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Litigating Lost Productivity Claims in Construction: Developing Methodologies, ASCE Standards

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Today's faculty features:

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Litigating Lost Productivity Claims in Construction: Developing Methodologies, ASCE Standards

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Ali Salamirad

- Ali Salamirad concentrates his practice in the areas of construction and surety law. Many of the nation's leading surety companies, general and specialty contractors trust Mr. Salamirad's guidance and counsel when dealing with the myriad of issues that arise in the construction industry.
- Mr. Salamirad has successfully handled a wide range of cases on federal, state and private construction projects, including bid disputes and protests, subcontractor substitutions, labor claims, extra work disputes, differing site condition claims, delay, productivity and efficiency claims, default terminations, takeover and completion efforts, and surety financing arrangements.
- Among many other matters, Mr. Salamirad successfully represented surety and its contractor at trial against the County of San Bernardino resulting in $6.8 million dollar verdict for unpaid contract balance, prompt payment penalties and lost productivity damages incurred as a result of encountering differing site conditions utilizing a "measured mile" analysis.

Tong Zhao, PhD, PE, PSP, CCP

DELTA CONSULTING GROUP

- ✓Senior Director, Delta Consulting Group
- ✓Ph.D., University of Maryland, College Park
- ✓20+ years consulting, teaching & Research combined
- ✓Expert witness testimonies in domestic and international litigations/arbitrations
- ✓Professional Field
  - Productivity Analysis
  - Forensic Delay Analysis
  - CPM Scheduling
  - Forensic Construction & Engineering
  - Cost and Damage Analysis
- Member, the Standards Committee for Identifying, Quantifying, and Proving Loss of Productivity, ASCE

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- Litigating Lost Productivity
  - Liability
  - Causation
  - Resultant injury
- LOP Quantification Methodologies
- ASCE Standards
- Recent Decisions
- Best Practices

Introduction

WHAT IS PRODUCTIVITY?

- **Productivity is a measurement of rate of output per unit of time or effort usually measured in labor hours.**
  - Input/Output: labor hours per installed unit
    - ✓ Easier to measure the effort per unit of work complete
  - Output/Input: Installed quantities per labor hour
    - ✓ Easier to measure the production per labor hour
    - ✓ Example: 5 lineal feet of 4” pipe per labor hour
- **Productivity Factor/Productivity Index/Efficiency Factor**
  - The ratio of actual productivity to planned productivity
  - Representing the efficiency
- **Why is productivity so important?**
  - Labor cost often is the biggest cost component in construction projects.
  - Declined productivity will reduce contractor’s profit margin, or even make it unprofitable
    - ✓ Less competitive
    - ✓ Struggle to survive

Understanding the Burden of Proof, and The Need For Experts

- As the USDC confirmed in *Safeco Ins. Co. of Am. v. County of San Bernardino,* Case No. EDCV 05-194-VAP (Opx) and the Ninth Circuit confirmed in 347 Fed. Appx. 315; 2009 U.S. App. LEXIS 21593:

"Plaintiff's proof of certain elements of its damages claim relied on the "measured mile" approach. Defendant County's criticisms of the Plaintiff's proof of its lost productivity damages lack merit. "That loss of productivity of labor resulting from improper delays caused by defendant is an item of damage for which plaintiff is entitled to recover admits of no doubt, . . . nor does the impossibility of proving the amount with exactitude bar recovery for the item.' Luria Bros. & Co. v. U.S., 369 F.2d 701, 177 Ct. Cl. 676 (Cl. Ct. 1966)(citations omitted). Defendant's criticism, inter alia, that Hutchison [contractor's expert] used a flawed comparison of the impacted and unimpacted periods lacks merit; LTE encountered severe site conditions nearly every day during construction of this Project, as set forth in the Findings of Fact, above. The calculation of the contractor's lost productivity damages, using the measured analysis, satisfied the Plaintiff's burden of proof."

Understanding the Burden of Proof, and The Need For Experts

- In affirming the District's Court's judgment, the Ninth Circuit went on to state:

The district court also did not commit clear error by accepting the Safeco expert's measured-mile analysis and method of identifying impacted and unimpacted days. The County contends that the expert's analysis might have excluded some low-productivity unimpacted days or wrongly attributed decline in production to the fault of the County. Yet "once the cause and existence of damages have been so established, recovery will not [**4] be denied because the damages are difficult of ascertainment. Liability cannot be evaded because damages cannot be measured with [*318] exactness." Schroeder v. Auto Driveaway Co., 11 Cal. 3d 908, 114 Cal. Rptr. 622, 523 P.2d 662, 670 (Cal. 1974)

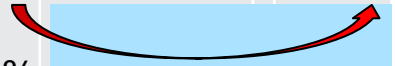
- Critical to understand that exactness is not required. Burden is typically a preponderance of evidence.
- Critical to understand that experts are needed to analyze LP

A Hypothetical Example

	Plan		
Labor	$400,000		40%
Material	$350,000		35%
General Conditions & Indirects	$100,000		10%
Overhead	$100,000		10%
Profit	$50,000		5%
Total Contract Price	$1,000,000		100%

A Hypothetical Example (Cont.)

	Plan		Actual	
Labor	$400,000	40%	$450,000	45%
Material	$350,000	35%		
General Conditions & Indirects	$100,000	10%		
Overhead	$100,000	10%		
Profit	$50,000	5%		
Total Contract Price	$1,000,000	100%	$1,000,000	100%



Labor cost increased by 12.5%

A Hypothetical Example (Cont.)

	Plan		Actual	
Labor	$400,000	40%	$450,000	45%
Material	$350,000	35%	$350,000	35%
General Conditions & Indirects	$100,000	10%	$100,000	10%
Overhead	$100,000	10%	$100,000	10%
Profit	$50,000	5%	0	0%
Total Contract Price	$1,000,000	100%	$1,000,000	100%

Profit wiped out!

Loss of Productivity

- **US Case Law - Centex Bateson Construction Co., VABCA Nos. 4613, 5162-5165, December 3, 1998. 99-1 BCA ¶30,153, 149, 257.**
  - *Impact costs are additional costs occurring as a result of the loss of productivity; loss of productivity is also termed inefficiency … if productivity declines, the number of man-hours of labor to produce a given task will increase …*
- **AACE Recommended Practice 25R-03, Estimating Lost Labor Productivity in Construction Claims**
  - *… lost productivity can be translated to "…the increased cost of performance caused by a change in the contractor's anticipated or planned resources, working conditions or method of work."*
- **ASCE CI 71-21, Identifying, Quantifying, and Proving Loss of Productivity**

– *Loss of Productivity: the difference between actual productivity and the planned or "should have been" productivity.*

Direct vs Cumulative Impact

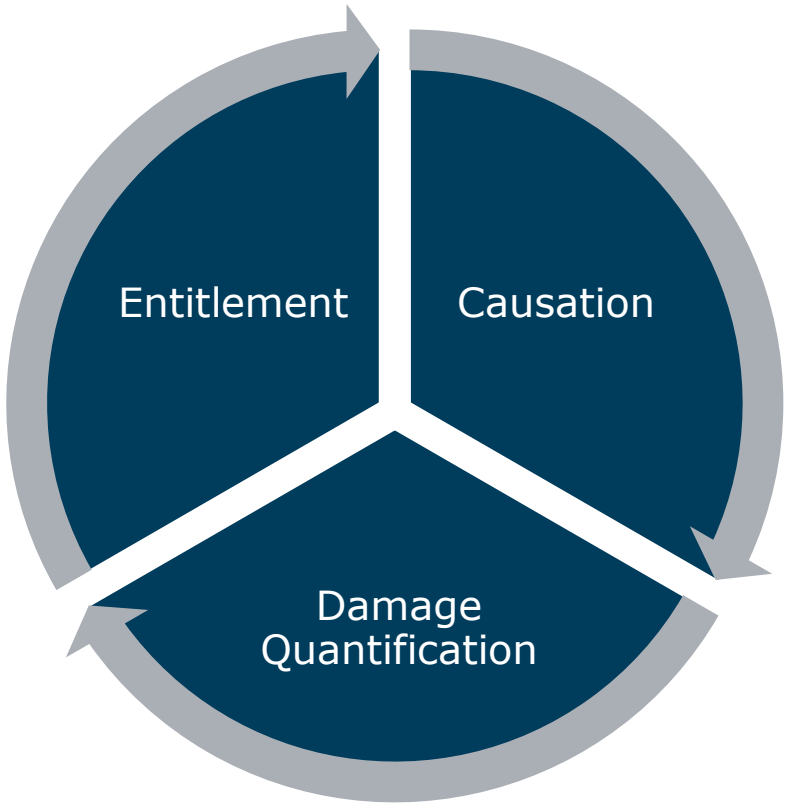
- **US Case Law - Centex Bateson Construction Co., VABCA Nos. 4613, 5162-5165, December 3, 1998. 99-1 BCA ¶30,153, 149, 257.**
  - *Direct impact is generally characterized as the immediate and direct disruption resulting from a change that lowers productivity … [It] is considered foreseeable and the disrupting relationship to unchanged work can be related in time and space to a specific change …*
  - *Cumulative impact is the unforeseeable disruption of productivity resulting from the "synergistic" effect of an undifferentiated group of changes. Cumulative impact is referred to as the "ripple effect" of changes on unchanged work that causes a decrease in productivity and is not analyzed in terms of spatial or temporal relationships. This phenomenon arises at the point the ripples caused by an indivisible body on two or more changes on the pond of a construction project sufficiently overlap and disturb the surface such that the entitlement to recover additional costs resulting from the turbulence spontaneously erupts … This result is unforeseeable and indirect.*

Loss of Productivity vs Definable Extra Work

- **AACE Recommended Practice 25R-03, Estimating Lost Labor Productivity in Construction Claims**
  - *Prior to initiating a loss of productivity analysis, the claimant should carefully consider whether the productivity loss can be recast as an impact of specifically definable extra work. If so, then such productivity loss ought to be incorporated into the estimate of the extra work and resolved in that manner.*
  - *While preferred, this is not always achievable*

Entitlement, Causation and Quantum

Three Leg Stool for A Loss of Productivity Claim



Or,
Liability
Causation
Resultant Injury

Entitlement

- **AACE Recommended Practice 25R-03, Estimating Lost Labor Productivity in Construction Claims**
  - *While the general cause(s) of lost productivity may be easy to speculate upon (at least in hindsight), the contractor seeking to be compensated for a cost increase must first demonstrate entitlement, that is, a contractual right to recover damages, to the level of certainty required by decision makers or the trier of fact.*
- **Contractual Right**
  - the contract conditions
  - Statutory rights (CA PCC 7104 – differing site conditions)
  - a result of the owner's breach of its implied or expressed duties
- **Entitlement Preservation**
  - Notice Requirements
  - Reservation of rights (release and waiver) in change orders and payment applications/certifications

Defense – Lack of Entitlement

- **Productivity lower than the contractor's plan does not necessarily mean that the LOP is attributable to the owner**
- **Self-inflicted events/impacts**
  - Bid bust (productivity expectations were never reasonable)
  - Lack of experience or proper training
  - Poor workmanship, construction errors, and resulted rework
  - Lack of proper management
  - Lack of coordination between trades
  - Deficient construction engineering for which the contractor was responsible
- **Impacts caused by parties unrelated to the owner**
  - Price escalation
  - Subcontractors
  - Vendors

Causation

- **AACE Recommended Practice 25R-03, Estimating Lost Labor Productivity in Construction Claims**
  - *… the contractor must be able to show a cause and effect relationship between the event and the impact to labor productivity in order to recover damages (i.e., costs and/or time). However, the recoverable damages are not limited to direct costs. They may also include ripple damages or indirect costs to the extent that a cause and effect relationship can be established between the downstream effects and the originating event.*
- **Causation is required for LOP claims for direct impacts and ripple damages (cumulative impacts)**
- **For example:**
  - **differing site conditions resulted in LOP**
  - **Access limitations resulted in LOP**
  - **Schedule compression, trade stacking, etc. resulted in LOP**

EVIDENCE OF CAUSATION – NOT A "ONE SIZE FITS ALL" FORMULA

- **The process usually involves**
  - Careful and thorough review of project documents and records
  - Interviews with project personnel
  - Compelling presentation and analysis demonstrating disruption events and their effects, which could include:
    - Schedule analysis to demonstrate acceleration, re-sequence, and resource changes
    - Impact tracking (contemporaneously)
    - Cause and effect matrix
    - Graphical illustration
      - Stop-and-go, out-of-sequence, "hop-scotching," etc.
      - Time and spatial correlation with disruption events

Damage Quantification

- Damage does not have to be quantified with absolute mathematical certainty or precision.

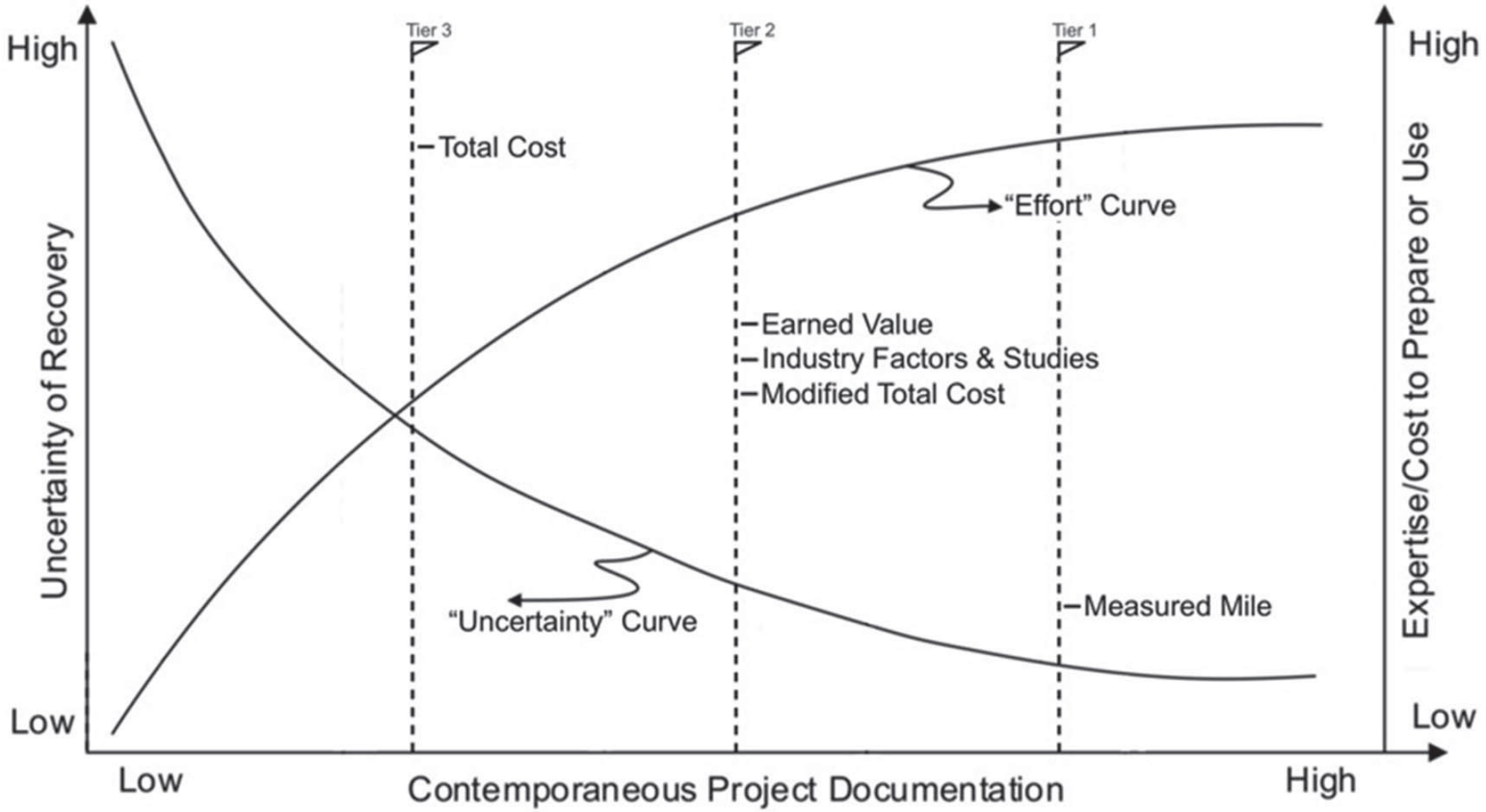
- Loss of productivity primarily involves activity related damages

- When loss of productivity resulting in critical path delays, it can also cause time related damages.

- However, time-related/delay damages are not the same as LOP, which is often overlooked by lawyers and their clients

Ranking of LOP Quantification Methods

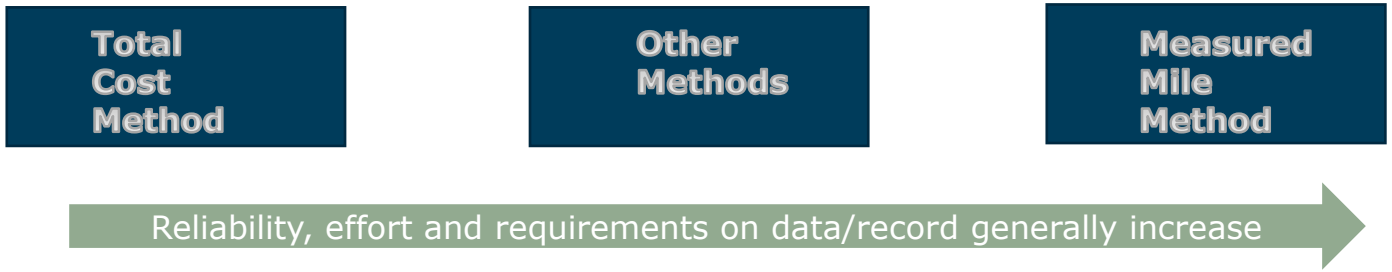
- **ASCE CI 71-21, Identifying, Quantifying, and Proving Loss of Productivity**



Ranking of LOP Quantification Methods

- **AACE Recommended Practice 25R-03, Estimating Lost Labor Productivity in Construction Claims**
  - Measured Mile Study
  - Other Project Specific Studies
  - Project Comparison Study
  - Specialty Industry Studies (e.g., Acceleration, Learning Curve, Weather, etc.)
  - General Industry Studies (USACE, MCAA, NECA, estimating manuals)
  - Cost Based Methods

- **AACE and ASCE Ranking General Commonality**



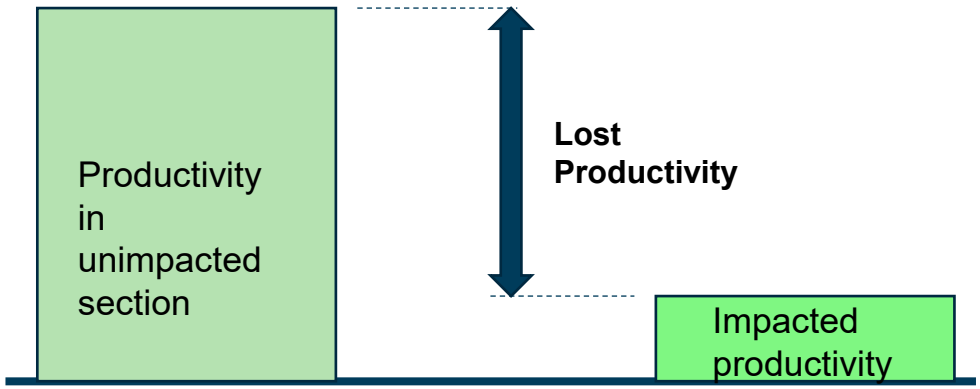
LOP Measurement Metrics vs Certainty

- Productivity Measurement
  - Input:
    - labor hours vs monetary amount
      - Labor rate variability
      - Potentially non-labor costs
  - Output:
    - Completed quantity vs percent complete
- Comparison
  - Productivity vs Productivity Factor vs Cost
    - Actual (impacted) vs Actual (unimpacted)
    - Actual (impacted) vs similar project
    - Actual (impacted) vs budgeted/planned
  - Identical vs Similar vs Dissimilar

LOP Quantification Methods

Measured Mile Method

- **According to AACE and ASCE, the Measured Mile Method is the most accepted approach to quantify lost labor productivity.**
- **Original MM method compares identical activities between relatively unimpacted and impacted sections of the project.**



Measured Mile Method (Cont.)

- The obvious advantage is that it relies on **actual** performance achieved on the **same work** from the **same project**, thereby eliminating most disputes over the validity of cost estimates.
- Because the cost of the work in both impacted and unimpacted work is being tracked, this approach necessarily accounts for contractor inefficiencies
- Accepted before the term "measured mile" was used.
  - U.S. Court of Appeals: "well established" methodology (*671 F.2d 539 (D.C. Cir. 1982).*)
- Dwight Zink introduced the term "measured mile" procedure in his 1986 article entitled *The Measured Mile: Proving Construction Inefficiency Costs*
- Relaxed:
  - Similar work
  - Lightly impacted baseline
  - Comparison using productivity factor

Similar Work/Lightly Impacted Baseline/ Comparison Using Productivity Factor

- Appeal o f P.J. Dick VABCA Nos. 5597, 5836 37, 5839 50, 5951 65, 6017 24, 6483, 01 2 BCA ¶ 31,647
  - A claim for loss of productivity using the measured mile method comparing the productivity factor for electrical feeder and branch conduit activities on a VA hospital project.
  - The government's expert criticized the dissimilarity between the feeder conduit and branch conduit would not support a reasonable comparison.
  - The Board rejected this criticism, and the electrical subcontractor was awarded LOP damages based on the comparison of productivity factors between feeder conduit production and branch conduit production.
- Clark Concrete, Inc., 99 1 BCA ¶ 30,280:
  - *[The Government] is correct in asserting that the work performed during the periods compared by [the Contractor] was not identical in each period. We would be surprised to learn that work performed in periods being compared is ever identical on a construction project, however. And it need not be; the ascertainment of damages for labor inefficiencies is not susceptible to absolute exactness. We will accept a comparison if it is between kinds of work which are reasonably alike, such that the approximations it involves will be* ***meaningful****.*

Pitfalls in Applying the Measured Mile Method

- **Deficient data and calculation**
  - The "sample" of relatively unimpacted work
  - Garbage in, garbage out
  - Inaccurate/incomplete cost data
- **Inappropriate productivity measurement**
  - e.g., output quantity does not properly reflect the actual work done
  - e.g., earnings contain material costs
  - e.g., the reported labor hours and quantities do not align in time
- **Dissimilar work to make the comparison meaningless**
  - Compare apples to oranges
  - Substantial differences in work need to be evaluated to determine whether they can be addressed with proper adjustments
- **Failure to exclude the LOP for self-inflicted impacts**
- **Disconnection with Causation**
  - e.g., severe impacts and better productivity

Cost Based Method

- Total Cost Method
  - Least preferred method
  - 4-part tests
    - It is impracticable to apply more preferred method
    - The contractor's bid or estimate was reasonable
    - The contractor's actual costs were reasonable
    - The contractor was not responsible for the claimed loss
- Modified Total Cost Method
  - Improved from the Total Cost Method by excluding contractor self-inflicted impacts or bid errors – i.e., reducing the cost pool to account for contractor errors and issues

Other Variance Based Methods

- Project Comparison Study
  - Comparing actual productivity from the subject project to different project
  - Challenges to demonstrate reasonable similarity to ascertain a meaningful damage quantification.
  - High rise construction may be easier to compare than pipeline installation in different soil and at different depths
- Total Loss Analysis on Productivity
  - Similar to Total Cost Method
  - Comparing actual productivity to the contractor's bid or estimated productivity
- Specific Variance Analysis/Earned Value Analysis
  - Calculate the cost/productivity variance for a specific activity that was impacted for an event with entitlement/causation established

Academic/Industry Studies

- Relies on the statistics of historical project information or survey
- Whether sample is representative is questionable
- The source data for industry studies is not always known
- The industry studies bear little cause and effect relationship with the project in question.

Overtime
- Kossoris (1947)
- NECA (1962;1969;1989)
- O'Connor (1969)
- Howerton (1969)
- USACE (1979)
- BRT (1974;1980)
- Blomburg (1988)
- CII (1988;1994)
- Haneiko & Henry (1991)
- MCAA (1987, 2016)
- Hanna et al. (2005a)

Overmanning & Congestion & Stacking of Trades
- Waldron (1968)
- O'Connor (1969)
- JIBEI (1970, UK)
- Kappaz (1977)
- USACE (1979)
- Borcherding & Sebastian (1980)
- Thomas & Jansma (1985)
- Smith (1987)
- Thomas & Smith (1990)
- Gunduz (2004)
- Hanna et al. (2005c)

Shift Work
- Cook (1954, UK)
- Waldron (1968)
- Horner & Talhouni (1993, UK)
- Hanna et al. (2005b)

Nighttime Operation
- Ellis & Kumar (1993)
- Elrahman & Perry (1998)
- Hancher & Perry (2001)

Weather
- Clapp (1966a;1966b)
- Fox (1967)
- Witrock (1967)
- Grimm & Wagner (1974)
- Kuipers (1976)
- USACE/Brauer et al. (1984)
- Daytner & Thomas (1985)
- Koehn & Brown (1985)
- US Army Cold Region/Abele (1986)
- US Army Cold Region (1987)
- Thomas & Yiakoumis (1987)
- Hancher & Abd-Elkhalek (1998)
- Thomas et al. (1999)
- El-Rayes & Moselhi (2001)
- NECA (2004)

Crew Level
- Gates & Scarpa (1978)
- NECA (1987)
- Cass (1992)

Learning Curve
- UN (1965, Europe)
- Gates & Scarpa (1972)
- Ward & Thomas (1984)
- Daytner & Thomas (1985)
- Thomas et al. (1986)
- CII (1997)
- Emir (1999)

Combining Multiple Factors
- Thomas & Yiakoumis (1987)
- Thomas & Smith (1990)
- NECA (1992)
- MCAA (1994, 2016)
- Singh (2001)

Changs & Cumulative Impacts
- Leonard (1988)
- CII (1990;1994;1995)
- Ibbs & Allen/CII (1995)
- Ibbs (1997;2005;2012)
- Hanna (1999a;1999b)
- Hanna/CII (2001)
- Ibbs & McEniry (2008)

MCAA (Mechanical Contractors Association of America) Factors

- MCAA Factors first published by the MCAA in 1971
- 16 MCAA Factors describe various labor inefficiency categories
- The MCAA Factors are not derived from an empirical study
- were prepared by a polling method at an MCAA convention
- They are accepted by courts and boards
- They are to be applied to the planned hours

Factor	Percent of Loss per Factor		
	Minor	Average	Severe
1. STACKING OF TRADES: Operations take place within physically limited space with other contractors. Results in congestion of personnel, inability to locate tools conveniently, increased loss of tools, additional safety hazards and increased visitors. Optimum crew size cannot be utilized.	10%	20%	30%
2. MORALE AND ATTITUDE: Excessive hazard, competition for overtime, over-inspection, multiple contract changes and rework, disruption of labor rhythm and scheduling, poor site conditions, etc.	5%	15%	30%
3. REASSIGNMENT OF MANPOWER: Loss occurs with move-on, move-off men because of unexpected changes, excessive changes, or demand made to expedite or reschedule completion of certain work phases. Preparation not possible for orderly change.	5%	10%	15%
4. CREW SIZE INEFFICIENCY: Additional workers to existing crews "breaks up" original team effort, affects labor rhythm. Applies to basic contract hours also.	10%	20%	30%
5. CONCURRENT OPERATIONS: Stacking of this contractor's own force. Effect of adding operation to already planned sequence of operations. Unless gradual and controlled implementation of additional operations made, factor will apply to all remaining and proposed contract hours.	5%	15%	25%
6. DILUTION OF SUPERVISION: Applies to both basic contract and proposed change. Supervision must be diverted to (a) analyze and plan change, (b) stop and replan affected work, (c) take-off, order and expedite material and equipment, (d) incorporate change into schedule, (e) instruct foreman and journeyman, (f) supervise work in progress, and (g) revise punch lists, testing and start-up requirements.	10%	15%	25%

Factor	Percent of Loss per Factor		
	Minor	Average	Severe
7. LEARNING CURVE: Period of orientation in order to become familiar with changed condition. If new men are added to project, effects more severe as they learn tool locations, work procedures, etc. Turnover of crew.	5%	15%	30%
8. ERRORS AND OMISSIONS: Increases in errors and omissions because changes usually performed on crash basis, out of sequence or cause dilution of supervision or any other negative factors.	1%	3%	6%
9. BENEFICIAL OCCUPANCY: Working over, around or in close proximity to owner's personnel or production equipment. Also badging, noise limitations, dust and special safety requirements and access restrictions because of owner. Using premises by owner prior to contract completion.	15%	25%	40%
10. JOINT OCCUPANCY: Change cause work to be performed while facility occupied by other trades and not anticipated under original bid.	5%	12%	20%
11. SITE ACCESS: Interferences with convenient access to work areas, poor man-lift management or large and congested worksites.	5%	12%	30%
12. LOGISTICS: Owner furnished materials and problems of dealing with his storehouse people, no control over material flow to work areas. Also contract changes causing problems of procurement and delivery of materials and rehandling of substituted materials at site.	10%	25%	50%
13. FATIGUE: Unusual physical exertion. If on change order work and men return to base contract work, effects also affect performance on base contract.	8%	10%	12%
14. RIPPLE: Changes in other trades' work affecting our work such as alteration of our schedule. A solution is to request, at first job meeting, that all change notices/bulletins be sent to our Contract Manager.	10%	15%	20%
15. OVERTIME: Lowers work output and efficiency through physical fatigue and poor mental attitude.	10%	15%	20%
16. SEASON AND WEATHER CHANGE: Either very hot or very cold weather.	10%	20%	30%

A Hypothetical Example

- A piping contractor was engaged by an owner to construct a water supply pipe from a pump station near a reservoir to a small water treatment plant along an existing road connecting the pump station and the water treatment plant.
- The contract represented to the piping contractor that the piping contractor would have the sole possession of the project site until the completion of the piping works.
- After the piping contractor started the work, the owner hired another road contractor to improve the existing road.
- During the rest of the construction duration, the piping contractor had to worked concurrently with the road contractor, with significant interference to the progress of the piping works.
- Segments 1 and 2 respectively represent the part of the pipe works without and with concurrent work between the two contractors.
- Assumed that all the other possible affecting factors, events and conditions, such as learning curve, are negligible.

A Hypothetical Example (Cont.)

	Bid	Actual
Pipe length (lf)	2,000	2,000
Labor rate ($)	50	50
Segment 1 length (lf)	1,000	1,000
Productivity rate for Segment 1 (hr/lf)	10.05	12
Segment 1 hours (hr)	10,050	12,000
Segment 1 cost ($)	$502,500	$600,000
Segment 2 length (lf)	1,000	1,000
Productivity rate for Segment 2 (hr/lf)	10.05	18
Segment 2 hours (hr)	10,050	18,000
Segment 2 cost ($)	$502,500	$900,000
Total hours (hr)	20,100	30,000
Total cost ($)	$1,005,000	1,500,000

A Hypothetical Example – LOP Quantification

- Total Cost Method – Segment 2
  - Actual – Bid = $900,000-$502,500=$397,500
  - Did not address potential bid error or contractor's self-inflicted performance issue
- Modified Total Cost Method
  - A bid error of $22,500 in segment 2
  - Actual – Bid – Bid error = $900,000-502,500-22,500 = $375,000
  - Assumed contractor could have achieved the planned productivity adjusted for bid errors "but for" the owner-caused damaging event

A Hypothetical Example – LOP Quantification (Cont.)

- MCAA Factors
  - "Concurrent operation" with a level of "severe"
  - An adjustment of 25% applied to the bid = $502,500X25% = $125,625
  - MCAA factors were based a survey which bears little cause and effect relationship with the specific project
- Measured Mile Method
  - Segment 1 as the measured mile
  - Lost productivity = 18 hr/ft – 12 hr/ft = 6 hr/ft
  - Lost hours = 6 hr/ft X 1,000 ft = 6,000 hrs
  - Damage = $50/hr X 6,000 hrs = $300,000
  - It considered the actual effect of the concurrent work
  - It did not rely on bid
  - It relied on the piping contractor's actually achieved performance on the project absent the concurrent work.

Frye Test vs Daubert Test

- The **Frye test** (*Frye v. United States* 1923)preceded the Daubert test and is still applicable in some state courts.
- The Frye test merely requires that the expert testimony be based on principles and methods that are generally accepted in the scientific community.

- **Daubert Test**

  Rule 702 of the Federal Rules of Evidence provides:

- A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case.

The Daubert Test

- The supreme court suggested the trial court consider various factors to assess the validity of the theory or technique:
  - Has the theory been tested?
  - Has it been subjected to peer review?
  - What is the theory or technique's known or potential rate of error?
  - Are standards controlling the application of the theory or technique available?
  - Is the theory or technique generally accepted?
- All federal courts and some state courts use the Daubert test.
- Some other state courts use the Frye test, a combination of the Daubert and Frye tests, or some other test.

Trane US Inc. v. Yearout Service, et al.

- The US District Court for the Middle District of Georgia Macon Division
- GSC, the general contractor on a design-build hangar renovation project at Robins Air Force Base
- Yearout, a subcontractor responsible for providing a "turnkey mechanical and plumbing system."
- Trane U.S. Inc., was hired by Yearout to provide air units for the project
- Trane settled its claims, and the remaining claims were between Yearout, and GSC & Surety.
- Yearout's expert's opinions on loss of productivity were excluded by the court, though his qualification was confirmed.
- The industry study on overtime and shift work was not sufficiently tested, nor peer-reviewed
  - The reliability of the data is unknown
  - No sufficient causation
  - The implementation was not reliable

ASCE CI 71-21, Identifying, Quantifying, and Proving Loss of Productivity

Other Standards/Recommended Practices

- **AACE Recommended Practice 25R-03, Estimating Lost Labor Productivity in Construction Claims**
  - Published in 2004
  - Relies on North America legal system
  - Focuses on Loss of Productivity Quantification Methodologies
- **Society of Construction Law Delay and Disruption Protocol, 2nd Edition**
  - Published in 2017
  - Briefly addresses disruption claims and quantification.
  - Focuses upon the UK construction market and, in particular, the English law position

ASCE CI 71-21, Identifying, Quantifying, and Proving Loss of Productivity

- **Newly published (2021)**
  - The Standards Committee for Identifying, Quantifying, and Proving Loss of Productivity was formed in 2016.
- **A variety of perspectives**
  - Owners, designers, contractors, attorneys, mediators, triers of fact, educators, and researchers;
  - Construction-only, design-only, and design-construct projects;
  - Small and large projects;
  - Public and private work; and
  - International and domestic contexts.
- **Broader Guidance**
  - Collecting, storing and validating productivity data
  - Identifying productivity loss, maintaining project records, and mitigating losses
  - A preferred order of methods for quantifying productivity loss
    - Tier 1: Measured Mile
    - Tier 2: Academic and industry productivity factors studies; modified total cost
    - Tier 3: Total cost
  - Avoiding productivity loss

Best Practices/Takeaways

Best Practices/Take-ways

- Entitlement/Causation/Damage Quantification
- Working with Experts
  - Daubert Test
    - Reliability of the data
    - Reliability of the methodology
    - Reliability of the methodology implementation
- Advice to Contractors, Owners and Designers
  - Develop appropriate productivity metrics
  - Monitor labor cost/productivity to identify productivity losses and their causes as early as possible
  - Get the expert involved early to validate that the actual conditions differed materially from those that should have been reasonably anticipated, and to estimate productivity losses with a reasonable degree of certainty
  - Take proactive measures to avoid/mitigate productivity losses.
    - Improvement on planning/scheduling/supervision/change management/labor training, etc.

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