International Experts in Claims Analysis, Dispute Resolution, and Project Management for Process, Oil & Gas, Pipeline, Power, Industrial, Infrastructure, and Building Construction Projects

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Quantum and Damages Analysis: Cost-Based Engineering and Construction Claims

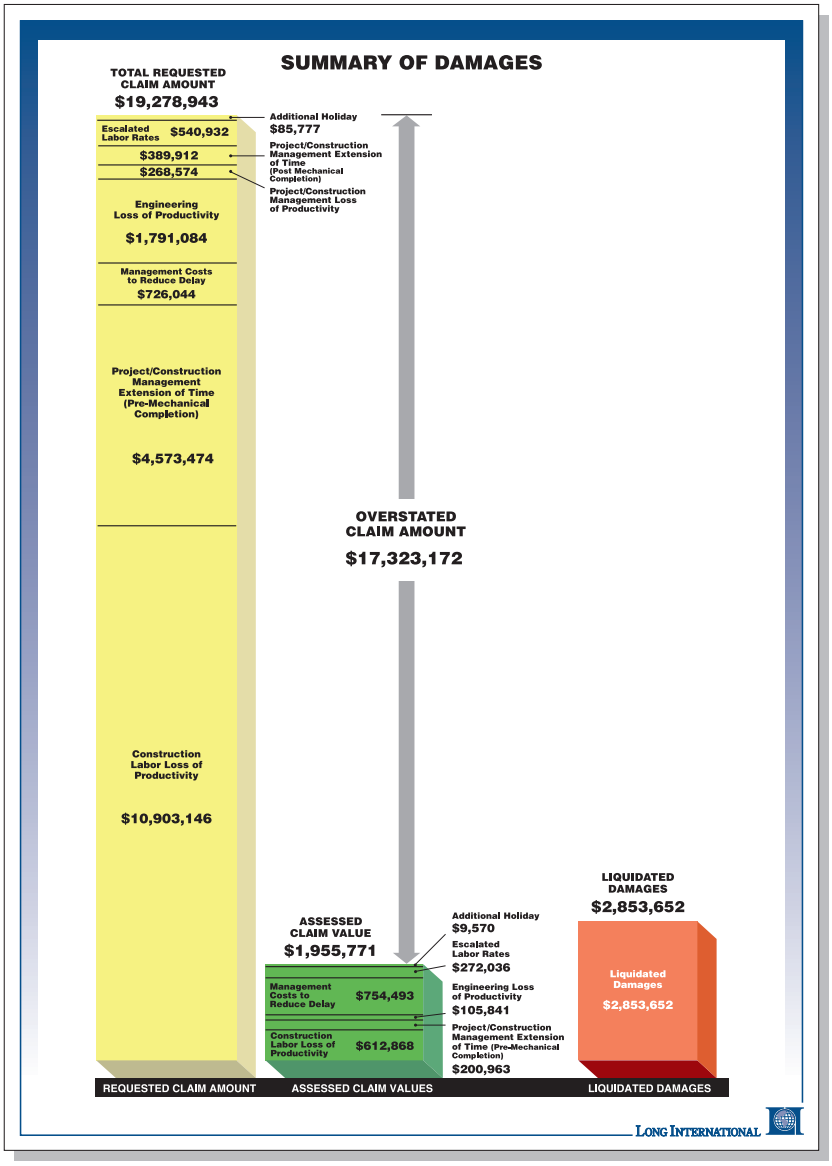
OVERVIEW

Cost-based engineering and construction claims address increased time and performance costs resulting from unresolved change orders, disputed specifications, delays, loss of productivity, and other causes. An owner may seek to recover for increased costs to design and construct a project due to contractor mismanagement. Our quantum and damages experts calculate the damages incurred by defective contractor work, decreased production capacity due to defective design, and delay or liquidated damages resulting from contractor delays.

Our man-hour, quantity, and cost variance analyses determine a contractor's responsibility for bid error and performance problems in addition to owner responsibility for compensable problems. With our comprehensive approach to damages, we seek to develop a supportable basis for damages derived from analyzing problems caused by both parties, contractual risks, and actual man-hours and costs incurred.

Quantum Calculations

- Man-hour, quantity, and cost variance analyses
- Evaluation of the reasonableness of a contractor's bid estimate
- Costs of changes in scope
- Loss of productivity costs
- Delay and prolongation costs
- Costs associated with contractor performance problems and rework
- Owner damages
- Other costs



Cost / Damages Matrix

(All Costs Shown in $000)

Project Work Activities	Original Contract Value	Approved Change Orders	Current Contract Value	Pending Change Orders	Bid Error (Uncompensable)	Contractor Caused Problems (Uncompensable)	Potential Compensable Damages: Issue No. 1 Inaccurate P&IDs	Issue No. 2 Increased Piping Quantities	Issue No. 3 Delay	Issue No. 4 Disruption/ Loss of Productivity	Total Actual Costs
ENGINEERING	$2,500	$400	$2,900	–	–	$120	$250		$500	–	$3,770
EARTHWORK	$1,000	–	$1,000	–	–	$200	–	–	–	–	$1,200
CONCRETE	$500	$20	$520	–	–	$100	–	–	–	–	$620
STRUCTURAL STEEL	$1,000	$100	$1,100	–	–		–	–	–	–	$1,100
INSTALLED EQUIPMENT	$7,200	$900	$8,100	–	–	$50	–	–	–	–	$8,150
PIPING	$2,000	$1,055	$3,055	$2,500	$500	$750	$1,250	$345	–	$2,500	$10,900
Direct Labor	$500	$250	$750	$600	$75	$112	$300	$75	–	$600	$2,512
Labor Taxes & Burdens	$215	$108	$323	$280	$35	$53	$145	$35	–	$280	$1,151
Permanent Material & Equip	$800	$400	$1,200	$950	$200	$300	$475	$100	–	$950	$4,175
Consumable Materials	$50	$25	$75	$50	$10	$15	$40	$5	–	$50	$245
Owned Construction Equip	$25	$10	$35	$25	$10	$15	$30	$5	–	$25	$145
Rental Equipment	$10	$5	$15	$10	$50	$75	$10	$25	–	$10	$195
Subcontracts	$400	$257	$657	$585	$120	$180	$250	$100	–	$585	$2,477
TANKAGE	$500	$100	$600	–	–	–	–	–	–	–	$600
INSTRUMENTATION	$800	$200	$1,000	$700	–	$600	$1,000	–	–	$700	$4,000
ELECTRICAL	$1,500	$450	$1,950	$900	–	$800	$1,800	–	–	$900	$6,350
PROJECT/CONST MANAGEMENT	$2,000	$425	$2,425	$1,800	$400	$750	$2,200	–	$600	$1,800	$9,975
OTHER FIELD INDIRECTS	$1,500	$300	$1,800	$1,300	$300	$600	$1,000	$300	$450	$1,300	$7,050
HOME OFFICE OVERHEAD	$2,000	$400	$2,400	$800	–	$400	$400	$200	$600	$800	$5,600
FEES/PROFIT	$2,500	$850	$3,350	$1,000	–	–	$800	$80	$750	$1,000	$6,980
TOTAL PROJECT	$25,000	$5,200	$30,200	$9,000	$1,200	$4,370	$8,700	$925	$2,900	$9,000	$66,295

POTENTIAL CLAIM VALUE = $21,525

TOTAL COST OVERRUN = $36,095

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Combined Methodologies

In cost-based claims, direct, indirect, and "other" costs comprise a contractor's claimable costs and are determined by:

(1) technical analyses to isolate changes in scope, timing, sequencing, etc., to which costs are applied, and

(2) cost variance analyses that compare the original estimate for work with the actual cost incurred and correlate the variances to the causes of cost growth.

The Cost/Damages Matrix on this page illustrates the breakdown of costs of various work activities to categories of cost variances between the original contract values and actual costs incurred. Ideally, the analytical results of (1) and (2) equal the same claimable amount, but generally they do not. Differing results arise because the sum of cost components of separately priced claimable events may differ from actual costs incurred when comparing actual costs to the control budget or contract values for each cost component.

Quantum and Damages Analysis: Cost-Based Engineering and Construction Claims

Combining engineering analyses and fact finding with cost accounting and cost-variance analysis produces a well-supported and compensable claim or presents a strong defense against a claim's validity, which may be overstated, as illustrated in the Summary of Damages graphic on page 1. Long International's engineering, accounting, and financial experts join their experience and knowledge in an integrated approach. Our experts not only seek to identify the technical issues that increase man-hours and costs in a contractor's job cost reports but also seek to ensure that costs represented in job cost reports are traceable to the payroll reports, accounts paid, and general ledger. The result is a claim that has received detailed engineering analysis to help evaluate causation and entitlement, together with a proof of costs incurred arising from the cause.

Accounting and Engineering Perspectives

Engineering and accounting professionals often prepare and review construction cost-based claims. Engineers may focus on man-hours, quantities installed, and costs recorded in project job cost reports. Accountants may focus on man-hours and costs recorded in project cost ledgers and general ledgers. The flow chart on page 3 highlights labor cost reporting that provides the basis for labor cost variance analyses. The plot of field change man-hours over time on page 4 illustrates an example "measured mile" analysis of productivity loss caused by late engineering, RFIs, and field changes. In combination with the productivity loss analyses on page 4, we can evaluate the causes of productivity loss and actual labor costs together to support a compensable claim amount.

When presenting construction claims in mediation, arbitration, or litigation, testifying fact and expert witnesses may offer evidence as to the quantum of damages from: (1) project job cost reports and (2) project cost and general ledgers. Because we integrate engineering and accounting analysis approaches, we can address the data in *all* reports and records, which strengthens the basis for a claim.

When increased labor or productivity loss are at issue, man-hours and costs in project job cost reports need to correspond to or reconcile with those in accounting ledgers. This is also true for other costs, such as permanent equipment and materials, owned or rented equipment, subcontracts, engineering, project and construction management, and other cost accounts.

Costs that Count

Proof of costs incurred that arise from the cause takes more than assertion. In addition to proving cause through detailed engineering analysis, our quantum and damages experts establish the propriety of those costs. Costs should be clearly identified by type, with labor categorized by a specific job number, work package, trade, and activity. While some contracts allow for a specified hourly rate for labor, disputed change orders may need to reflect the actual labor cost paid. Also, a labor rate in a project job cost report may not match the actual cost because of payroll tax timing, benefits, and overtime. Payroll taxes may have reached a maximum amount for an individual depending on the time of year when work was performed. Benefits may vary by trade. Some claimed overtime costs may not have been paid if compensation is based on a monthly salary.

Likewise, material costs should be based on actual costs of installed or used materials. These can vary over time depending on when materials were purchased, *i.e.,* previously purchased warehoused materials or ones bought specifically for a project. While overhead or indirect costs may be charged to a job based on a standard rate, a cost review should include evaluating actual costs for overhead and indirect costs. Actual percentages for overhead often vary; an assumed percentage for a given project may differ from actual costs.

General ledgers and financial statements include total project job costs, including material, labor, subcontract, and overhead costs, as "Jobs-in-Process." However, proof of cost incurrence per full books and records requires that costs recorded in project job cost reports be traced to general ledger costs.

Cost Verification

Challenges in preparing or evaluating the validity of a cost-based claim include: (1) identifying the specific costs incurred on a project and (2) determining that the contractor actually incurred the costs. Specific job costs are most easily identified in job cost ledgers and job cost reports. These reports typically contain direct, indirect, and "other" costs related to project activities over time or at points in time, *e.g.,* labor, material, equipment, support labor, small tools, temporary utilities, and mobilization and demobilization costs, to name a few.

Cost verification is a vital step in preparing or evaluating a cost-based claim. If cost records are available, we begin by understanding the job cost system and general ledger financial reporting system. Records commonly used to verify costs include:

- Labor
  - Time sheets
  - Labor contracts
  - Payroll reports
  - Hourly rate calculations
  - Salary and bonus reports
- Material
  - Invoices
  - Purchase orders
  - Requisition forms
  - Bills of lading
- Subcontractor
  - Contracts
  - Payment requests
  - Change orders
- Rental equipment
  - Rental agreements
  - Equipment utilization reports
  - Invoices
- Home-office overhead
  - Audited cost pools
  - Overhead calculation and rates
- Owned equipment
  - Equipment and small tools schedule
  - Equipment depreciation schedule
  - Equipment rate schedule

A critical step that is often overlooked is determining that costs recorded in job cost ledgers reflect what a contractor actually paid to its labor, subcontractors, vendors, suppliers, etc. Recorded costs of completed work may *not* have been paid. A job cost report may include a subcontractor's cost even though a prime contractor is disputing that cost with the subcontractor. When costs cannot be shown to have been actually incurred and paid in a cost-based claim, they may be disallowed and excluded in the recovery. Therefore, costs per the job cost ledger need to be compared to the contractor's cash and accounts payable ledgers and reconciled.

Job cost and financial reporting systems vary by contractor. Longer contract performance durations, more use of subcontractors, and more complex projects require more demanding and complicated preparation of or defense against cost-based claims. If joint-venture partners are involved, cost reporting can be even more complicated. Long International's integrated engineering, accounting, and financial team has the experience and knowhow to prepare or defend against the most demanding cost-based claims.

Supportable Results

Entitlement. Causation. Cost Verification. Long International integrates the perspectives and experience of its engineers, financial experts, and accounting professionals to prepare or defend against cost-based engineering and construction claims.

Labor Cost Verification Steps

1. Substantiate period labor costs from job cost reports to monthly job status reports and weekly/daily labor job cost reports by work package.
2. Trace weekly/daily labor job cost reports to workers' daily timesheets.
3. Determine the propriety of labor rates for labor operations by labor class compared to the labor bid rate.
4. Compare labor hours expended to original estimates for work performed.
5. Determine labor rates and labor hour variance from the estimate and compare to change orders, if any.

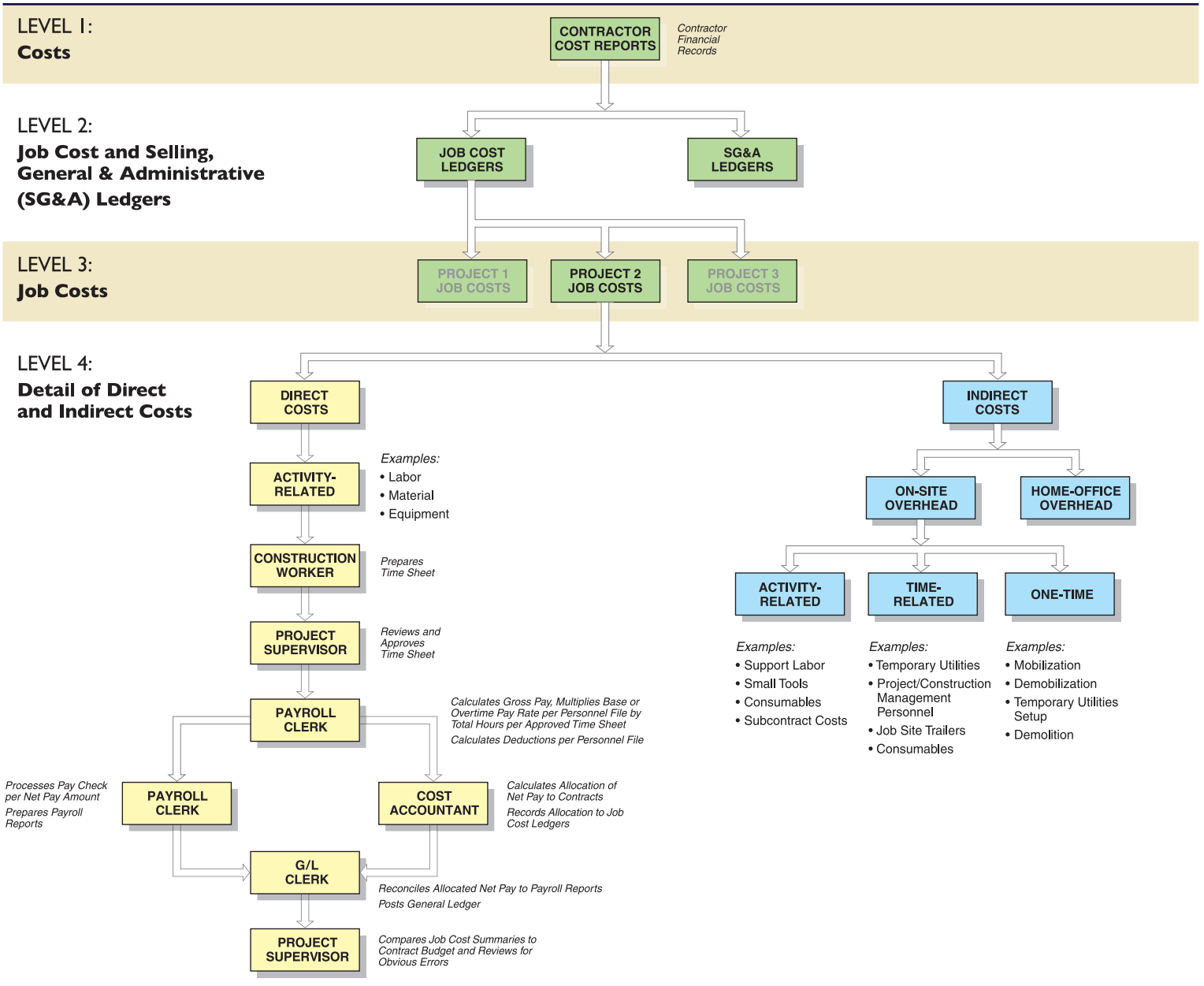
In summary, trace from labor job cost ledgers to underlying labor timesheets, labor rate agreements, and payroll reports showing gross pay, payroll taxes, fringe benefits, and other deductions that document labor payments for payroll.

Productivity Loss Damages

In the construction industry, it is largely agreed that delays, multiple changes, out-of-sequence work, overtime work, and other disrupting events diminish labor productivity. However, there is no universally accepted method for estimating the resulting productivity loss, and industry experts and the courts have criticized some of the studies used to estimate such losses.

Delays and impacting events often cause contractors to work overtime, perform work out of its planned sequence or in parallel rather than in series, work in weather conditions that are less favorable than they reasonably planned, work in crowded conditions, employ multiple shifts, etc., all in an effort to make up time to mitigate delay. When there are multiple changes and impacting events on a project and they act in sequence or concurrently, there may be a cumulative effect of the individual changes and impacting events that is much greater than a sum of the individual parts. Multiple change orders and other types of owner-caused delays and disruption, as well as contractor-caused and force majeure delays and disruption, can negatively impact a contractor's performance of unchanged work such that it expends additional time, man-hours, and costs in completing its "unchanged" base scope work. These disruptions often result in a contractor submitting delay and labor productivity loss claims.

To determine a contractor's entitlement to labor productivity loss claims, or to defend against such claims, often requires a detailed assessment



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of contemporaneous man-hours, installed quantities, the timing of changes and impacting events, and an allocation of responsibility for the various causes of delay and disruption.

Long International's experts employ numerous methods to analyze, demonstrate, or disprove a contractor's entitlement to recovery of increased costs as a result of productivity loss caused by delays and impacting events for which an owner or contractor may be responsible. If a settlement is not negotiated, our experts have testified in both domestic and international arbitration and litigation proceedings involving the complex issues of labor efficiency and productivity loss.

Productivity Loss Analyses

Our productivity loss analysis methods are consistent with those set out in:

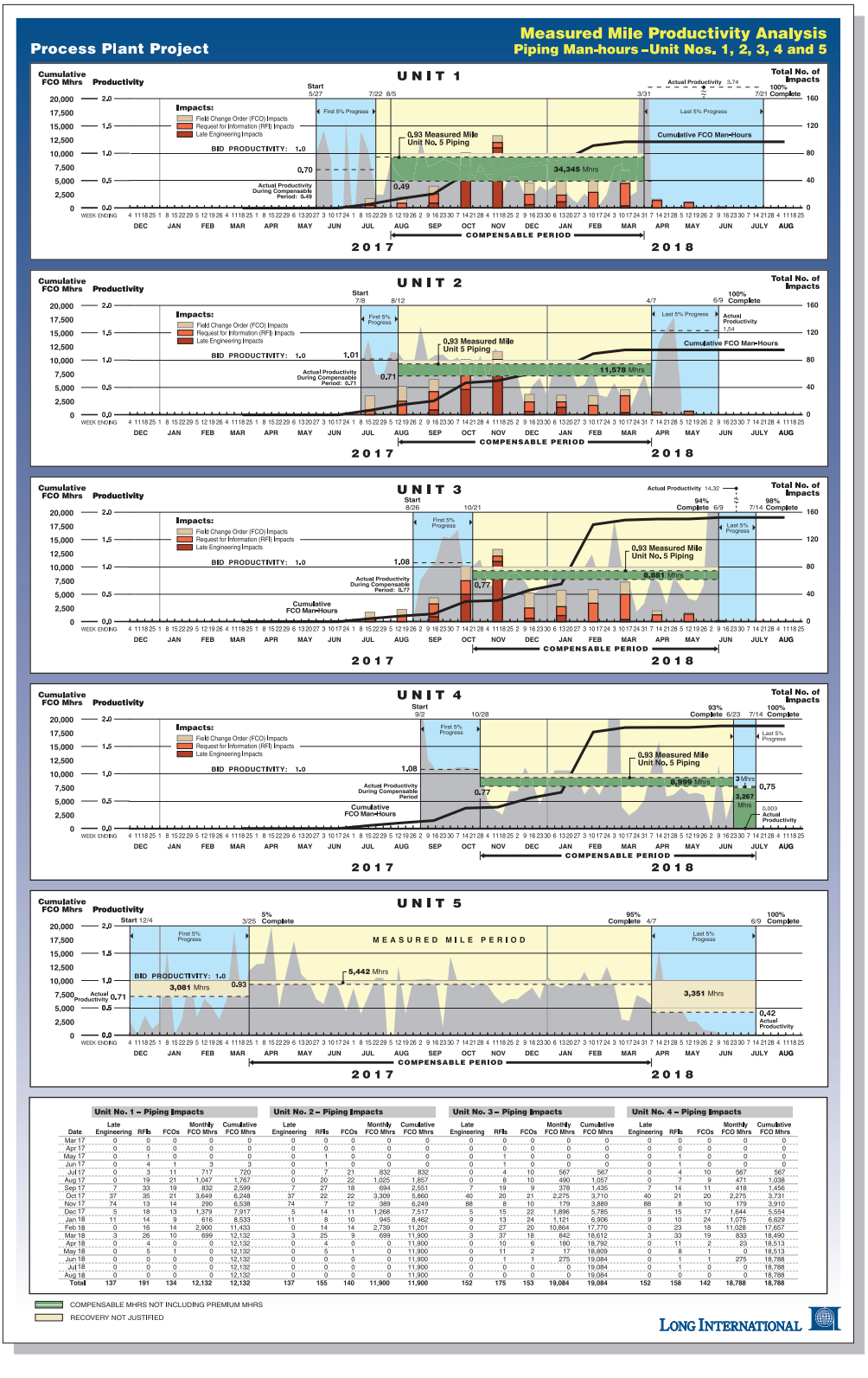
- The Society of Construction (SCL) Delay and Disruption Protocol;
- AACE International's Recommended Practice 25R-03, Estimating Lost Labor Productivity in Construction Claims; and
- American Society of Civil Engineers (ASCE) Standard ANSI/ASCE/CI 71-21, Identifying, Quantifying, and Proving Loss of Productivity.

These methods include:

- Measured mile analysis, as illustrated in the graphic to the right
- Actual productivity and earned value calculations
- Corroboration with industry studies
- Assessment of the reasonableness of bid estimate productivity using industry estimating guide productivity comparisons
- Identification of the timing of impacting events
- Evaluation of cumulative impacts

Our quantum experts also have expertise in Dynamic Simulation Analysis and System Dynamics and have analyzed what was purported in 2017 to be one of the largest and most complex Dynamic Simulation models ever created.

Once we have identified, evaluated for entitlement, and quantified a contractor's heads of claim, we may utilize various methods of presenting such damages, depending on the contract terms, legal issues, and availability of data and documentation.



Methods of Presenting Damages

Our methods of preparing or evaluating a contractor's claim for damages, including loss of productivity damages, include:

- Total cost
- Modified total cost
- "A"/"B" estimates
- Jury verdict
- Delta estimates
- Specific damages analysis
- Quantum meruit
- Quantum and damages graphics

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