and exposure perimeter; it does not inherit approval from the exhausted diligence mandate. This explicit hand-off prevents an attractive computed ratio from authorising a materially different obligation calendar.

The adverse walk-through is intentionally unambiguous. Suppose the source has only the original base opening amount available under the fixed stress. The auxiliary calculation records unpaid early service. Suppose instead the larger conditional amount is nominally offered but usable cash arrives after the obligation. The annual model cannot resolve that date failure. In both cases implementation remains held, for different reasons. The first has a quantified annual insufficiency; the second has unresolved temporal availability. The record preserves that distinction because their cures and evidence owners differ. Neither later replenishment nor a positive project NPV pays an earlier unfulfilled obligation.

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

What would change the recorded HOLD?

A new submission must establish the chosen source's usable opening amount at least USD48.8om, permitted access before the relevant service payment, complete protection costs and incidence, and a dated reconciliation consistent with the appraisal perimeter. For the alternate reprofile route, it must instead establish accepted revised payment terms and the financing comparison. The Chair then makes a new bounded exposure decision. Even fully established conditions would make a branch eligible for that decision; they would not prove broader feasibility, bankability or project performance.

Decision implications

- State the exposure and its authority before describing attractive results.
- A condition needs an acceptance event and an adverse-answer consequence.
- Preserve the competing choice and the basis for returning to committee.

GOVERNANCE AND APPLICATION

19 Monitoring must retain the original thesis

An operating monitoring protocol linked to model inputs

Preserve the thesis and diagnose the changed mechanism

Monitoring should preserve the causal thesis accepted at commitment. A report containing actual receipts, costs and ratios can be accurate while leaving the decision-maker unable to explain a variance. The useful question is which proposition changed, whether that change is temporary or persistent and what response remains available. The monitoring record should therefore retain the accepted input basis, obligation calendar and evidence status. It should follow the project as an operating system, rather than replace the original thesis with a fresh narrative every time performance becomes uncomfortable.

The approved model is a reference, not an immutable description of reality. Its value in monitoring comes from a transparent bridge between the accepted assumptions and new evidence. The team should preserve

the original case, the current forecast and the explanation for each material movement. Overwriting the baseline can make every later forecast look internally consistent while destroying the ability to learn from the decision. A current model needs current inputs; a decision record also needs the history of what changed. Those functions should be connected without merging their editions.

Variance diagnosis should begin with the operating mechanism. A cash shortfall may arise from lower usable service, a changed customer mix, delayed acceptance, slower collection or a different cost perimeter. These causes can imply different responses even when the aggregate loss is similar. The monitoring team should reconcile physical activity, contractual entitlement and collected cash. It should avoid using an accounting label as the final explanation. The institution needs to know whether it faces an operational problem, a commercial dispute, a timing mismatch or a mistaken original assumption before choosing the corrective action.

Completion monitoring should continue until the project has achieved the relevant usable-service state. A construction progress measure may describe physical work without demonstrating commissioning, operating rights, interface availability or collectible receipts. The accepted financing bridge should identify the events that matter to the cash calendar. A delay in one of those events can increase uses and defer resources at the same time. The monitoring record should show the combined effect, assign the response and check whether the funding available still supports completion. A project can be close to physically finished while remaining financially exposed.

Collection monitoring should separate entitlement from cash. A billed amount, accepted invoice and bank receipt occupy different points in the operating chain. A report can show revenue close to plan while service-date liquidity deteriorates. The monitoring protocol should identify which stage moved and what evidence supports the revised collection date. If a counterparty dispute changes the expected receipt, the forecast should retain the uncertainty and the action being taken. Treating all outstanding amounts as readily available can conceal a timing problem until the obligation has become immediate.

Operating burden should be examined through cause and persistence. Maintenance, energy, labour, outsourced service or restoration costs can change with utilisation, prices, asset condition or contract interpretation. The relevant question is whether a variance will reverse, recur or alter the long-term service proposition. The team should distinguish a one-time correction from a new operating requirement. It should also ask whether

spending is being deferred to preserve reported cash at the expense of reliability. A favourable current cash figure can conceal an accumulating obligation if the asset is consuming capacity that the forecast expected to maintain.

Build the liquidity monitoring calendar around the next obligation dates. Reconcile dated receipts with permitted uses, committed facilities and required approvals, and identify each condition on access and the lead time to activate it. The annual cash evaluation leaves that sequence to a separate transaction analysis: a positive annual balance may still arrive after a payment is due. When access or timing remains unresolved, the protocol should show the exposed obligation and the latest date for verification or an available response. The test is whether the response produces usable resources before the constraint binds.

For each covenant test, the responsible reviewers should reconcile the reported ratio with the accepted agreement's calculation perimeter, testing date, adjustment mechanism and notice requirements. A convenient internal definition can otherwise conceal the state that matters under the agreement. Label an early watch item as a management estimate and keep forecast pressure, a measured breach and an accepted remedial action separate. Each state should follow its specified decision route and authority. If the contractual definition or status remains unresolved, return that question to the responsible reviewers before using the ratio to justify continued exposure.

Interdependence monitoring should extend beyond the asset boundary when an external service controls performance. A transport link, energy supply, utility connection or counterpart operating system can determine whether the financed asset delivers usable service. The team should identify the dependency, evidence of its current availability and feasible substitution. It should also ask whether the disruption changes several cash drivers at once. A narrowly satisfactory report on the financed asset can miss deterioration at a critical interface. The monitoring perimeter should follow the original causal thesis and the obligations it supports.

Distinguish information about a proposition from an event that activates a decision route. An indicator can provide a useful warning while the appropriate response remains observation. A trigger should specify the evidence required, the owner, the permitted response and the escalation path. Set its transaction-specific boundary through accepted analysis of the obligations and response lead times. When an indicator approaches that boundary, the team should know what further evidence would

activate the route and who must receive it. A dashboard colour becomes operationally useful when that connection tells the team what action its authority permits.

Monitoring should identify reversible and irreversible responses. Correcting an operating routine, collecting additional evidence or revising a near-term forecast may preserve options. Drawing a facility, changing contractual commitments or disposing of an asset may create consequences that need further authority. The protocol should show which actions are available at each stage of pressure. It should also identify what information would change the chosen response. A team facing a developing shortfall can otherwise default to the most familiar action, even when a different intervention would address the cause more effectively.

Reforecasting should preserve scenarios with explanatory differences. The current central case should implement the team's accepted view, while a pressure case should retain the relevant mechanism and action assumptions. Quietly improving later cash to offset an early shortfall can hide the unresolved problem. The institution should be able to identify whether the forecast reflects verified improvement, a selected expectation or a hoped-for recovery. It should also separate the operational correction from the financing response. Additional funding may bridge a timing mismatch without repairing a structurally weak service or commercial proposition.

Escalation should be timed to the ability to respond. A protocol that reports a problem only after the obligation is missed can establish the historical fact while offering little control. The team should identify the lead time for evidence, negotiation, funding and operational correction. The monitoring schedule should then give the authorised decision-maker enough time to act. This does not require treating every forecast movement as an emergency. It requires matching attention to the mechanism, reversibility and response window. Earlier escalation can preserve choices when later certainty arrives too late to use them.

Learning should be recorded without rewriting the original decision. An adverse outcome does not prove that every initial assumption was unreasonable; a favourable outcome does not validate assumptions that were poorly evidenced. The review should compare what was known, what was accepted and what occurred. It should identify whether the institution needs better evidence, a different model perimeter, changed authority or a different risk appetite. The accepted thesis provides the

reference for that learning. A record that substitutes a new explanation for the old one can protect reputations while denying the institution an opportunity to improve its decisions.

The monitoring report should end with a diagnosis and an authorised next step. It can state the changed proposition, its effect on usable service and cash, the evidence status, the available response and the date by which another decision is needed. The supporting model and registers should remain inspectable. This keeps the reporting process focused on preserving or revising the commitment basis. A long horizon becomes manageable through repeated bounded decisions supported by current evidence, rather than through an assumption that the original forecast remains correct because the financing was designed to last.

Evidence and scope

The OECD report executive summary identifies infrastructure interdependencies and multiple operators as resilience-governance challenges. Its focus is continuity of essential services. This paper uses that narrow proposition to motivate monitoring of critical interfaces; it makes no claim about a measured project disruption or financial recovery.

Evidence: [Good Governance for Critical Infrastructure Resilience](#)

Completed illustrative monitoring protocol

Completed CR-DELAYED monitoring and stop record. The original decision remains diligence-only; these observations cannot create implementation authority.

Completed illustrative monitoring protocol			
Case observation	Evidence/status	Required action	Authority and timing
Source amount only matches base protection	CR-SOURCE: insufficient for selected fixed stress	HOLD implementation; request a different accepted source or proposed calendar	Protection Review Lead reports before the evidence gate
Nominal source is large enough; access date unknown	CR-TIMING: unresolved	HOLD implementation; verify usable cash before supplied payment	Payment Verification Officer; Chair retains stop
Recipient refuses reprofile	CR-RECIPIENT: adverse answer	STOP alternate calendar; no silent restoration of branch	Payment Verification Officer logs refusal; Chair closes branch
Fees or competing claim consumes assumed balance	CR-INCIDENCE: new cash use	INVALIDATE bridge result and return a new cash perimeter	Finance Appraisal Lead; no reuse of old requirement
Diligence cap or evidence deadline reached	CR-MANDATE: gate closed	STOP further diligence exposure; no automatic renewal	Diligence Coordinator stops uses; Chair alone can issue new mandate

Distinct causes require distinct responses

This original classification prevents a similar cash movement from being treated as evidence of a single problem.

Distinct causes require distinct responses		
Cause	Diagnostic question	Useful response
Operating shortfall	Is the service physically available and usable?	Repair the operating cause and reconcile the cash effect
Collection delay	Is entitlement accepted and when is cash usable?	Resolve collection and fund the dated interval
Scope change	What additional service or use became necessary?	Reconcile authority, resources and future burden
Forecast error	Which original assumption was unsupported?	Revise the thesis and return to the relevant authority
Interface disruption	Which external dependency controls performance?	Coordinate restoration or accepted substitution

Escalate while options remain

Escalate a changed proposition when its effect can threaten an obligation or remove a practical response before the next normal decision date. Preserve the original basis, current evidence and authorised action.

1. Retain the original baseline alongside the current forecast.
2. Diagnose the physical, contractual and collection chain.
3. Match the reporting interval to the response lead time.
4. Record what evidence would change the diagnosis or action.

Frequent monitoring can produce noise

A monitoring regime can distract operating teams if it treats every small movement as a material change. Indicators should be chosen for their link to the thesis and response window. Consolidated routine reporting can coexist with prompt escalation of a mechanism that affects obligations or removes an available action.

No real-time assurance

The monitoring record routes an invalidated source, timing, incidence or recipient condition to a stop or fresh decision within the original mandate. In CR-DELAYED, the cap or deadline closes diligence and only the Chair can issue a new mandate. Covenant interpretation and compliance status require the responsible reviewers' transaction-specific assessment of the executed definition; this framework supplies neither. The annual calculation also leaves actual receipt and payment sequencing to a dated liquidity analysis, as specified in the calculation dictionary.

Decision implications

- Keep the accepted baseline and current forecast as separate inspectable records.
- Similar cash variances can require different operational and financing responses.
- Escalation should arrive while an authorised response remains practical.

GOVERNANCE AND APPLICATION

20

Where the long-horizon thesis fails

A falsifier and strongest counterargument assessment

The competing choice and the evidence that changes the answer

A long-horizon financing thesis should contain the conditions under which it fails. The paper argues that capital becomes more resilient when the institution connects obligations to usable service, collectible cash and

available responses. That proposition does not imply that a long tenor, project structure or elaborate control system is always preferable. A financing choice can reduce one source of pressure while increasing commitment, cost or inflexibility elsewhere. The analysis should identify those trade-offs before a positive illustration becomes a general prescription. The strongest test is whether a competing structure would better serve the same bounded institutional objective.

An uncertain operating proposition can favour staged investment over a large initial commitment. If the institution can learn about service demand or delivery performance before committing the full scope, a smaller reversible step may preserve valuable choices. The comparison needs equivalent decision objectives and an honest technical perimeter. The flexible-scale illustration in this paper is a supplied cash path, not evidence that a smaller asset provides the same capacity or service. The institution would need to establish what it gains, what it defers and what it gives up before treating the lower commitment as an available alternative.

A rapidly changing service need can weaken the case for a fixed long horizon. The financial model may extend receipts from a service configuration that becomes less relevant as users, technology or policy change. A physically durable asset is not necessarily a durable commercial proposition. The decision-maker should ask what can be adapted, what adaptation costs and who has authority to perform it. If the required change is easier under a shorter commitment or more flexible operating arrangement, a long financing structure can restrict the response. The relevant horizon should follow the evidence and options, rather than the asset's physical life alone.

Balance-sheet financing can be a serious competing choice when the institution has the capacity and authority to absorb the exposure. It may permit flexible funding and operational coordination that a separate project structure makes more complex. The comparison still needs a defined perimeter, resource availability and a transparent account of who bears losses. Moving obligations onto a larger balance sheet does not make the underlying service risk disappear. The committee should judge whether the institution can manage that risk better, and whether doing so fits its mandate. A familiar project-finance format should not win merely because the analysis began with that format.

Small or relatively simple commitments can make elaborate structures disproportionate. A detailed system of covenants, reserves, contractual interfaces and specialist approvals can consume time and resources while offering limited incremental protection. The appropriate control depends

on the exposure, reversibility and ability to observe performance. The institution should compare the useful protection with the burden the structure creates. A concise financing arrangement with clear authority and credible resources may outperform a more elaborate design for a bounded decision. Complexity should earn its place through a mechanism that matters, not through its resemblance to institutional practice.

Weak collection evidence can defeat a long cash-flow forecast regardless of nominal tenor. An operating asset may deliver useful service while its right or ability to collect remains unresolved. Extending the forecast can increase present-value contributions without repairing the missing entitlement or collection path. The committee should identify what evidence would establish usable receipts and whether the project can continue while that matter is uncertain. A financing adjustment can bridge a dated gap, but it cannot create a commercial right through calculation. When the cash proposition is fundamentally unresolved, the better decision may be to defer the commitment or change the operating model.

Operating rights should bound the feasible financing horizon. Compare the access, concession, licence and land arrangements with the receipt calendar, rather than assuming that they extend for the asset's physical life. If later cash depends on renewal or an unresolved transfer, identify the obligations relying on that conditional end state and the available fallback. Return the rights question for transaction-specific legal review before relying on those receipts. Where the necessary rights cannot be established, compare a shorter commitment or different structure. The financing consequence follows the unresolved reliance; this comparison supplies no legal conclusion about a particular project.

A long tenor can shift rather than remove refinancing or maturity pressure. It may reduce current obligations while leaving a substantial future amount or increasing total exposure to uncertain operating conditions. The committee should inspect the full calendar and the resources assumed at the end. A headline claim that the tenor matches the asset life is insufficient if the cash needed at maturity depends on disposal, renewal or a future financing market. The relevant test is whether the supplied and evidenced cash path supports the actual obligations. A structure that looks comfortable early can still concentrate a difficult decision later.

Support can create an unattractive trade-off when its conditions, cost or contingent obligations exceed its useful protection. A guarantee, facility or public commitment should be assessed through the event it covers and the resources it can deliver. It can also change incentives, authority and the

distribution of losses. If the institution uses support to maintain an otherwise weak proposition, it may postpone the need to change the project while increasing exposure. The committee should compare support with operating correction, scope change or refusal of further commitment. Protection deserves a defined purpose and an exit or review route.

The thesis also fails when controls are formal but unavailable in practice. An escalation route can be written clearly while the authorised body lacks time, information or resources to act. A reserve can exist in a model while its use is constrained. A counterparty remedy can be named while collection is delayed or disputed. The structure's practical strength depends on the response mechanism, not merely on its documentation. The institution should test whether the owner can obtain the relevant evidence, make the decision and deliver the action before the constraint binds. A control that arrives too late does not preserve the choice it was designed to protect.

The apparent resilience can depend on moving exposure outside the reported perimeter. An unlevered valuation can look favourable while financing obligations are supplied separately; an equity view can improve by shifting loss to a sponsor or public institution; current cash can improve by deferring maintenance. These results may reflect legitimate choices, but the institution should show the entire relevant burden. The paper's fixtures deliberately separate cash valuation from supplied service coverage. They do not establish an optimal allocation of losses or a debt structure. A claim of resilience should identify whose resources and choices become more secure.

The long-horizon thesis is weakest where the evidence horizon is short and adaptation is costly. A model can make distant cash explicit without making it well supported. The committee should examine which later assumptions materially affect the decision and whether an earlier reversible choice can produce better evidence. It should also ask whether the proposed structure preserves an exit if the forecast fails. An uncertain future does not prohibit investment. It makes the relation between commitment and learning important. A decision that requires confidence the evidence cannot support may need a different scale, timing or structure.

The falsifier should be operational rather than rhetorical. The institution can identify a proposition whose adverse resolution changes the recommendation: the service cannot be made usable within the funding bridge, the collection right is insufficient, critical interfaces remain unavailable or a competing scope delivers the required objective with less

irreversible exposure. Each falsifier should name the evidence and the decision owner. A statement that the thesis remains valid unless circumstances change offers no useful test. The committee needs to know which changed circumstance matters and what it will do when that circumstance is established.

The comparison should preserve the same objective wherever possible. Choosing between a large asset and a staged service solution requires an account of capacity, quality, timing, accessibility and future options. Comparing only cash valuation can reward an option that omits part of the required service. The analytical team should state what is equivalent and what remains different. Where equivalence cannot be established, the committee can still compare choices, but it should recognise the trade-off it is accepting. The flexible-scale fixture provides a numerical contrast under authored cash assumptions; the engineering and service comparison remains explicitly unresolved.

The resulting judgment is conditional. Long-horizon capital can be useful when the service proposition, cash perimeter, rights, obligations and responses form a coherent system. It can become unattractive when commitment exceeds the evidence, control burden is disproportionate or a more adaptable choice better serves the objective. A defensible recommendation does not need to claim universal superiority. It needs to explain why the proposed structure wins for the stated decision, identify the conditions under which it loses and preserve a route to revise exposure when those conditions become evident.

A falsifier changes the choice

These conceptual tests are authored decision rules, not observations about an actual project.

A falsifier changes the choice		
Thesis dependency	Adverse evidence	Competing response
Service can become usable	A critical interface cannot be delivered within the funded bridge	Change scope, stage delivery or defer commitment
Receipts are collectible	Rights or counterpart performance remain materially unresolved	Repair the commercial proposition before extending tenor
Long horizon is relevant	A service change makes adaptation central to value	Compare shorter commitment and flexible operating arrangements
Controls can respond	Authority or resources arrive after the constraint binds	Simplify and fund a practical response route
Structure fits the exposure	Control burden is disproportionate to a reversible decision	Compare a simpler or balance-sheet arrangement
Scope choices are comparable	A smaller option omits required service	Resolve the technical trade-off before cash ranking

State when the preferred structure loses

Accept a financing recommendation only with an explicit competing choice, its relevant service perimeter and the evidence that would make it preferable. A positive cash calculation should not suppress the institutional objective or the cost of irreversible commitment.

1. Test whether the service need and rights support the proposed horizon.
2. Compare control burden with useful protection.
3. Identify the evidence that would change the recommendation.
4. Retain authority to stop or revise exposure at the specified gate.

Flexibility can have a real cost

Staging or shortening commitments can sacrifice useful scale, integration or funding certainty. A more flexible option should not be preferred by slogan. Its service consequences, implementation burden and later funding need should be analysed alongside the choices it preserves. The comparison remains a transaction-specific judgment.

No universal structure ranking

The fixtures do not hold engineering scope and institutional objectives constant across every case. The app cannot value real options, support arrangements or balance-sheet capacity. This chapter specifies comparison questions and falsifiers; it establishes no empirically optimal tenor or financing structure.

Decision implications

- A long horizon is conditional on service relevance, rights and collectible cash.
- A competing choice needs a comparable objective and an honest scope perimeter.
- A useful falsifier names evidence and an authorised change in exposure.

PRACTICAL APPENDICES

21 Appendix: reproducible calculation dictionary

A replication procedure another analyst can run

Exact inputs, exact method and bounded readings

Reproduction begins with the exact input object, the canonical implementation and the frozen complete result. The paper's numerical examples are authored fixtures. They do not represent an observed client, asset or financing transaction. Another analyst should be able to inspect the supplied cash paths, execute the same public module and compare the result before judging its interpretation. The purpose of the calculation dictionary is to make the arithmetic perimeter inspectable. A successful reproduction confirms consistency with the specified computation; it does not validate the assumptions or establish that the financing is appropriate.

The unit of time is an equally spaced annual period in these fixtures. The initial investment is supplied at the start, followed by operating cash values. The engine discounts each supplied cash flow using its position in that sequence. It does not read calendar dates, calculate day counts or simulate cash within a period. Labels help the reader identify the row but do not change the calculation interval. A transaction that depends on monthly collection, irregular construction draws or dated service requires a model that explicitly represents those events. The annual examples should not be stretched into a liquidity calendar by interpretation.

The monetary unit is illustrative USD millions across cash flow, cash available for debt service and supplied service obligations. The fixture uses the same scale for each amount. No actual currency conversion, tax treatment or inflation convention is embedded in these examples. An analyst can describe the unit as an illustrative monetary scale, but cannot

infer a real project's pricing basis. The discount-rate input is expressed in percent in the app schema and is converted by the canonical implementation. This distinction matters because an input percentage and an output fractional return require different display conventions.

The cash-flow series provides the unlevered valuation perimeter in this paper. The supplied debt-service series is evaluated separately for coverage; the app does not subtract it from the cash-flow series to derive an equity cash path. The analyst should not describe the resulting present value as equity value or the return as an equity return. Those interpretations would require a defined financing, tax and distribution model. The illustrations deliberately let the reader compare cash valuation and supplied service coverage without asserting that the service schedule has been optimally sized or contractually agreed.

Cash available for debt service is supplied independently in each row. The app does not derive it from revenue, operating cost, tax, working capital or reserve movements. The fixture author therefore owns the definition and evidence boundary of that input. In these examples it is an illustrative operating cash amount, with terminal residual cash kept outside the final period's cash-available figure. This prevents an assumed terminal receipt from silently increasing service coverage in a period without service. A transaction analysis should reconcile its actual cash-available definition before importing the value into a coverage calculation.

Supplied debt service is an obligation series, not a generated repayment plan. The module computes coverage for rows with positive service. It returns an undefined coverage value when no positive obligation is supplied. That state should not be displayed as a zero ratio or interpreted as unlimited capacity. It means the specific comparison is not defined for that row. The engine does not infer principal, interest, balance, tenor or covenant definitions from the service values. A reader seeking those properties needs an accepted financing model and terms, not a reinterpretation of the illustrative schedule.

Net present value uses the supplied cash-flow series and discount rate. The initial value is included at the beginning; later values are discounted according to their period. The rate sensitivity keeps those values constant and changes the discount rate. It therefore shows how a valuation responds to that arithmetic assumption. It does not establish the appropriate cost of capital or forecast a change in operating performance. The committee should preserve the distinction between sensitivity to an evaluation rate and sensitivity to the causal cash drivers. Either can be informative, but they answer different questions.

The return calculation uses the distinct positive roots of the cash-flow polynomial in the reciprocal discount factor, interpreting each supplied JSON number as its canonical decimal. Version 1.1.2 removes repeated factors by exact polynomial division and counts roots with an integer Sturm chain. Rational intervals then isolate the roots; conversion of one minus the discount factor, divided by that factor to a fractional Number rate occurs only after isolation. A small floating residual does not admit a root. The export retains the certified count and intervals, including roots whose distinct rates cannot be represented or whose isolation budget is exhausted. Such rates are explicitly unavailable rather than described as absent. Readers should inspect that record, the cash-flow signs and warnings before selecting a headline. Percentage presentation occurs after computation; residuals describe only the rounded rate's floating diagnostic. The conventional investment fixtures below do not establish a single-return promise for other schedules.

The annual app discounts project cash at the supplied annual period boundaries and compares same-period CFADS with service. It supplies no invoice date, receipt timestamp, payment cut-off, account-access event or within-year cash balance. The auxiliary bridge adds only an explicit annual retained-cash balance under the assumption that each period's entire CFADS is available before its service payment. A separate dated register must replace that ordering assumption before payment availability is accepted. This is the canonical time-resolution boundary for the study; the financing, coverage and monitoring chapters cross-refer here while testing their distinct rights, denominator, access and authority questions.

Payback is a separate reading of the supplied cumulative cash path. The first crossing uses canonical decimal cumulative cash amounts. A within-period fraction is interpolated from the amount still unrecovered before the supplied flow. Displayed cumulative amounts and recovery times remain rounded numeric readings; later losses do not erase the first observed recovery. It should not be treated as a substitute for discounted value, coverage or terminal reliance. The module implements its stated arithmetic reading, while the investment decision needs a broader account of obligations and evidence. A short payback can coexist with weak early coverage because the calculations compare different things. The dictionary keeps each output connected to its question. Combining distinct metrics into an unqualified assessment can obscure the specific mechanism that requires attention.

The operating stress is a mechanical scenario defined in the canonical output. It reduces future cash-flow and cash-available values while leaving the initial value and supplied service unchanged. That rule can be

reproduced and interpreted as an illustrative pressure test. It is not a probability distribution, empirical downside calibration or a causal simulation of price, demand, maintenance and collection. Those mechanisms could affect inputs differently. The paper's separate authored fixtures explore distinct cash-path changes without asserting likelihood. A reader should use the mechanical stress as a transparent comparison, then test the relevant real mechanism with appropriate evidence.

A published token selects a scalar from a frozen input or output through an exact pointer. Its claim entry states the illustrative status, unit, basis, model and sensitivity. The block that publishes it lists the reciprocal claim identifier, and the claim lists the block. The audit checks that the live computation reproduces the frozen result and that the selected scalar agrees with the ledger. This removes a common source of drift between a chart, table and narrative. It cannot prove that the sentence interpreting the scalar is sound; that remains an independent analytical review.

The replication procedure should preserve raw values and separate formatting. A display may round an amount or ratio for readability while the frozen output retains full precision. The ledger defines that display convention. An analyst comparing results should use the complete output and the documented computational tolerance where the app itself applies one. Copying rounded values back into a new calculation creates a different model. The same caution applies to units: a fractional return shown as a percentage, a common monetary scale and an undefined ratio should keep their meaning in every exported form.

Reproduction also requires coherent software and source editions. The audit hashes the canonical module and its imported implementation files, the fixture, output and bindings. It reopens source receipts and canonical manuscript inputs. A changed implementation requires an explicit freeze refresh and a review of the affected claims; the audit never silently accepts a new result by replacing the expected output. This preserves a meaningful failure signal. A result mismatch can then lead to a deliberate decision about the model, rather than a build process that rewrites evidence until it appears consistent.

The calculation dictionary finishes with a boundary test. If a proposed claim requires debt sizing, cash-waterfall allocation, tax, currency conversion, contractual remedies, reserve mechanics, irregular dates or operating causality, the current app does not establish it. The paper can explain why the issue matters and specify what a transaction analysis should resolve. It cannot publish a derived numerical result that the

engine never calculated. That discipline allows a simple transparent tool to contribute to an institutional decision without acquiring an unsupported claim to comprehensiveness.

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

Discounted cash-flow valuation

NPV = sum of cash flow at t divided by $(1 + r)^t$, with initial cash at $t = 0$.

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

Exact NPV sign certificate

NPV sign is evaluated as an exact rational from the canonical decimal representation of the validated JSON numbers. The JSON export retains the exact fraction and a rounded forty-significant-digit decimal; charts use its Number approximation.

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

Certified IRR root isolation

IRRs are the distinct positive roots of the exact canonical-decimal cash-flow polynomial in $x = 1 / (1 + r)$. Square-free reduction and a BigInt Sturm chain certify the count; rational intervals isolate each root before nearest-even Number rate conversion.

Input and output meanings

This dictionary describes the actual canonical capital module used for the illustrative fixtures. It does not add calculations.

Input and output meanings		
Field	Meaning in this paper	Boundary
cashflow	Supplied unlevered cash in each equally spaced period	No generated operating or equity cash model
cfads	Supplied cash available for debt service	No automatic tax, working-capital or reserve bridge
debtService	Supplied positive service obligation	No repayment balance, sizing or covenant engine
discountRate	Input rate expressed in percent	No estimate of an actual cost of capital
irrs	List of fractional roots under the stated method	No guaranteed unique return; use explicit display format
dscr	Cash available divided by positive supplied service	Undefined where no positive service is supplied

Replicate before interpreting

Use the exact fixture and canonical module; compare complete frozen outputs and scalar bindings before assessing the narrative. Preserve a mismatch as a failure until an explicit reviewed change resolves it.

1. Read the input units, annual interval and cash perimeter.
2. Execute the canonical compute function on the frozen fixture.
3. Compare complete output, software receipts and scalar pointers.
4. Review the interpretation separately from arithmetic parity.

A simple app can underrepresent a financing decision

The objection is valid if the app is presented as a transaction model. The paper uses it for transparent supplied-cash comparisons and identifies questions it cannot answer. A richer accepted model is necessary when dates, contractual definitions or financing mechanics govern the recommendation. Simplicity is useful only while its perimeter remains explicit.

Reproduction does not establish truth

Exact arithmetic parity establishes consistency with the supplied inputs and canonical method. It establishes no observed project outcome, likelihood, lender acceptance or optimal structure. Semantic support, visual legibility and the appropriateness of the decision framework require independent review.

Decision implications

- Reproduce the complete output before reducing it to displayed metrics.
- Keep annual intervals, supplied cash definitions and units explicit.
- A scalar binding establishes parity while interpretation remains a separate judgment.

PRACTICAL APPENDICES

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Appendix: illustrative financing studies

A complete illustrative input and output ledger with bounded comparisons

Original schedules and repaired decision tests

The studies in this appendix are deliberately distinct supplied-cash comparisons. They separate early operating ramp, supplied service burden, operating cash reduction, combined pressure and a smaller initial commitment. The cases are authored illustrations. Their numbers were selected to expose mechanisms, not calibrated from observed assets, lender terms or a market distribution. The complete inputs and outputs remain available with the canonical app and scalar bindings. The reader can reproduce each result and challenge the interpretation without having to infer an omitted annual path from a headline metric.

The comparison holds the evaluation rate and equally spaced annual convention constant. Each case contains an initial investment followed by operating-period values. The initial amount is negative in the unlevered cash-flow series. Cash available and supplied service are separate inputs, with no generated repayment balance. Later periods without service retain an undefined coverage comparison. This structure lets the cases answer a limited question: how do specified cash paths and obligations change valuation and weakest-period coverage? It cannot establish that any proposed debt amount, reserve or contract makes the path feasible.

The foundation study supplies a positive early ramp followed by a stable operating cash amount and an illustrative terminal receipt. Its useful lesson is the difference between valuation over the full cash horizon and service coverage in the early period. The terminal receipt contributes to the unlevered cash-flow series, while the cash-available series retains operating cash alone. The study does not establish that the terminal

amount is collectible or that the operating values are forecasts. Those are explicit author assumptions whose relevance a transaction team would need to verify before a binding commitment.

The delayed-ramp study changes the early operating cash path while retaining the foundation's initial commitment, later operating cash, terminal receipt and supplied service. It therefore isolates an early-period pressure under those held assumptions. The later cash still contributes to value, while the weakest supplied coverage reflects the lower early amount. The case should not be described as a full construction-delay model: it does not move investment dates, increase completion uses or apply contractual consequences. It shows the financing significance of a specified slower cash ramp and identifies the additional mechanisms a real delay analysis would require.

The heavy-service study retains the foundation unlevered cash path and changes the supplied service obligation. Its present value is therefore unchanged while coverage falls under the larger obligation. That result is useful because it exposes a reporting error: an unchanged favourable asset valuation does not establish that the proposed financing obligations are supported. The case does not calculate how the larger service arose. It could not establish interest, principal, maturity or lender terms from the supplied amount. The analyst must preserve that boundary and review the actual financing calendar separately.

The operating-burden study supplies lower operating cash and a lower terminal receipt under the same initial commitment and service series. It is an authored cash path intended to examine persistent cash pressure. It does not derive that pressure from a cost model or assert a particular operating-cost increase. The reader should inspect both value and coverage rather than interpret the case name as a causal simulation. A real analysis would reconcile the affected costs, timing, recoverability and maintenance consequences. The illustrative reduction helps frame that diligence question while leaving the mechanism explicitly unresolved.

The combined-pressure study changes the initial commitment, early ramp, later operating cash, terminal receipt and supplied service together. It represents a transparent joint pressure case, without assigning probability or correlation. Its usefulness is the interaction of a larger use, weaker receipts and heavier obligations within the supplied perimeter. It does not claim that those changes will occur together in an actual asset. The committee should use the comparison to ask which dependencies could produce a similar joint effect, what evidence supports that mechanism and what practical action remains available before exposure becomes difficult to reverse.

The flexible-scale study uses a smaller initial commitment, a different cash ramp, later operating amount, terminal receipt and service series. It illustrates how a different commitment path can compare favourably on some supplied metrics. The study does not hold technical service output constant and does not value staged expansion or a real option. It therefore cannot justify selecting a smaller asset solely from its cash calculation. The required next step is a scope and objective comparison: what service is delivered, what is deferred, what adaptation remains possible and what later uses would be required to reach the intended institutional outcome?

The summary should be read across metrics and assumptions. A present value above zero at the selected rate represents the result of the unlevered supplied cash path. Minimum coverage below the unity reference means supplied cash available is smaller than supplied service in at least one tested period. Neither result establishes a contractual breach, acceptable debt capacity or lender approval. The record should identify the specific period and its inputs before choosing a response. The six cases contain no universal threshold for acceptance. They supply transparent contrasts that make different decision mechanisms easier to inspect.

The mechanical cash stress is applied consistently by the canonical app within each study. It changes future cash-flow and cash-available values according to the published method while retaining initial cash and supplied service. The result can reverse a value reading or weaken coverage. Such a reversal demonstrates sensitivity within the stated arithmetic rule. It does not establish a downside probability or identify which operational driver caused the change. The case-specific narrative and full input path remain necessary to interpret what the comparison can and cannot support.

The rate sweep answers a different question. It holds the supplied cash path constant and varies the evaluation rate according to the canonical sensitivity output. A valuation crossing is therefore an arithmetic property of that path, not evidence that the institution will face a particular financing rate. The app's return-root information can help explain the crossing, subject to its method and warnings. A financing team should avoid calling an evaluation-rate sensitivity an interest-rate or refinancing model. Those mechanisms affect obligations and funding choices that this module does not generate.

The complete annual tables preserve the input path rather than conceal it behind averages. Each row shows the canonical period, supplied cash flow, cash available, supplied service and selected coverage. The values are directly bound to the frozen output, which in turn is compared with live execution on audit. The labels identify the sequence; the rows retain the

annual convention. The tables include periods without service so that the reader can see the boundary of the coverage result. An undefined value is shown as such, rather than converted into a favourable ratio.

The study comparison should retain the assumptions that matter to its directional reading. The heavy-service contrast holds the unlevered path constant; the delayed-ramp contrast holds later cash constant; the combined case changes several inputs; the flexible case changes scope assumptions that remain technically unverified. If a reader changes one of those premises, the interpretation should be reviewed alongside the new computed result. Exact reproduction of an old fixture does not establish the validity of a new one. The canonical workflow makes it possible to create a new explicit case without silently rewriting the original illustration.

A completed review of these studies would ask whether the interpretations follow from the actual outputs, whether the numerical display preserves units and whether any sentence extends beyond the engine. It would also check that the chosen scenarios contribute distinct reasoning. The appendix should not become a collection of cosmetically renamed cases with identical cash paths. Here each study identifies the changed input and decision mechanism. Their limitations remain visible even when a particular metric looks attractive. The reader can therefore use the cases as reproducible analytical exercises, while recognising the further evidence and modelling needed for a transaction recommendation.

No scenario probability or equivalent technical scope

The original project fixtures contain no actual project data, debt-sizing solution, financing-rate forecast or real-option valuation. The appended bridge diagnostics add conditional annual retained-cash balances, with no contractual reserve adequacy conclusion. Proposed service alternatives retain unresolved recipient terms. The flexible case is not technically equivalent by assertion.

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

Distinct cash paths and supplied obligations

All values are illustrative canonical outputs at the common selected evaluation rate. NPV uses illustrative USD millions; coverage is a ratio. The mechanical downside is the app rule, not an estimated probability.

Distinct cash paths and supplied obligations				
Study	Unlevered NPV	Minimum coverage	Stressed NPV	Stressed minimum coverage
A defined service asset	183.05	1.11	98.44	0.89
Operating receipts arrive later	127.24	0.33	53.79	0.27
The same project carries heavier obligations	183.05	0.80	98.44	0.64
Persistent pressure on operating cash	35.46	0.72	-19.63	0.58
Construction and operations are challenged together	12.49	0.24	-47.61	0.19
A smaller commitment preserves operating margin	161.08	1.21	92.86	0.97

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

A defined service asset: complete annual path

The early cash available exceeds the supplied service while later operating and terminal cash contribute to valuation. Challenge the cash-available definition, the early collection path and the terminal receipt before applying this reading to a real asset.

A defined service asset: complete annual path				
Period	Unlevered cash, USDm	Cash available, USDm	Supplied service, USDm	Coverage
Initial investment	-240.00	0.00	0.00	not defined
Operating year 1	40.00	40.00	36.00	1.11
Operating year 2	48.00	48.00	36.00	1.33
Operating year 3	52.00	52.00	36.00	1.44
Operating year 4	52.00	52.00	36.00	1.44
Operating year 5	52.00	52.00	36.00	1.44
Operating year 6	52.00	52.00	36.00	1.44
Operating year 7	52.00	52.00	36.00	1.44
Operating year 8	52.00	52.00	36.00	1.44
Operating year 9	52.00	52.00	36.00	1.44
Operating year 10	52.00	52.00	36.00	1.44
Operating year 11	52.00	52.00	36.00	1.44
Operating year 12	52.00	52.00	36.00	1.44
Operating year 13	52.00	52.00	0.00	not defined
Operating year 14	52.00	52.00	0.00	not defined
Operating year 15	52.00	52.00	0.00	not defined
Operating year 16	52.00	52.00	0.00	not defined
Operating year 17	52.00	52.00	0.00	not defined
Operating year 18	112.00	52.00	0.00	not defined

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

Operating receipts arrive later: complete annual path

The weakest coverage arises from the supplied early ramp even though later cash supports a positive valuation. An appropriate response must address the dated early gap; a later surplus cannot pay an earlier obligation without a credible funding bridge.

Operating receipts arrive later: complete annual path				
Period	Unlevered cash, USDm	Cash available, USDm	Supplied service, USDm	Coverage
Initial investment	-240.00	0.00	0.00	not defined
Operating year 1	12.00	12.00	36.00	0.33
Operating year 2	24.00	24.00	36.00	0.67
Operating year 3	38.00	38.00	36.00	1.06
Operating year 4	52.00	52.00	36.00	1.44
Operating year 5	52.00	52.00	36.00	1.44
Operating year 6	52.00	52.00	36.00	1.44
Operating year 7	52.00	52.00	36.00	1.44
Operating year 8	52.00	52.00	36.00	1.44
Operating year 9	52.00	52.00	36.00	1.44
Operating year 10	52.00	52.00	36.00	1.44
Operating year 11	52.00	52.00	36.00	1.44
Operating year 12	52.00	52.00	36.00	1.44
Operating year 13	52.00	52.00	0.00	not defined
Operating year 14	52.00	52.00	0.00	not defined
Operating year 15	52.00	52.00	0.00	not defined
Operating year 16	52.00	52.00	0.00	not defined
Operating year 17	52.00	52.00	0.00	not defined
Operating year 18	112.00	52.00	0.00	not defined

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

The same project carries heavier obligations: complete annual path

The unlevered path matches the foundation while supplied service is heavier. This isolates financing pressure from asset valuation. The actual service schedule must be explained by accepted financing terms before any debt-capacity conclusion is made.

The same project carries heavier obligations: complete annual path				
Period	Unlevered cash, USDm	Cash available, USDm	Supplied service, USDm	Coverage
Initial investment	-240.00	0.00	0.00	not defined
Operating year 1	40.00	40.00	50.00	0.80
Operating year 2	48.00	48.00	50.00	0.96
Operating year 3	52.00	52.00	50.00	1.04
Operating year 4	52.00	52.00	50.00	1.04
Operating year 5	52.00	52.00	50.00	1.04
Operating year 6	52.00	52.00	50.00	1.04
Operating year 7	52.00	52.00	50.00	1.04
Operating year 8	52.00	52.00	50.00	1.04
Operating year 9	52.00	52.00	50.00	1.04
Operating year 10	52.00	52.00	50.00	1.04
Operating year 11	52.00	52.00	50.00	1.04
Operating year 12	52.00	52.00	50.00	1.04
Operating year 13	52.00	52.00	0.00	not defined
Operating year 14	52.00	52.00	0.00	not defined
Operating year 15	52.00	52.00	0.00	not defined
Operating year 16	52.00	52.00	0.00	not defined
Operating year 17	52.00	52.00	0.00	not defined
Operating year 18	112.00	52.00	0.00	not defined

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

Persistent pressure on operating cash: complete annual path

The positive CFADS remains below supplied service throughout repayment, while service ends before the operating horizon. The bridge appendix traces a finite upfront requirement under explicit retention assumptions. Later restoration distinguishes this path from the delayed ramp; neither the name nor the minimum coverage ratio proves that recurring external support is necessary.

Persistent pressure on operating cash: complete annual path				
Period	Unlevered cash, USDm	Cash available, USDm	Supplied service, USDm	Coverage
Initial investment	-240.00	0.00	0.00	not defined
Operating year 1	26.00	26.00	36.00	0.72
Operating year 2	30.00	30.00	36.00	0.83
Operating year 3	34.00	34.00	36.00	0.94
Operating year 4	34.00	34.00	36.00	0.94
Operating year 5	34.00	34.00	36.00	0.94
Operating year 6	34.00	34.00	36.00	0.94
Operating year 7	34.00	34.00	36.00	0.94
Operating year 8	34.00	34.00	36.00	0.94
Operating year 9	34.00	34.00	36.00	0.94
Operating year 10	34.00	34.00	36.00	0.94
Operating year 11	34.00	34.00	36.00	0.94
Operating year 12	34.00	34.00	36.00	0.94
Operating year 13	34.00	34.00	0.00	not defined
Operating year 14	34.00	34.00	0.00	not defined
Operating year 15	34.00	34.00	0.00	not defined
Operating year 16	34.00	34.00	0.00	not defined
Operating year 17	34.00	34.00	0.00	not defined
Operating year 18	74.00	34.00	0.00	not defined

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

Construction and operations are challenged together: complete annual path

Several uses, receipts and obligations change together. The weak early comparison and narrower valuation require separate attention. No likelihood is assigned; the committee should identify the actual dependency that could justify such a joint case.

Construction and operations are challenged together: complete annual path				
Period	Unlevered cash, USDm	Cash available, USDm	Supplied service, USDm	Coverage
Initial investment	-288.00	0.00	0.00	not defined
Operating year 1	12.00	12.00	50.00	0.24
Operating year 2	24.00	24.00	50.00	0.48
Operating year 3	30.00	30.00	50.00	0.60
Operating year 4	42.00	42.00	50.00	0.84
Operating year 5	42.00	42.00	50.00	0.84
Operating year 6	42.00	42.00	50.00	0.84
Operating year 7	42.00	42.00	50.00	0.84
Operating year 8	42.00	42.00	50.00	0.84
Operating year 9	42.00	42.00	50.00	0.84
Operating year 10	42.00	42.00	50.00	0.84
Operating year 11	42.00	42.00	50.00	0.84
Operating year 12	42.00	42.00	50.00	0.84
Operating year 13	42.00	42.00	0.00	not defined
Operating year 14	42.00	42.00	0.00	not defined
Operating year 15	42.00	42.00	0.00	not defined
Operating year 16	42.00	42.00	0.00	not defined
Operating year 17	42.00	42.00	0.00	not defined
Operating year 18	82.00	42.00	0.00	not defined

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

A smaller commitment preserves operating margin: complete annual path

The smaller supplied commitment and different cash path offer a comparison with greater flexibility in the narrative. Technical service equivalence is unresolved. The cash result cannot establish that this option delivers the same required objective.

A smaller commitment preserves operating margin: complete annual path				
Period	Unlevered cash, USDm	Cash available, USDm	Supplied service, USDm	Coverage
Initial investment	-180.00	0.00	0.00	not defined
Operating year 1	34.00	34.00	28.00	1.21
Operating year 2	38.00	38.00	28.00	1.36
Operating year 3	42.00	42.00	28.00	1.50
Operating year 4	42.00	42.00	28.00	1.50
Operating year 5	42.00	42.00	28.00	1.50
Operating year 6	42.00	42.00	28.00	1.50
Operating year 7	42.00	42.00	28.00	1.50
Operating year 8	42.00	42.00	28.00	1.50
Operating year 9	42.00	42.00	28.00	1.50
Operating year 10	42.00	42.00	28.00	1.50
Operating year 11	42.00	42.00	28.00	1.50
Operating year 12	42.00	42.00	28.00	1.50
Operating year 13	42.00	42.00	0.00	not defined
Operating year 14	42.00	42.00	0.00	not defined
Operating year 15	42.00	42.00	0.00	not defined
Operating year 16	42.00	42.00	0.00	not defined
Operating year 17	42.00	42.00	0.00	not defined
Operating year 18	82.00	42.00	0.00	not defined

Preserve the distinct mechanism

Select a case for the decision mechanism it tests. State held assumptions, changed inputs, outputs and the further evidence required. Treat a metric reversal as sensitivity under the named rule, without assigning empirical likelihood.

1. Reproduce the complete annual path and selected scalar bindings.
2. Identify which comparison holds the relevant input constant.
3. Inspect the weakest service period and terminal reliance separately.
4. Resolve scope equivalence before ranking alternative commitments.

The cases are deliberately simplified

Annual supplied paths omit the detail a transaction committee would require. That limitation is acceptable for an explanatory study only if the reader can inspect the inputs and the conclusions remain bounded. The next analysis should introduce actual dated and contractual mechanisms where they control the choice.

Delayed Ramp annual bridge: base minimum

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

Delayed Ramp, base, minimum-opening variant: opening USD36.00m; annual retained-cash balance, USDm

Illustrative annual USDm. The delayed path consumes opening USD36.00m before mature CFADS replenishes protection in period 6. Later balances assume every surplus remains available. A distribution or return of protection would require a different diagnostic. Restoration identifies a source-review point; it establishes neither permission to release cash nor recipient consent to that release.

Delayed Ramp, base, minimum-opening variant: opening USD36.00m; annual retained-cash balance, USDm						
Period	Opening	CFADS	Service	Closing	Unpaid	
1	36.00	12.00	36.00	12.00	0.00	
2	12.00	24.00	36.00	0.00	0.00	
3	0.00	38.00	36.00	2.00	0.00	
4	2.00	52.00	36.00	18.00	0.00	
5	18.00	52.00	36.00	34.00	0.00	
6	34.00	52.00	36.00	50.00	0.00	
7	50.00	52.00	36.00	66.00	0.00	
8	66.00	52.00	36.00	82.00	0.00	
9	82.00	52.00	36.00	98.00	0.00	
10	98.00	52.00	36.00	114.00	0.00	
11	114.00	52.00	36.00	130.00	0.00	
12	130.00	52.00	36.00	146.00	0.00	
13	146.00	52.00	0.00	198.00	0.00	
14	198.00	52.00	0.00	250.00	0.00	
15	250.00	52.00	0.00	302.00	0.00	
16	302.00	52.00	0.00	354.00	0.00	
17	354.00	52.00	0.00	406.00	0.00	
18	406.00	52.00	0.00	458.00	0.00	

Operating Burden annual bridge: base minimum

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

Operating Burden, base, minimum-opening variant: opening USD36.00m; annual retained-cash balance, USDm

Illustrative annual USDm. The burden path has the same finite opening deficit USD36.00m but restores it only in period 14, after service ends.

Equal opening amounts therefore conceal different source durations.

Debt-free CFADS restores retained protection; it does not improve coverage during repayment. A source expiring at the final payment would need explicit terms for this later restoration.

Operating Burden, base, minimum-opening variant: opening USD36.00m; annual retained-cash balance, USDm						
Period	Opening	CFADS	Service	Closing	Unpaid	
1	36.00	26.00	36.00	26.00	0.00	
2	26.00	30.00	36.00	20.00	0.00	
3	20.00	34.00	36.00	18.00	0.00	
4	18.00	34.00	36.00	16.00	0.00	
5	16.00	34.00	36.00	14.00	0.00	
6	14.00	34.00	36.00	12.00	0.00	
7	12.00	34.00	36.00	10.00	0.00	
8	10.00	34.00	36.00	8.00	0.00	
9	8.00	34.00	36.00	6.00	0.00	
10	6.00	34.00	36.00	4.00	0.00	
11	4.00	34.00	36.00	2.00	0.00	
12	2.00	34.00	36.00	0.00	0.00	
13	0.00	34.00	0.00	34.00	0.00	
14	34.00	34.00	0.00	68.00	0.00	
15	68.00	34.00	0.00	102.00	0.00	
16	102.00	34.00	0.00	136.00	0.00	
17	136.00	34.00	0.00	170.00	0.00	
18	170.00	34.00	0.00	204.00	0.00	

Delayed Ramp annual bridge: stress minimum

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

Delayed Ramp, stress, minimum-opening variant: opening USD48.80m; annual retained-cash balance, USDm

Illustrative annual USDm. Stressing CFADS while preserving payments raises required opening protection to USD48.80m and delays restoration to period 12. The larger amount and longer duration can alter source appraisal even though project value remains positive. Comparing this source with a service reprofile still requires its price, access conditions and recipient terms; the diagnostic supplies none of them.

Delayed Ramp, stress, minimum-opening variant: opening USD48.80m; annual retained-cash balance, USDm						
Period	Opening	CFADS	Service	Closing	Unpaid	
1	48.80	9.60	36.00	22.40	0.00	
2	22.40	19.20	36.00	5.60	0.00	
3	5.60	30.40	36.00	0.00	0.00	
4	0.00	41.60	36.00	5.60	0.00	
5	5.60	41.60	36.00	11.20	0.00	
6	11.20	41.60	36.00	16.80	0.00	
7	16.80	41.60	36.00	22.40	0.00	
8	22.40	41.60	36.00	28.00	0.00	
9	28.00	41.60	36.00	33.60	0.00	
10	33.60	41.60	36.00	39.20	0.00	
11	39.20	41.60	36.00	44.80	0.00	
12	44.80	41.60	36.00	50.40	0.00	
13	50.40	41.60	0.00	92.00	0.00	
14	92.00	41.60	0.00	133.60	0.00	
15	133.60	41.60	0.00	175.20	0.00	
16	175.20	41.60	0.00	216.80	0.00	
17	216.80	41.60	0.00	258.40	0.00	
18	258.40	41.60	0.00	300.00	0.00	

Operating Burden annual bridge: stress minimum

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

Operating Burden, stress, minimum-opening variant: opening USD115.20m; annual retained-cash balance, USDm

Illustrative annual USDm. The stressed burden requires USD115.20m and restores protection in period 17. Funding every payment would not reverse its separately adverse project-value stress. A loss-bearing strategic mandate could justify another decision, but none is supplied. The completed comparison rejects the unchanged operating proposal under its stated stressed-value condition and requires fresh appraisal for redesign.

Operating Burden, stress, minimum-opening variant: opening USD115.20m; annual retained-cash balance, USDm						
Period	Opening	CFADS	Service	Closing	Unpaid	
1	115.20	20.80	36.00	100.00	0.00	
2	100.00	24.00	36.00	88.00	0.00	
3	88.00	27.20	36.00	79.20	0.00	
4	79.20	27.20	36.00	70.40	0.00	
5	70.40	27.20	36.00	61.60	0.00	
6	61.60	27.20	36.00	52.80	0.00	
7	52.80	27.20	36.00	44.00	0.00	
8	44.00	27.20	36.00	35.20	0.00	
9	35.20	27.20	36.00	26.40	0.00	
10	26.40	27.20	36.00	17.60	0.00	
11	17.60	27.20	36.00	8.80	0.00	
12	8.80	27.20	36.00	0.00	0.00	
13	0.00	27.20	0.00	27.20	0.00	
14	27.20	27.20	0.00	54.40	0.00	
15	54.40	27.20	0.00	81.60	0.00	
16	81.60	27.20	0.00	108.80	0.00	
17	108.80	27.20	0.00	136.00	0.00	
18	136.00	27.20	0.00	163.20	0.00	

Delayed Ramp annual bridge: stress base opening

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

Delayed Ramp, stress, base-opening variant: opening USD36.00m; annual retained-cash balance, USDm

Illustrative annual USDm. Opening USD36.00m leaves unpaid service USD12.80m. The later restoration in period 10 concerns this smaller target after nonpayment; it is not a superior fully paid branch. Arrears are neither rescheduled nor waived. A cure requires explicit new payment dates, pricing and recipient acceptance before its calendar can be modelled.

Delayed Ramp, stress, base-opening variant: opening USD36.00m; annual retained-cash balance, USDm						
Period	Opening	CFADS	Service	Closing	Unpaid	
1	36.00	9.60	36.00	9.60	0.00	
2	9.60	19.20	36.00	0.00	7.20	
3	0.00	30.40	36.00	0.00	5.60	
4	0.00	41.60	36.00	5.60	0.00	
5	5.60	41.60	36.00	11.20	0.00	
6	11.20	41.60	36.00	16.80	0.00	
7	16.80	41.60	36.00	22.40	0.00	
8	22.40	41.60	36.00	28.00	0.00	
9	28.00	41.60	36.00	33.60	0.00	
10	33.60	41.60	36.00	39.20	0.00	
11	39.20	41.60	36.00	44.80	0.00	
12	44.80	41.60	36.00	50.40	0.00	
13	50.40	41.60	0.00	92.00	0.00	
14	92.00	41.60	0.00	133.60	0.00	
15	133.60	41.60	0.00	175.20	0.00	
16	175.20	41.60	0.00	216.80	0.00	
17	216.80	41.60	0.00	258.40	0.00	
18	258.40	41.60	0.00	300.00	0.00	

Operating Burden annual bridge: stress base opening

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

Operating Burden, stress, base-opening variant: opening USD36.00m; annual retained-cash balance, USDm

Illustrative annual USDm. The stressed burden leaves unpaid service USD79.20m once protection is exhausted. Later debt-free CFADS accumulates without proving discharge or consent to cure those earlier obligations. Recipient terms, an arrears register and a new calendar remain necessary. An eventual positive balance therefore cannot establish sufficiency when original payments were due.

Operating Burden, stress, base-opening variant: opening USD36.00m; annual retained-cash balance, USDm						
Period	Opening	CFADS	Service	Closing	Unpaid	
1	36.00	20.80	36.00	20.80	0.00	
2	20.80	24.00	36.00	8.80	0.00	
3	8.80	27.20	36.00	0.00	0.00	
4	0.00	27.20	36.00	0.00	8.80	
5	0.00	27.20	36.00	0.00	8.80	
6	0.00	27.20	36.00	0.00	8.80	
7	0.00	27.20	36.00	0.00	8.80	
8	0.00	27.20	36.00	0.00	8.80	
9	0.00	27.20	36.00	0.00	8.80	
10	0.00	27.20	36.00	0.00	8.80	
11	0.00	27.20	36.00	0.00	8.80	
12	0.00	27.20	36.00	0.00	8.80	
13	0.00	27.20	0.00	27.20	0.00	
14	27.20	27.20	0.00	54.40	0.00	
15	54.40	27.20	0.00	81.60	0.00	
16	81.60	27.20	0.00	108.80	0.00	
17	108.80	27.20	0.00	136.00	0.00	
18	136.00	27.20	0.00	163.20	0.00	

Delayed ramp with redistributed nominal annual service

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

Unchanged project cash with proposed service

Illustrative USDm. Only supplied service changes from the source fixture; project cashflow and CFADS remain identical. The full source and intervention JSON files disclose the unchanged entries.

Unchanged project cash with proposed service				
Period	Project cash	CFADS	Proposed service	Coverage
Initial investment	-240.00	0.00	0.00	not defined
Operating year 1	12.00	12.00	9.60	1.25
Operating year 2	24.00	24.00	19.20	1.25
Operating year 3	38.00	38.00	30.40	1.25
Operating year 4	52.00	52.00	41.42	1.26
Operating year 5	52.00	52.00	41.42	1.26
Operating year 6	52.00	52.00	41.42	1.26
Operating year 7	52.00	52.00	41.42	1.26
Operating year 8	52.00	52.00	41.42	1.26
Operating year 9	52.00	52.00	41.42	1.26
Operating year 10	52.00	52.00	41.42	1.26
Operating year 11	52.00	52.00	41.42	1.26
Operating year 12	52.00	52.00	41.42	1.26
Operating year 13	52.00	52.00	0.00	not defined
Operating year 14	52.00	52.00	0.00	not defined
Operating year 15	52.00	52.00	0.00	not defined
Operating year 16	52.00	52.00	0.00	not defined
Operating year 17	52.00	52.00	0.00	not defined
Operating year 18	112.00	52.00	0.00	not defined

Operating burden with reduced nominal annual service

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

Unchanged project cash with proposed service

Illustrative USDm. Only supplied service changes from the source fixture; project cashflow and CFADS remain identical. The full source and intervention JSON files disclose the unchanged entries.

Unchanged project cash with proposed service				
Period	Project cash	CFADS	Proposed service	Coverage
Initial investment	-240.00	0.00	0.00	not defined
Operating year 1	26.00	26.00	20.80	1.25
Operating year 2	30.00	30.00	24.00	1.25
Operating year 3	34.00	34.00	27.20	1.25
Operating year 4	34.00	34.00	27.20	1.25
Operating year 5	34.00	34.00	27.20	1.25
Operating year 6	34.00	34.00	27.20	1.25
Operating year 7	34.00	34.00	27.20	1.25
Operating year 8	34.00	34.00	27.20	1.25
Operating year 9	34.00	34.00	27.20	1.25
Operating year 10	34.00	34.00	27.20	1.25
Operating year 11	34.00	34.00	27.20	1.25
Operating year 12	34.00	34.00	27.20	1.25
Operating year 13	34.00	34.00	0.00	not defined
Operating year 14	34.00	34.00	0.00	not defined
Operating year 15	34.00	34.00	0.00	not defined
Operating year 16	34.00	34.00	0.00	not defined
Operating year 17	34.00	34.00	0.00	not defined
Operating year 18	74.00	34.00	0.00	not defined

Decision implications

- A complete cash path explains more than a headline metric.
- Keep held assumptions visible when interpreting a comparison.
- Value, supplied service coverage and technical equivalence answer different questions.

PRACTICAL APPENDICES

23 Appendix: diligence and financing worksheets

Practical records that expose unanswered questions

Completed records that retain evidence and consequences

Use the completed fictional CR-DELAYED trail to trace a conditional calculation into a stopped decision. The appendix retains the exact calculation files, the reproduced arithmetic and the deliberately unresolved case materials. Its disposition is diligence-only, with implementation HOLD, a defined cap, relative evidence gate, accountable owner and stop consequence. These entries describe no real project history. When adapting the form, attach each actual accepted item to its source, date, permitted use and authority, then revisit the disposition. A completed record preserves that dependency even when the correct answer remains conditional.

Review a cash input by naming the service or event it represents, its cash perimeter, timing convention and evidence status. Then identify the decision it can change. An uncertain minor cost may need a sensitivity test; a conditional first receipt may control completion funding and require evidence before exposure advances. In the illustrative record, the supplied values remain author assumptions, with the sensitivity that tests their relevance recorded beside them. Numerical fit to the spreadsheet does not close their evidence status. The reviewer should carry that status into the recommendation until forecast support is established.

The source-and-use worksheet asks when a resource is available and what it can pay. A nominal commitment can have conditions, permitted uses or a draw process that differs from the assumed expenditure path. The record should identify the acceptance event and the lead time needed to make

cash usable. It should also retain any residual use that lacks a committed source. A financing total that balances only through an assumed future receipt does not show the institution how it will fund the interval. The worksheet turns that gap into an explicit decision dependency rather than a hidden plug.

The cash-priority worksheet is conceptual because the app does not implement a waterfall. It describes which obligations need resources and which distributions should remain conditional. The transaction team must reconcile that order with actual documents, dates and available cash. The practical question is whether an action to preserve one payment consumes resources needed for another essential service. A priority diagram can organise the reasoning, but only an accepted model and terms can establish the actual allocation. The illustrative entries deliberately avoid presenting a generated reserve, payment or equity distribution that the canonical engine never calculated.

The completed fictional timing record keeps the annual arithmetic and the assumed relative decision calendar separate. D has no established timestamp, and source access, receipt ordering and actual payment cut-offs remain unresolved. Its gate therefore closes the diligence mandate while implementation remains held. A transaction team adopting this record must replace the declared assumptions with dated evidence and a permitted-use definition; it cannot inherit payment authority from the annual path.

The dependency worksheet expands the review beyond a single party or asset. It identifies the external service or counterparty performance that controls the thesis, the evidence needed and the fallback available. A good entry distinguishes responsibility for an interface from the power to restore it. The project may depend on an organisation whose timing it cannot directly control. The financing recommendation should recognise that limitation and state the consequence if the dependency remains unresolved. The worksheet is useful when it creates a concrete coordination or stop decision, rather than merely listing every imaginable risk.

The committee-conditions worksheet records the proposition protected by each condition. It should specify who can accept completion, what evidence is required and whether an adverse result changes the recommendation. A condition such as satisfactory diligence leaves too much to interpretation if it does not identify the material question. The illustrative form separates scope reconciliation, first collectible receipt,

funding adequacy and operating rights. Each entry retains a consequence for further exposure. A committee can then approve a bounded step without implying that every later question has already been answered.

The monitoring worksheet preserves the original thesis. It links a current observation to a changed proposition, a forecast effect and an authorised response. This makes the report useful after approval, when teams can be tempted to treat the accepted case as historical background. The completed record requires a bridge from the original input to current evidence. It also asks what information would change the diagnosis. A variance should not automatically trigger more funding or less spending. The institution should first identify whether the cause is operational, contractual, collection-related or a mistaken original assumption.

The challenge worksheet should retain disagreements in a form that can be resolved. A reviewer may disagree about the service perimeter, evidence sufficiency, scenario relevance or interpretation of a model output. The record should name the proposition, the competing reading and the evidence or decision needed. Merely logging a comment as addressed can close the administrative task while leaving the disagreement intact. A substantive disposition should say what changed or why the original reading remains justified within its scope. Unresolved material challenges should remain visible to the authority accepting exposure.

These records should be kept proportionate. A small reversible planning decision does not require the same evidence and documentation as a binding financing commitment. The institution can use a concise mechanism map early, then deepen the record as exposure and irreversibility grow. The important continuity is the proposition, evidence status and decision consequence. The same material issue should not disappear because the team changes document formats between stages. Proportionate diligence reduces unnecessary work while preserving the information that an authorised decision-maker needs to understand the commitment.

Adapt each completed entry by replacing illustrative language with exact accepted facts, assumptions and terms, while retaining any unresolved state. Test whether the entry identifies a committee choice or helps an operator diagnose a changed mechanism. If it has no decision consequence, return to the proposition that controls further exposure rather than filling more fields. A short accurate dependency record can serve the decision better than a fully populated form. The entries supply a starting point for that reasoning; adoption requires the team's own accepted basis and does not make the wording pre-approved.

Completed illustrative cash-input review

All entries are author assumptions or conceptual requirements. No row claims to be an accepted forecast.

Completed illustrative cash-input review			
Input proposition	Current status	Required evidence or test	Disposition
Initial commitment covers defined scope	Illustrative supplied amount	Scope-to-use reconciliation and cost review	Do not infer funding adequacy from the fixture
Early operating cash is collectible	Illustrative ramp assumption	Service, entitlement and collection bridge	Test delay and identify funding for the interval
Cash available supports service	Separately supplied annual input	Accepted cash-available definition and obligation calendar	Keep coverage interpretation within that perimeter
Terminal receipt is usable	Illustrative residual assumption	Right, end state, timing and collection analysis	Separate from ongoing operating cash
Stable later cash persists	Illustrative annual continuation	Maintenance, rights and commercial evidence	Challenge persistence and adaptation needs

Completed illustrative sources and uses challenge

The worksheet identifies resource categories without inventing a financing balance.

Completed illustrative sources and uses challenge			
Use or resource	Acceptance event	Open dependency	Decision consequence
Completion use	Defined scope and commissioning bridge accepted	Interfaces and cost perimeter	Hold additional commitment until reconciled
Committed resource	Binding availability and permitted uses established	Draw conditions and timing	Confirm cash can fund the relevant use
Expected operating receipt	Usable service and collection event	Ramp and counterpart performance	Retain as assumption until evidence supports it
Contingent support	Covered event and access process accepted	Authority, resources and timing	Do not count as immediate cash by label
Residual requirement	Full use path compared with available resources	Unfunded or conditional interval	Name the institution bearing the gap

Completed conceptual cash-priority review

This record specifies questions for an accepted transaction model. No waterfall calculation is asserted.

Completed conceptual cash-priority review			
Cash use	Question before allocation	Evidence or authority	Boundary
Essential operation	What spending preserves usable service?	Accepted operating and maintenance plan	Deferral can transfer burden to later periods
Dated service	What obligation must be met and when?	Accepted terms and cash calendar	Annual coverage does not establish dated liquidity
Restricted or reserved cash	When is use permitted?	Reviewed account and access definitions	A model balance alone does not make cash available
Restoration or completion	What use protects the operating thesis?	Technical need and authorised funding	Compare with other essential uses
Distribution	What conditions permit payment to capital?	Accepted documents and available cash	No equity distribution derived by the app

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

Completed illustrative event-to-cash bridge

CR-DELAYED completed conditional timing record. D is an assumed annual boundary whose actual timestamp remains unresolved; the business-day offsets are fictional policy assumptions.

Completed illustrative event-to-cash bridge			
Event / object	Recorded time or status	Acceptance evidence	Adverse consequence
Diligence begins	D minus 30 assumed business days	CR-MANDATE: fictional cap/use approval	No implementation exposure authorised
Evidence gate	D minus 10 assumed business days	CR-SOURCE, CR-TIMING and CR-INCIDENCE unresolved	STOP mandate; implementation HOLD
Counterfactual source activation	6 assumed business-day lead after a new approval	No actual provider lead accepted	Any longer lead requires a revised dated check
Counterfactual usable-cash deadline	D minus 4 assumed business days	Usable cash receipt and access evidence absent	HOLD if receipt/use not established
First service payment boundary	D; actual collection and payment timestamps unresolved	No dated payment and collection register supplied	Annual availability assumption cannot authorise payment

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

Completed illustrative committee conditions

CR-DELAYED final gate record: arithmetic is verified; source/access, dates and incidence remain unresolved. The stopped diligence mandate creates no implementation authority.

Completed illustrative committee conditions			
Condition	Recorded requirement	Current status / owner	Disposition
Annual cash amount	Stressed opening at least USD48.80m	Arithmetic verified; funding unresolved / Protection Review Lead	HOLD
Access and dates	Permitted usable cash before the actual supplied payment	Unresolved / Payment Verification Officer	HOLD
Cost and incidence	All carrying costs and competing uses included; loss bearer accepts exposure	Unresolved / Finance Appraisal Lead	HOLD; revise fixture if new uses arise
Recipient alternative	Accepted revised calendar and complete financing comparison	Unresolved / Payment Verification Officer	TERMS HELD
Mandate deadline	Earlier of USD1.00m cap or D minus 10 business days	Recorded fictional policy / Diligence Coordinator	STOP; fresh Chair mandate required

Completed illustrative challenge disposition

A completed disposition explains what changed or why the bounded reading remains justified.

Completed illustrative challenge disposition			
Challenge	Competing reading	Resolution needed	Current disposition
Positive valuation implies financeability	Asset cash may be attractive while supplied service is unsupported	Inspect weakest coverage and actual funding calendar	Reject the inference; retain separate questions
Smaller commitment is superior	Technical service equivalence may be absent	Compare objective, scope and adaptation	Cash illustration retained; technical ranking unresolved
Mechanical stress is probable	A deterministic rule has no likelihood calibration	Obtain relevant empirical or causal support	No probability claimed
Support removes risk	Coverage, access and residual obligations can differ	Verify covered event and usable resources	Treat support as bounded response
Model reproduction validates assumptions	Parity establishes arithmetic consistency	Review input evidence and interpretation	Keep acceptance separate from mechanical checks

Use a record to expose a choice

Retain the proposition, evidence status, unresolved dependency, owner and decision consequence in every practical record. Increase detail as exposure becomes less reversible, while preserving the same material question across stages.

- 1. Replace illustrative entries with accepted transaction evidence.
- 2. Keep unresolved states visible and assign an adverse-answer consequence.
- 3. Distinguish operating correction, financing response and authority.
- 4. Preserve substantive challenge dispositions and coherent editions.

Forms can become procedural theatre

A completed register can create confidence without improving the decision if entries are vague, copied or unsupported. Reviewers should test a material entry from proposition to evidence and consequence. A compact record that exposes an actual dependency is preferable to a fully populated form that hides uncertainty.

Illustrative entries require replacement

Before using these conceptual records to support further exposure, establish the institution-specific evidence, accepted terms and competent review behind the proposed action. The records contain no actual client, funding commitment, contract clause or operating result. Their role is to organise the review; legal sufficiency, financing readiness and authority remain questions for the relevant evidence and decision process.

A numerical path does not decide a calendar

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

The selected fully protected stress branch begins with USD48.8om. Its first annual deficit USD26.4om leaves USD22.4om. The next deficit USD16.8om leaves USD5.6om, and the following deficit USD5.6om leaves USD0.0om. Every annual payment is conditionally met under the declared ordering. That exact sequence is evidence CR-BRIDGE-STRESS. It remains separate from CR-TIMING because it supplies no timestamp for the receipt of those CFADS amounts or the permitted release of protection.

Illustrative. Under the stipulated fictional business-day arithmetic, approval at D minus 10 with a 6-day activation lead would allow usable receipt at D minus 4. This is an author-selected relative timing branch, not evidence about a provider. It is only useful after the actual date D, cut-off rules and usable-cash definition are established. The record explicitly leaves those facts unresolved. A same-day nominal receipt could still be too late if payment access or bank cut-off precedes usability. The annual cash vector cannot choose the ordering of those events.

The current record therefore ends at HOLD even though the larger annual protection path balances. A revised case with verified source capacity but unresolved account access would still fail the access gate. A verified source and account with unpriced carrying charges would require a new balance perimeter if those charges consumed retained cash. A recipient accepting changed service with an earlier payment cut-off would require a fresh dated test. These branches demonstrate how the status depends on the precise missing proposition. They also prevent the fictional committee from becoming a story in which every uncertainty is conveniently resolved by a positive ratio.

The deadline has a practical purpose. Diligence can become open-ended if each unresolved object merely generates another request. The recorded cap and evidence gate instead close the mandate. Only the Chair can approve a fresh bounded information purchase or implementation decision after receiving a new exposure record. The Diligence Coordinator controls permitted uses, the Protection Review Lead controls source and access evidence and the Payment Verification Officer controls dated payment and recipient evidence. A role can verify its own object without accepting a different object outside its remit. That separation makes the stop authority usable when the arithmetic specialist has completed its work but the funding specialist has not.

A completed fictional record is a demonstrated form

The stated roles, mandate, business-day convention, deadline and value condition are authored policy assumptions. No real committee, funding source, consent, bank account or provider lead has been supplied. The recorded HOLD is therefore a complete illustrative disposition under those assumptions, not an external decision. It demonstrates traceability and adverse routing; it does not demonstrate actual source capacity or dated liquidity. Any institution adopting the form must replace the fictional objects with accepted evidence and its own authority perimeter.

Decision implications

- A practical record should expose a dependency with a decision consequence.
- Keep unresolved states visible instead of filling every field with a favourable answer.
- Scale detail to exposure while preserving the material proposition.

PRACTICAL APPENDICES

24

Appendix: source scope and challenge record

A transparent publication record

Evidence perimeter, exact artifacts and unresolved judgment

The public evidence perimeter of this paper consists of the primary sources listed in its catalogue and the original analytical reasoning explicitly authored around them. The cited guidance is used at narrow locators and within its stated institutional purpose. The paper contains no confidential agreement, undisclosed client case or observed operating dataset. Its numerical studies are deterministic illustrations with frozen inputs and canonical computations. This publication record explains those boundaries so that a reader can distinguish a sourced institutional proposition from an authored framework or a selected example.

The primary cards retain publisher, title, edition, URL, locator, summary, limits and a successful retrieval receipt. A receipt establishes that specified public content was actually available to the research process in a readable form. It does not establish that every later sentence is supported by that content. The source-specific audit reopens the retained bytes or exact

browser response and verifies the hash. Failed or challenge responses cannot certify another page. This preserves a checkable evidence trail while leaving source interpretation to independent domain review.

Several sources provide broad institutional guidance rather than transaction evidence. World Bank project-finance pages describe structures, cash-flow reliance, bankability and risk allocation. The paper uses their narrowly stated propositions to motivate questions and boundaries. The guidance does not prove that a particular project is financeable or that its risk has been effectively allocated. The original decision frameworks explain how an institution might organise those questions. They should not be mistaken for a finding that an actual agreement, borrower or asset satisfies the framework.

Use public guidance on appraisal, assurance, cost, schedule and risk to define the review question, then obtain the operating forecast and financing terms needed to answer it. Those inputs are not supplied by the manuals used for these illustrations. The source card should identify the topic, and the manuscript claim should identify the exact proposition drawn from it, within the manual's original scope. Where the reasoning extends that proposition, present the extension as inspectable original analysis rather than attribute it to the institution. This separates a supported review method from an unsupported transaction conclusion.

Use the accounting reference for the stated distinction between accounting categories and cash reporting. To define cash available for debt service, obtain the relevant financing agreement and modelling bridge separately: the accounting source does not determine that transaction perimeter. Connect cash flow, revenue and coverage to the definition and calculation actually being used. Familiar terminology cannot close a missing contractual or modelling link. A reviewer should resolve that link before treating the term as an accepted cash input, preserving the narrow role of the public reference.

The resilience and governance sources identify institutional coordination, infrastructure dependencies and continuity problems. Use those narrow propositions to frame the dependency to investigate, then seek asset-specific evidence for any loss distribution, disruption probability or restoration time. The cited material supplies none of those measures for an asset in this study. The monitoring and committee frameworks are original proposals whose decision mechanisms remain explicit. Assess them by whether they expose a material dependency and support a practical response; a respected institution's discussion of the governance problem is not empirical proof that the proposed control works.

The source-derived and quotation budgets are checked across the complete research corpus. Shared publisher URLs are grouped so that a source cannot receive a fresh allowance by appearing under a different paper or identifier. Every cited block counts regardless of whether its author labels the surrounding analysis original. The shared internal card is counted once; printed bibliographies contain metadata and limits without repeating the summary. These limits encourage narrow paraphrases and fresh relevant evidence. They do not excuse an unsupported factual statement that omitted its source label; independent review must still inspect that boundary.

The claim ledger records sourced propositions, illustrative quantities and selected model readings. A numerical value is published through an exact token with a reciprocal block binding. The audit reruns the canonical app, compares the complete frozen result and checks the scalar selected by the claim. This supports consistency among text, tables, charts and app calculations. It does not establish that a scenario is probable or that its assumptions are accepted. The illustrative label therefore remains visible at each quantitative block, alongside purpose, sensitivity and limitation.

The challenge record should distinguish mechanical failure from analytical disagreement. A missing source receipt, unresolved token, changed model output, clipped text or omitted canonical block is a defect that can be tested directly. A disagreement about evidence sufficiency, causal reasoning or the relevance of a scenario requires an independent judgment. Both can block acceptance, but they should not be merged into a self-reported passed flag. The publication process should retain the actual checks, coherent hashes and reviewer dispositions. An author cannot establish independent acceptance by writing an affirmative manifest.

The visual record should contain actual renders of every PDF page. Automated geometry, font, density and duplication checks can identify important defects, while independent inspection must assess legibility, composition and the usefulness of exhibits. A page count declaration is insufficient. The substantive-page calculation uses the actual reopened PDF and chapter-to-reference boundaries, excluding covers, contents, source lists and publication furniture. A low-density ordinary page does not contribute to the required substantive count. These boundaries protect the corpus from meeting a length requirement by adding ceremonial material.

The current edition should state its real review status. A candidate can be useful for examination while remaining below publication acceptance. This paper does not infer a review score from schema compliance or

successful reproduction. Independent reviewers may reject weak synthesis, insufficient support, poor visual execution or repetition even when the mechanical gates pass. Their material challenges should remain open until a concrete revision or justified bounded reading resolves them. The final release record should identify the exact manuscript and artifact hashes accepted, rather than refer loosely to a project folder.

Future revisions should preserve what changed and why it matters. A repaired source locator, altered app method, new fixture or revised conclusion can affect claims differently. The change record should identify the affected proposition and the review needed. Merely changing the date does not create a new evidence basis. The coherent publication set includes canonical narrative, source cards, ledger, models, figures, HTML and PDF. Maintaining that relationship allows readers and reviewers to assess the paper as a reproducible public study while retaining its explicit limits.

Publication and acceptance boundaries

The record distinguishes a checked artifact property from a judgment that requires independent review.

Publication and acceptance boundaries		
Evidence or check	What it establishes	What it does not establish
Readable public-source receipt	Specific retained primary content and hash	Support for every interpretation or transaction claim
Canonical model reproduction	Exact result of the frozen illustrative input	Forecast validity, likelihood or financeability
Reciprocal claim binding	Published scalar and selected output agree	Soundness of the narrative interpretation
All-page render receipt	Actual PDF pages were rendered and hashed	Independent visual acceptance
Substantive-page measurement	Actual body boundaries and measured density	Original synthesis or institutional usefulness
Independent reviewer disposition	A named challenge was assessed against the artifact	Operating performance or recipient acceptance

A transparent process can still produce weak research

Detailed receipts and ledgers can make a weak argument reproducible. The publication standard must therefore include independent examination of substantive reasoning, actual source support and visual usefulness. Mechanical checks are necessary properties of the artifact, while acceptance remains a separate judgment about the complete study.

No independent acceptance asserted here

This authored publication record does not certify a review score, public release, financing readiness or field performance. The paper remains a candidate until the required independent reviewers inspect the exact complete artifacts and resolve material challenges.

PRIMARY EVIDENCE

References and source scope

wb-finance-issues

World Bank PPP Resource Center. Key Issues in Developing Project Financed Transactions. live guidance, accessed 2026-10-10

Locator: Debt Service Cover Ratio; Loan Life Cover Ratio

Scope: Definitions and financing logic only. Examples of leverage on the page are not current market benchmarks and are not used as such.

<https://ppp.worldbank.org/financing/issues-in-project-financed-transactions>

wb-finance-structures

World Bank PPP Resource Center. Finance Structures for PPP. live guidance, accessed 2026-10-12

Locator: Non-recourse project finance for PPPs; Alternatives to non-recourse project finance

Scope: A financing structure is not proof of bankability, legal effectiveness or off-balance-sheet accounting.

<https://ppp.worldbank.org/finance-structures-ppp>

wb-project-concepts

World Bank PPP Resource Center. Project Finance: Key Concepts. live guidance, accessed 2026-10-10

Locator: Typical project finance structure

Scope: Do not repeat the page's broad off-balance-sheet claim as an accounting conclusion. Contractual and accounting outcomes require transaction-specific analysis.

<https://ppp.worldbank.org/financing/project-finance-concepts>

wb-bankability

World Bank PPP Resource Center. Considerations for Government. live guidance, accessed 2026-10-10

Locator: Bankability

Scope: No universal debt-coverage threshold is supplied or inferred. A hypothetical model cannot establish lender willingness.

<https://ppp.worldbank.org/considerations-government>

wb-risk-allocation

World Bank PPP Resource Center. Risk Allocation. live guidance, accessed 2026-10-10

Locator: Currency risk; interest rate risk

Scope: Some reference-rate examples are historical. Cite mechanisms rather than treating named benchmarks as current loan terms.

<https://ppp.worldbank.org/risk-allocation>

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>

wb-credit-enhancement

World Bank PPP Resource Center. Third Party Risk Mitigation and Credit Enhancement. live guidance, accessed 2026-10-10

Locator: Credit enhancement and public support

Scope: Credit support creates obligations and conditions; it does not eliminate the underlying physical or commercial risk.

<https://ppp.worldbank.org/third-party-risk-mitigation-and-credit-enhancement>

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>

ifc-project-finance

International Finance Corporation. Project Finance in Developing Countries. 1999

Locator: Glossary: Debt Service Coverage Ratio; Economic Viability

Scope: Historical institutional primer. Its market observations are not used as contemporary statistics.

https://ppp.worldbank.org/sites/default/files/2022-05/ProjectFinance_DevelopingCountries_IFC.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>

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>

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>

ifrs-cash-flow

IFRS Foundation. IAS 7 Statement of Cash Flows. current issued-standard overview accessed 2026-10-10

Locator: Operating, investing and financing cash-flow categories

Scope: Management contribution measures are not asserted to be IFRS-defined measures. Applicable amendments and effective dates must be checked for a real reporting entity.

<https://www.ifrs.org/issued-standards/list-of-standards/ias-7-statement-of-cash-flows.html>

oecd-infrastructure-governance

Organisation for Economic Co-operation and Development. Infrastructure governance. live topic guidance accessed 2026-10-10

Locator: Key messages: long-term strategic infrastructure planning; project selection and prioritisation

Scope: A public governance principle, not proof that a particular private asset is viable or financed. No regulatory requirement or score is inferred.

<https://www.oecd.org/en/topics/infrastructure-governance.html>

oecd-infrastructure-resilience

Organisation for Economic Co-operation and Development. Good Governance for Critical Infrastructure Resilience. 2019 report, publisher abstract accessed 2026-10-10

Locator: Publisher Executive summary, opening discussion of system interdependency, government-operator partnerships and continuity of essential services

Scope: The publisher abstract supports the report purpose only. It does not measure a project outage, quantify losses or certify operational resilience.

https://www.oecd.org/en/publications/good-governance-for-critical-infrastructure-resilience_02f0e5a0-en.html

wb-government-guarantees

World Bank PPP Resource Center. Government Guarantees. live guidance accessed 2026-10-10

Locator: Fiscal prudence; contingent liabilities; costs of guarantees

Scope: Conceptual public support guidance; no guarantee pricing, eligibility, legal enforceability or available facility is assumed for an actual project.

<https://ppp.worldbank.org/government-guarantees>

wb-guarantees

World Bank PPP Resource Center. Guarantee Mechanisms in PPPs. live guidance under publisher review, accessed 2026-10-10

Locator: Trigger mechanisms; fiscal exposure; guarantee scope

Scope: The page states that content is undergoing enhancement. Use is limited to conceptual design questions; current products, pricing and legal terms require separate confirmation.

<https://ppp.worldbank.org/guarantees>

wb-infrastructure-finance

World Bank PPP Resource Center. Infrastructure Finance. live guidance accessed 2026-10-10

Locator: Types of financing approaches; project financing complexity

Scope: No broad claim about off-balance-sheet treatment is adopted. The guide does not prove transaction feasibility or establish current market borrowing terms.

<https://ppp.worldbank.org/infrastructure-finance>

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: Complete canonical manuscript, verified public source receipts and reproducible illustrative studies assembled. Mechanical checks, independent assessment and release verification have separate records bound to this edition.

2026-10-10: Substantive repair of the finite-service protection inference; traced base/stress cash bridges, proposed service comparisons, adverse fictional committee record, contribution map, consolidated time boundary and readable chart/table continuations.