SIMPLAR FOUNDATION

Journal of Research and Practice in Projects and Organizations

Independent Cost Estimation (ICE) in Public and Private Project Delivery: Definitions, Statutory Frameworks, and Delivery-Method Comparisons

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ABSTRACT

Independent Cost Estimation (ICE) has become a central governance and risk-management mechanism in both public and private project delivery, particularly as owners expand the use of alternative delivery methods such as Design–Build (DB), Progressive Design–Build (PDB), and Construction Manager/General Contractor (CM/GC or CM@R). This paper synthesizes definitions of ICE from academic literature, professional guidance, and practitioner experience, and examines how ICE is implemented across statutory, policy, and organizational frameworks. Drawing on a multi-source analytical synthesis of published research, statutory and policy documents, and expert insight from public agencies and private-sector practitioners, the paper compares ICE's role in traditional Design–Bid–Build (DBB), DB, CM@R, and PDB across sectors including transportation, vertical construction, industrial facilities, and public infrastructure. The analysis suggests that ICE effectiveness depends less on the mere presence of an independent estimate and more on timing of engagement, transparency of reconciliation processes, and clarity of institutional authority. The paper concludes with implications for policy design and recommendations for owners seeking to institutionalize ICE as a durable oversight tool.

1. Introduction

Cost uncertainty is a persistent challenge across the construction industry, affecting public infrastructure, vertical building projects, and large private developments alike. Despite advances in estimating techniques and project controls, construction projects continue to experience cost escalation driven by interacting sources of uncertainty, including scope evolution, subsurface conditions, market volatility, labor constraints, and supply-chain disruptions. Research on megaproject delivery demonstrates that early cost estimates are systematically undermined by optimism bias and strategic misrepresentation, leading to chronic underestimation of risk and erosion of owner confidence across sectors (Flyvbjerg, 2014). Complementary probabilistic analyses further show that construction cost outcomes are best understood as distributions shaped by compounding uncertainties rather than as deterministic point forecasts, reinforcing the systemic nature of cost overruns in both public and private projects (Eke, 2017).

In response to these challenges, owners have increasingly turned to Independent Cost Estimation (ICE) as a governance and risk-management mechanism. Originally developed in defense, aerospace, and other large public capital programs as a means of providing independent cost validation separate from project advocacy, ICE emerged as a response to persistent cost growth and accountability concerns and was adopted more broadly in civil and building

construction beginning in the early 1990s, largely following early experiments with alternative delivery methods that reduced reliance on competitive price discovery (GAO, 2009; AACE International, 2016). ICE introduces a third-party perspective intended to validate budgets, challenge assumptions, and mitigate information asymmetry between owners, designers, and constructors (RICS, 2017; DBIA, 2020). While ICE has long been used in public-sector transportation programs, its role has expanded significantly with the growth of alternative delivery methods such as Design–Build (DB), Construction Manager at Risk (CM@R), and Progressive Design–Build (PDB) across multiple construction sectors (FHWA, 2023).

In these collaborative delivery environments, where prices are often negotiated rather than competitively bid, ICE frequently serves as the owner's primary safeguard against optimism bias, strategic pricing, and incomplete risk recognition. Unlike traditional Design–Bid–Build (DBB), where market competition provides an external price signal, alternative delivery methods rely on progressive scope definition and negotiated cost agreements. This shift places greater emphasis on governance mechanisms that support informed decision-making under uncertainty (Molenaar & Gransberg, 2001; Flyvbjerg, 2014). Independent cost estimation is therefore increasingly positioned not as a substitute for competition, but as a decision-support tool that enables owners to evaluate affordability, reconcile pricing assumptions, and understand residual risk exposure throughout project development (RICS, 2017; DBIA, 2020).

However, the effectiveness of ICE varies widely across jurisdictions, sectors, and delivery methods, depending on how independence is defined, when the estimator is engaged, and how reconciliation processes are structured. Poorly timed or rigid applications of ICE may introduce adversarial dynamics, reinforce false certainty, or fail to account for market volatility, while well-integrated approaches can enhance transparency, trust, and cost realism (Eke, 2017; FHWA, 2023).

This paper examines Independent Cost Estimation as a cross-sector governance mechanism applicable to both public and private construction projects. Drawing on academic literature, professional guidance, statutory and policy contexts, and insights from interviews with experienced owners, contractors, and cost estimation professionals, the study addresses three research questions: (1) How is ICE defined and conceptualized across construction sectors? (2) How do statutes, policies, and organizational practices implement ICE in public and private projects? and (3) How does the role of ICE differ across DBB, DB, CM@R, and PDB delivery methods? By situating ICE within a broader framework of probabilistic uncertainty and project governance, the paper seeks to clarify both its value and its limitations in contemporary construction delivery.

Methodology

This paper is based on a qualitative, multi-source analytical synthesis drawing on documentary data, statutory analysis, and expert practitioner insight. Data sources included (1) a structured review of peer-reviewed academic literature, industry standards, and institutional guidance related to cost uncertainty, project governance, and alternative delivery methods; (2) systematic review of publicly available statutes, procurement codes, policy manuals, and guidance documents issued by state and federal agencies governing the use of independent cost estimation and alternative delivery; and (3) qualitative insights obtained from subject matter experts across both the public and private sectors.

Expert input was informed by semi-structured interviews and professional discussions with public agency officials, federal oversight personnel, contractors, consultants, insurance representatives, and independent cost estimation professionals with varied experience across transportation, vertical, and industrial projects. To support synthesis across these diverse sources, artificial intelligence–assisted tools were used to organize large volumes of textual data, identify recurring themes, and facilitate cross-comparison of practices; all interpretive judgments, analytical framing, and conclusions were developed and validated by the author. The methodology emphasizes interpretive and comparative analysis rather than statistical inference, positioning Independent Cost Estimation as a governance mechanism examined through the combined lenses of theory, policy, statutory context, and practitioner experience.

2. Defining Independent Cost Estimation

2.1 Academic and Professional Definitions

Academic literature describes ICE as a parallel estimating process conducted by an entity that is organizationally and financially independent from the designer, constructor, or development team, with the objective of providing an unbiased assessment of probable project cost (Flyvbjerg, 2014; Eke, 2017). Independence is framed as a governance safeguard against optimism bias and strategic misrepresentation, particularly on complex or high-risk projects.

Professional guidance from organizations such as the Federal Highway Administration (FHWA), the Design–Build Institute of America (DBIA), and the Royal Institution of Chartered Surveyors (RICS) emphasizes similar principles. ICE is defined as a third-party estimate prepared using industry-standard means-and-methods assumptions, current market pricing, and contractor-style production logic, rather than historical averages alone (DBIA, 2020; FHWA, 2023; RICS, 2017).

Across these sources, three defining characteristics consistently emerge: (1) institutional independence from parties responsible for design and construction, (2) methodological rigor comparable to contractor estimating practices, and (3) use as a decision-support tool rather than a bid replacement.

2.2 Distinguishing ICE from Engineer's and Owner's Estimates

ICE is frequently mixed with traditional engineer's or owner's estimates. However, literature and practitioner interviews distinguish these clearly. Engineer's estimates are commonly prepared internally using historical bid data, standardized assemblies, and planning-level assumptions. ICE, by contrast, is expected to reflect construction sequencing, crew composition, equipment productivity, subcontractor pricing, escalation risk, and contingency logic consistent with market practice (Ashuri et al., 2012; RICS, 2017).

This distinction is particularly important in alternative delivery contexts, where negotiated pricing replaces competitive bidding as the primary cost-determination mechanism.

3. Statutory, Policy, and Organizational Foundations for ICE

3.1 Public-Sector Statutory Context

In the public sector, ICE is commonly embedded through enabling statutes, administrative rules, or agency manuals governing alternative delivery. In the United States, federal agencies encourage—but generally do not mandate—ICE use, allowing owners flexibility to tailor implementation to project complexity and risk profile (FHWA, 2023).

State and local statutes vary widely. Some explicitly require independent cost estimates prior to price negotiation or contract award for DB, CM@R, or PDB projects, while others rely on policy guidance rather than statutory prescription. Research suggests that broad, flexible enabling authority supports more effective ICE integration than narrowly prescriptive statutory language (Shrestha et al., 2018).

3.2 Private-Sector and Hybrid Applications

In private-sector and hybrid public–private projects, ICE is typically implemented through owner policy rather than statute. Institutional owners, such as healthcare systems, universities, industrial developers, and data-center operators, often require ICE at defined milestones to validate budgets, financing assumptions, and risk exposure (RICS, 2017; Eke, 2017). In these contexts, ICE functions as a fiduciary control mechanism aligned with lender, board, or investor oversight requirements.

3.3 Independence and Procurement Models

Across sectors, best practice emphasizes owner-procured ICE to preserve credibility and avoid conflicts of interest. Situations in which the constructor or design-builder retains the ICE—while sometimes permitted—are widely viewed as undermining functional independence (FHWA, 2023; DBIA, 2020).

4. ICE in Design–Bid–Build (DBB)

In DBB, ICE plays a limited but still valuable role. Competitive bidding remains the primary price-validation mechanism, reducing reliance on third-party estimates. ICE is most commonly used for feasibility analysis, capital programming, and funding approvals, particularly on large or atypical projects (RICS, 2017).

Where ICE is applied in DBB, it often supplements internal estimates by testing assumptions related to complex systems, specialized construction, or early contractor involvement pilots.

5. ICE in Design–Build (DB)

In DB, ICE supports owner decision-making before and during procurement. Owners commonly use ICE to validate affordability prior to advertisement and to assess whether submitted proposals represent reasonable market value (DBIA, 2020). ICE may also justify awarding contracts that exceed internal estimates by defined margins, particularly in volatile markets.

After award, ICE typically plays a reduced role in lump-sum DB, as price reconciliation opportunities are limited.

6. ICE in CM@R / CMGC

CM@R represents one of the earliest and most established applications of ICE. Negotiated Guaranteed Maximum Prices require reconciliation between the CM's estimate and an independent benchmark. Literature and practice consistently show that early and continuous ICE involvement improves cost accuracy, transparency, and trust (Ashuri et al., 2012; Shrestha et al., 2018).

Best practices include early engagement, consistent work breakdown structures, and iterative reconciliation at progressive design milestones.

7. ICE in Progressive Design–Build (PDB)

PDB places the greatest emphasis on ICE. Because contractor selection is primarily qualifications-based and price is negotiated later, ICE becomes the owner's principal cost-governance mechanism (FHWA, 2023). Effective PDB programs engage ICE early, integrate it into risk workshops, and use structured reconciliation protocols to align assumptions.

Empirical evidence from public and private PDB projects indicates that ICE-supported negotiations reduce contingency waste, accelerate delivery, and increase owner confidence (Shrestha et al., 2018; DBIA, 2020).

8. ICE Reconciliation and Information-Disclosure Strategies

A critical but often underdeveloped aspect of Independent Cost Estimation (ICE) practice is the strategy used to disclose cost information and reconcile differences between the owner's independent estimate and the contractor's or design-builder's price. Across delivery methods and sectors, three dominant ICE reconciliation strategies have emerged in both the literature and professional practice: double-blind, single-blind, and open-book (or transparent) models (Flyvbjerg, 2014; DBIA, 2020; RICS, 2017). These strategies reflect different assumptions about behavioral bias, trust, efficiency, and governance.

Insights from semi-structured interviews with experienced public owners, contractors, cost estimators, and federal oversight professionals consistently reinforced that reconciliation strategy selection is not neutral; rather, it materially shapes negotiation dynamics, risk perception, and project outcomes. Interview participants included senior DOT alternative delivery managers, private-sector construction executives, and independent cost estimation professionals with experience across transportation, vertical, and industrial projects.

8.1 Double-Blind ICE

In a double-blind ICE strategy, neither the contractor nor the ICE team has access to the other party's estimate prior to formal reconciliation. The owner or a neutral facilitator compares the two estimates and guides discussion around areas of divergence without disclosing specific figures. This approach is intended to preserve estimator independence and reduce anchoring effects, which behavioral research identifies as a major source of forecasting bias (Flyvbjerg, 2014).

Both the literature and interview evidence indicate that double-blind ICE is most commonly applied in early CM@R and PDB programs or in agencies seeking to reinforce strict independence during initial adoption of negotiated delivery methods (FHWA, 2023). However, practitioners cautioned that the effectiveness of double-blind models is highly contingent on facilitator expertise. Without informed questioning and structured reconciliation protocols, the process can become inefficient, prolong negotiations, and obscure the underlying drivers of cost differences, a concern echoed by multiple senior estimators interviewed.

8.2 Single-Blind ICE

In a single-blind strategy, the ICE team is granted access to the contractor's estimate, while the contractor does not see the independent estimate. This model allows the ICE to directly diagnose differences in quantities, production rates, crew assumptions, escalation treatment, and risk allocation, enabling more targeted and efficient reconciliation (DBIA, 2020; FHWA, 2023).

Interviewed owners and ICE professionals widely identified single-blind reconciliation as the most operationally efficient model for mature alternative delivery programs. Experienced estimators emphasized that access to contractor assumptions allows ICE to function as an analytical diagnostic tool rather than a competing price signal. At the same time, interviewees cautioned that if the owner treats the ICE estimate as a fixed or punitive benchmark, single-blind models may be perceived as asymmetrical or adversarial, reinforcing defensive pricing behavior.

8.3 Open-Book or Transparent ICE

Open-book ICE strategies involve shared visibility of estimates, assumptions, and cost drivers among the owner, contractor, and ICE team. Rather than comparing independent numbers in isolation, this approach emphasizes collaborative problem-solving, joint risk evaluation, and shared understanding of cost drivers (RICS, 2017; DBIA, 2020).

Both literature and interview findings suggest that open-book ICE is most effective in environments characterized by high trust, experienced participants, and stable market conditions. Several private-sector owners and long-term public owner–contractor partnerships described open-book ICE as a mechanism for accelerating convergence and improving cost literacy across organizations. However, consistent with governance theory, interviewees also noted risks of strategic behavior, reduced estimator independence, and cost anchoring if early figures dominate later discussions (Flyvbjerg, 2014).

8.4 Strategy Selection and Governance Implications

Evidence from both the literature and interviews indicates that no single ICE reconciliation strategy is universally superior. Rather, effectiveness depends on project complexity, market volatility, organizational maturity, and institutional trust (RICS, 2017; FHWA, 2023). Agencies new to negotiated delivery often favor double-blind approaches to reinforce independence, while more experienced programs tend to transition toward single-blind or open-book strategies to improve efficiency and collaboration.

Across all strategies, experts emphasized the importance of early agreement on reconciliation protocols, clarity of estimator authority, and explicit treatment of uncertainty ranges.

When these conditions are absent, ICE risks becoming either an adversarial audit function or an unquestioned authority, undermining its intended governance role.

9. Cross-Cutting Issues: Timing, Transparency, and Risk

Early ICE engagement consistently emerges as the most critical success factor. ICE introduced after major scope decisions offers limited value, while early involvement enables influence over design choices, risk allocation, and budget realism (Flyvbjerg, 2014).

Transparency in reconciliation, whether single-blind, double-blind, or open-book, matters more than the specific model chosen, provided roles and authority are clearly defined.

10. State and Sectoral Exemplars of ICE Implementation

This section synthesizes practices from selected U.S. states and non-transportation sectors that were repeatedly identified in interviews and literature as demonstrating mature or innovative use of Independent Cost Estimation (ICE). These exemplars are not presented as prescriptive models, but as illustrative cases showing how statutory flexibility, organizational structure, and delivery-method choice shape ICE effectiveness.

10.1 Utah: Programmatic Integration of ICE

Utah has developed one of the most mature applications of ICE across alternative delivery methods. Rather than relying on rigid statutory mandates, Utah integrates ICE through agency policy and programmatic practice. ICE is routinely engaged early in CM@R and PDB projects, participates in risk workshops, and uses contractor-style work breakdown structures to support reconciliation. Interview evidence suggests that Utah's consistent use of ICE has improved owner cost literacy and reduced adversarial price negotiations, particularly on complex corridor and program-level projects.

10.2 Virginia: Scope Validation and Early Cost Reconciliation

Virginia represents an innovative statutory procedural hybrid. In addition to ICE use during CM@R and PDB negotiations, Virginia employs a post-award scope validation period (typically 90–120 days) that allows the design-build team to identify inconsistencies or gaps in reference information before final price commitment. While ICE remains the primary pricing benchmark, this scope validation mechanism complements ICE by addressing uncertainty upstream, reducing later disputes and contingency loading.

10.3 Minnesota: Transparency and Procurement Discipline

Minnesota is frequently cited for its highly transparent procurement processes. Although ICE is not always mandated by statute, the state emphasizes clarity in cost assumptions, evaluation criteria, and reconciliation protocols. ICE is used selectively on larger or higher-risk projects, often in conjunction with detailed debriefings that reinforce industry confidence. Minnesota demonstrates how transparency can amplify the value of ICE even when its use is targeted rather than universal.

10.4 Kansas: Progressive Design–Build and Risk-Based ICE

Kansas provides a clear example of ICE embedded within a PDB framework. On recent industrial and infrastructure-support projects, ICE was procured early and worked in parallel with the PDB team to reconcile quantities, pricing assumptions, and risk allocations. The use of risk registers and shared contingency pools priced and validated through ICE enabled rapid decision-making and schedule acceleration, illustrating ICE's role as an enabler of collaboration rather than a constraint.

10.5 Washington and Maryland: Mega-Project Applications

Washington and Maryland illustrate ICE use on large, complex projects where traditional estimating approaches proved insufficient. In Washington, ICE has increasingly been applied to both DB and PDB projects to address market volatility and affordability challenges. Maryland's experience on mega-projects highlights both the potential and limitations of ICE, particularly when independence or integration with quality oversight is unclear. These cases underscore the importance of aligning ICE authority with owner decision-making structures.

10.6 Private and Vertical Construction Sectors

Outside transportation, institutional and private owners such as healthcare systems, universities, and industrial developers commonly deploy ICE as part of fiduciary oversight. In these contexts, ICE is often required by lenders, boards, or investors and applied at defined milestones (concept, schematic, design development). Unlike statutory public-sector applications, private-sector ICE is governed by internal policy but performs a similar function: validating budgets, informing go/no-go decisions, and managing escalation risk (RICS, 2017).

11. Comparative Tables

Table 1. Role of ICE by Project Delivery Method

Delivery Method	Primary Purpose of ICE	Typical Timing	Degree of Influence
Design–Bid–Build (DBB)	Budget validation, funding approval	Planning and pre-bid	Low
Design–Build (DB)	Affordability check, bid reasonableness	Pre-advertisement and bid evaluation	Moderate
CM@R / CMGC	GMP negotiation and reconciliation	Concept through 90% design	High
Progressive Design–Build (PDB)	Cost governance and risk pricing	Selection through GMP	Very High

Table 2. ICE Implementation Characteristics Across Sectors

Sector	ICE Trigger	Governance Mechanism	Common Challenges
Transportation (Public)	Statute or policy	Agency oversight, FHWA guidance	Market volatility, utilities, geotechnical risk
Vertical Public (Universities, Healthcare)	Owner policy	Board or fiduciary oversight	Scope creep, escalation
Industrial / Private	Lender or investor requirement	Financial governance	Confidentiality, data access
Public–Private Hybrid	Contractual mandate	Shared governance	Independence perception

12. Risks and Limitations of Independent Cost Estimation

While Independent Cost Estimation (ICE) is widely regarded as a best practice in complex project delivery, its use is not without risk. A balanced assessment requires acknowledging potential limitations and unintended consequences associated with ICE implementation. Recognizing these risks is essential for owners seeking to deploy ICE as a governance tool rather than an inflexible control mechanism.

12.1 False Sense of Certainty

One of the most common risks associated with ICE is the perception that an independent estimate represents an objective or definitive "correct" price. In reality, ICE is itself a forecast subject to uncertainty, market volatility, and incomplete information. Overreliance on ICE outputs can lead owners to underestimate residual risk when independent estimates are treated as deterministic point values rather than probabilistic ranges subject to uncertainty (Flyvbjerg, 2014; Eke, 2017). When ICE is treated as a deterministic benchmark rather than a probabilistic range, it may create unrealistic expectations and decision rigidity.

12.2 Adversarial Dynamics and Erosion of Collaboration

If positioned improperly, ICE can introduce adversarial dynamics into collaborative delivery environments. Contractors and design-build teams may perceive ICE as a policing mechanism rather than a neutral decision-support tool, particularly when estimates are used to challenge pricing without transparent discussion of assumptions. Interview evidence suggests that ICE deployed late or without clear reconciliation protocols can undermine trust, discourage openness, and incentivize defensive pricing behavior, counteracting the intended benefits of alternative delivery methods.

12.3 Misalignment with Market Conditions

ICE effectiveness depends heavily on how well estimators account for evolving market conditions, labor constraints, and subcontractor behavior, all of which contribute to probabilistic

cost uncertainty rather than predictable variance (Ashuri et al., 2012; Eke, 2017). ICE teams that rely excessively on historical data or static databases risk mischaracterizing cost exposure in non-stationary market conditions, where material prices, labor availability, and supply chains exhibit probabilistic volatility rather than stable trends (Eke, 2017; Ashuri et al., 2012).

12.4 Independence Versus Integration Tension

A structural tension exists between maintaining estimator independence and ensuring sufficient integration with the project team. Excessive separation may limit ICE understanding of evolving scope, constructability decisions, and risk mitigation strategies. Conversely, over-integration risks compromising perceived independence. Striking the appropriate balance requires deliberate role definition, controlled information sharing, and clear ethical boundaries (DBIA, 2020).

12.5 Cost, Schedule, and Administrative Burden

Engaging ICE entails direct costs and indirect schedule impacts. For smaller or lower-risk projects, ICE fees and reconciliation efforts may outweigh the value added. Additionally, poorly coordinated ICE processes can extend preconstruction timelines, particularly when reconciliation thresholds, escalation paths, or decision authority are unclear. These burdens are most pronounced when ICE is introduced late, forcing retroactive justification of design or pricing decisions.

12.6 Risk of Institutionalized Conservatism

Over time, routine reliance on ICE may unintentionally reinforce conservative design and construction decisions. If ICE assumptions consistently reflect risk-averse productivity rates or contingency practices, innovative approaches that could reduce cost or schedule may be discouraged. This risk is particularly acute when ICE estimates are used as hard constraints rather than as inputs to informed trade-off discussions.

12.7 Mitigation Strategies

The risks outlined above do not negate the value of ICE but underscore the importance of thoughtful implementation. Mitigation strategies include early ICE engagement, transparent reconciliation processes, explicit treatment of uncertainty ranges, periodic calibration against market outcomes, and clear communication that ICE supports not replaces owner judgment. When these conditions are met, ICE can function as a collaborative governance mechanism rather than a source of friction.

13. Conclusions and Implications

Independent Cost Estimation has evolved into a central oversight mechanism for complex construction projects across both public and private sectors. While DBB relies primarily on market competition, DB, CM@R, and PDB depend on ICE to ensure fiscal accountability, transparency, and informed risk allocation.

For policymakers and owners, the implication is clear: ICE should be enabled through flexible policy frameworks, supported by early engagement and qualified estimators, and

integrated into collaborative decision-making processes. When implemented thoughtfully, ICE enhances—not constrains—innovation and collaboration.

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