Class 5 vs Class 4 Cost Estimates and Their Relationship to Front-End Loading (FEL)

Practical guidance for scoping, accuracy expectations, and decision-making across FEL-1 and FEL-2

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1. Introduction

This document explains how Association for the Advancement of Cost Engineering (AACE) estimate classes—specifically Class 5 and Class 4—align with Front-End Loading (FEL) stages, what inputs they require, typical accuracy ranges, use cases, and how to apply them for decision-quality evaluations. The goal is to clarify when to use each estimate, what confidence to expect, and how to progress scope maturity to improve estimate accuracy before major funding decisions.

2. Overview: Estimate Classes and FEL

AACE estimate classes provide a common language for communicating scope maturity and estimate accuracy. Front-End Loading (FEL) is a stage-gate framework used to progressively define scope and reduce uncertainty before committing capital. In most organizations:

• **FEL-1 (Business/Concept Development):** Opportunity framing, high-level options, business case screening. Typically corresponds to Class 5 estimates.

• **FEL-2 (Select/Feasibility):** Alternative selection and concept definition. Typically corresponds to Class 4 estimates.

• **FEL-3 (Define/Front-End Engineering Design):** Detailed definition and execution planning. Typically corresponds to Class 3 estimates or better.

3. Class 5 Estimates (Concept Screening / Order-of-Magnitude)

Typical context: Early-stage screening during FEL-1 to compare options and decide whether to proceed.

3.1 Inputs and Scope Maturity

Typical inputs include:

• High-level scope description and objectives

• Very preliminary process/technical data (e.g., capacities, throughput, location)

• Block flow diagrams or conceptual layouts (if available)

• Factored or parametric estimating based on historical analogs

• Preliminary schedule, high-level execution strategy

• Market intelligence for unit costs and major equipment allowances

3.2 Methods and Tools

• Capacity/size factoring (e.g., six-tenths rule), parametric models

• Stochastic ranges to reflect major unknowns; probabilistic roll-ups (P50/P80)

• Location and escalation factors; allowances for undefined scope

• Top-down benchmarks from past projects

3.3 Accuracy and Contingency Guidance

Expected accuracy range is widest at this stage due to high uncertainty. Organizations often target ranges on the order of approximately −50% to +100% on total installed cost, depending on industry and data quality. Contingency is typically high and based on risk/uncertainty analysis rather than detailed itemization.

3.4 Typical Decisions Enabled

• Option screening and prioritization

• Initial business case sanity checks

• Gate decision to proceed from FEL-1 to FEL-2

3.5 Common Pitfalls

• Over-precision: quoting single-point numbers without ranges

• Anchoring on optimistic analogs

• Understated allowances for unknown scope and execution risks

4. Class 4 Estimates (Study / Feasibility)

Typical context: Selection and feasibility during FEL-2 to choose a preferred concept and define scope.

4.1 Inputs and Scope Maturity

Typical inputs include:

• Preliminary engineering: process flow diagrams (PFDs), heat/material balances

• Preliminary equipment lists with key sizes; major quantities approximated

• Preliminary plot plans and site constraints

• Preliminary execution plan and contracting strategy

• Vendor budgetary quotes for long-lead/major equipment where feasible

• Refined schedule and labor productivity assumptions

4.2 Methods and Tools

• Semi-detailed unit-rate build-ups for known quantities

• Factored estimating where detail is incomplete

• Improved benchmarking and location adjustments

• Quantified risk registers and Monte Carlo where appropriate

4.3 Accuracy and Contingency Guidance

With more defined scope than Class 5, accuracy typically tightens to something like −30% to +50% for total installed cost, again varying by sector and data quality. Contingency is still significant but increasingly driven by identified risks and quantified uncertainty rather than broad allowances.

4.4 Typical Decisions Enabled

• Select preferred concept and confirm feasibility

• Seek authorization to proceed to FEL-3 (front-end engineering design)

• Refine business case (NPV/IRR), sensitivity and risk profiles

4.5 Common Pitfalls

• Carrying forward optimistic assumptions from Class 5 without revalidation

• Insufficient vendor engagement for key cost drivers

• Inadequate integration between engineering, procurement, and construction planning

5. Side-by-Side Comparison

Attribute	Class 5 (FEL-1)	Class 4 (FEL-2)	Primary Use	Typical Accuracy
Scope Maturity	Very low; conceptual only	Low to moderate; preliminary engineering begun	Decision framing	Widest (e.g., −50%/+100%)
Inputs	High-level scope, analogs, factors	Prelim. PFDs, equipment lists, quotes	Screen vs. select	Tighter (e.g., −30%/+50%)
Method	Parametric, factored, benchmarks	Semi-detailed + factored + quotes	Screening/portfolio	Improving confidence
Contingency	High; uncertainty-based	Moderate-high; risk-based	Proceed/stop decision	Ranges + risk quantification

6. Relationship to FEL Stage-Gates and Governance

• Class 5 at FEL-1: Use for option screening with explicit ranges and decision criteria; avoid committing to fixed budgets.

• Class 4 at FEL-2: Use to select the preferred concept and set targets; begin establishing the basis of estimate (BoE) for FEL-3.

• Gate Reviews: Verify maturity criteria (deliverable checklists), challenge assumptions, and confirm risk-adjusted economics.

• Progression: Each gate reduces uncertainty by maturing scope, improving quantities, engaging vendors, and refining execution plans.

7. Practical Steps to Move from Class 5 to Class 4

• Develop and freeze a concept basis (functional requirements, key design criteria).

• Produce preliminary engineering deliverables (PFDs, H&MBs, equipment list, layout).

• Engage vendors for budgetary pricing of major equipment and validate lead times.

• Refine location/productivity factors and contracting strategy.

• Quantify risk with a living risk register; run sensitivity and, where appropriate, probabilistic analysis (P50/P80).

• Document the Basis of Estimate (assumptions, inclusions/exclusions, methods, data sources).

8. Illustrative Example

Suppose an organization is evaluating a new processing line. In FEL-1 (Class 5), a parametric estimate indicates a total installed cost of $40–80 million with high uncertainty due to undefined layout and vendor packages. After concept selection and preliminary engineering in FEL-2 (Class 4), vendor budget quotes and preliminary quantities narrow the estimate to $55–75 million, enabling a go/no-go decision to enter FEL-3 and fund front-end engineering design.

9. Checklist

Class 5 readiness:

• Clear problem statement and success criteria

• Defined option set and screening criteria

• Documented assumptions and cost basis with ranges

Class 4 readiness:

• Preliminary engineering package complete (PFDs, equipment list, layout)

• Vendor budget pricing obtained for key items

• Risk register and contingency rationale documented

• Updated business case with sensitivities

10. Glossary

• FEL: Front-End Loading: staged approach (FEL-1/2/3) to define scope and reduce uncertainty before execution.

• Basis of Estimate (BoE): Document capturing scope, methods, assumptions, data sources, and exclusions.

• Contingency: Budget for known-unknowns based on uncertainty and risk analysis.

• Class 5/4: AACE estimate classifications indicating scope maturity and expected accuracy ranges.

11. Notes and References

Concepts align with common industry practice (e.g., AACE International Recommended Practices on cost estimate classification and FEL). Accuracy ranges and labels vary by organization, industry, and data quality; adjust to your corporate standards and governance.