مدیریت پروژه‌های صنعت ساخت

(ساختمانی، زیرساختی و صنعتی)

فصل هفتم: مدیریت ریسک

فرآیند مدیریت ریسک

ارائه دهنده:

سید محمدرضا علوی‌پور

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

What we will learn?

- Risk management process
- Transferring or sharing risks
- CM roadmap related to this section

RISK MANAGEMENT PROCESS

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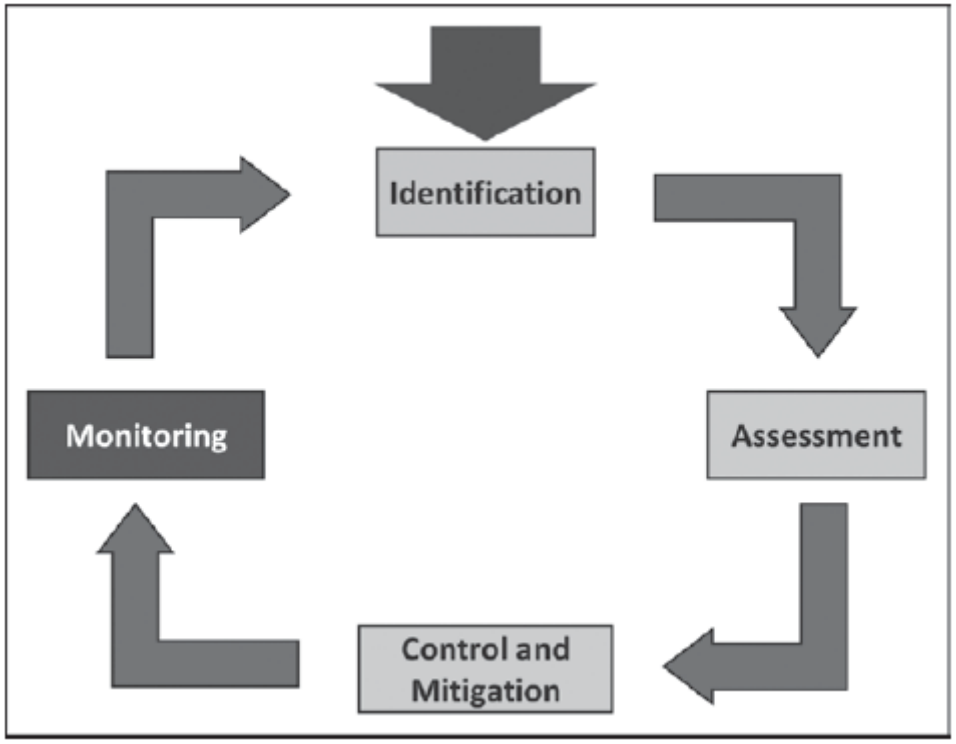
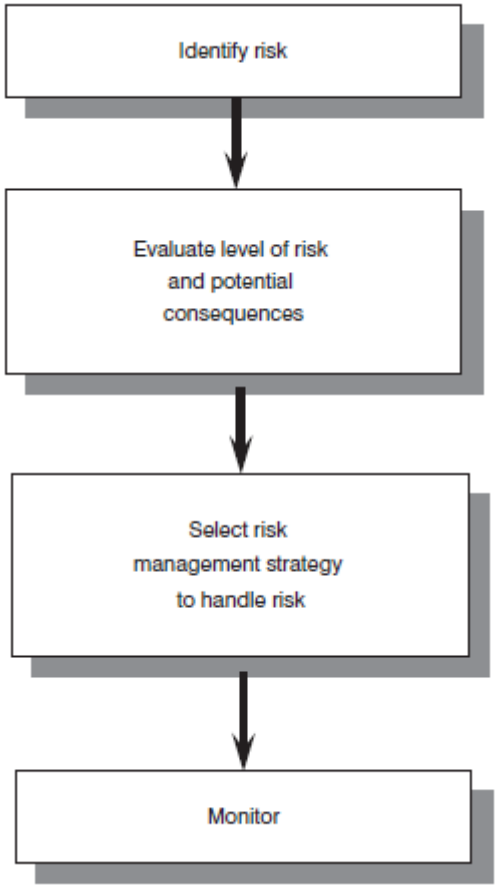
Process

- A **diligent approach** to risk management should incorporate **four major elements** that are implemented on a project throughout its delivery.



Process



Risk identification

- The first step of the risk management process is to **recognize risks**,

  which means the **project team** should identify **events that can potentially** affect either the project as a whole or one of the project team members,

  including the project owner, the designer, the general contractor, or any of the subcontractors and vendors.

- The **use of risk checklists** is quite **common** among organizations in the built environment.
- Whereas **large project owners and contractors** develop and maintain **their own checklists**, various organizations have developed **lists for use by anyone**.
  - *For instance, the Construction Industry Institute (CII) performed a study that identified 107 risks that are commonly encountered on construction projects (CII 2006).*

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Risk identification

- Although every project will have its own unique variety of risks, all will generally fall under one of the **following six categories**:
  1. Pre-bid risks
  2. Design risks
  3. Construction risks
  4. Political/legal/regulatory risks
  5. Financing risks
  6. Environmental risks

Risk identification – Pre-bid risks

- Contract risks
- Owner risks
- Price risks
- Time risks
- Work/labor risks
- Location risks
- Estimate preparation risks

See more in assessment section.

Risk identification – Design risks

Design Risks	Description
Poor-quality or inadequate design, drawings, or specs	The information and detail needed to construct an element of work is missing, incomplete, or inaccurate.
Noncompliance with design standards	The design doesn't meet the building code or other regulations.
Owner-directed changes	The owner changes their mind about the design after construction begins.
Excessive design review by owner, architect, or agency	Reviews and the approval process associated with design submittals take longer than typically allowed.
Changes in design standards or regulatory requirements	Regulatory requirements in place at the beginning of the project may change during construction.
Inaccuracies associated with supplemental design information such as soil reports, environmental reports, and so on	The information needed by the contractor and provided by the architect or owner is inaccurate.
Latent design defects affecting contractor's warranty	Defective design details that result in flawed construction after occupancy of the facility (such as a roof flashing leaks because of poor design).

Risk identification – Construction risks

Construction Risks	Description
Labor availability and quality of labor pool	If the contractor can't access the proper labor needed to complete a project, significant delays may be experienced. Quality issues resulting from an inexperienced workforce can also result in rework and cost overruns.
Differing site conditions	Sometimes the conditions on the building site are not communicated in the plans and specs. This discovery can lead to significant cost increases and delays.
Site access, traffic, parking issues	Projects located in highly congested areas can cause significant delays and storage issues for the contractor when trying to coordinate work.
Property damage or theft issues	The project site might be located in an area where security is an issue. The contractor has to protect the project, materials, and equipment against vandalism and theft.
Coordination with utilities, adjoining neighbors, and so on	Significant coordination efforts must be made when tying in electrical, plumbing, water, and gas lines to main supply lines. This often requires working with a local utility office, and their schedule and the contractor's schedule do not always coincide. Utility coordination can cause big delays.
Adverse weather	Weather is one of the most unpredictable construction risks. Contractors try to plan activities to avoid adverse weather conditions, but it isn't always possible. Having to place concrete in February in Minnesota can be a challenge and add cost to the job.

continues

Construction Risks	Description
Labor disputes, strikes	The use of union labor on public projects is often a requirement in some jurisdictions. When this is the case, delayed labor negotiations, disputes, and even strikes are always a possibility.
Availability of materials	The architect may specify materials that are difficult to get or have significant lead times.
Safety	Safety should be paramount on any project. Injuries always impact construction operations at some level and should be avoided at all cost. OSHA inspections will also have an impact on the project workflow and schedule.

Risk identification – Political/legal/regulatory risks

Political/Legal/ Regulatory Risks	Description
Changes in the law	Changes in local, state, and federal laws can affect construction (such as minimum wage law or documentation of employees).
Changes in sales tax or other tax structures	Unanticipated increases in sales or use taxes will impact material costs.
Protester actions, disputes	Any project that might be related to a public concern can get tangled up in a political web. Projects such as prisons, sewage plants, industrial facilities, and even schools can be targets for protest.
Community or adjoining business impacts	Dust, noise, mud, visibility, lights, working hours, and access issues can impact neighbors, the community, or adjoining businesses. For example, if the rerouting of traffic for your project impedes easy access to the parking lot of an adjacent business, you may be opening yourself up for a lawsuit.
Harassment issues	Breaches by employees or subcontractors can affect company harassment or professional conduct policies.

Risk identification – Financing risks

Financing Risks	Description
Economic climate	Economic downturns add the risk of bankruptcy, bid shopping by clients, and other negative impacts to a project. On the other hand, economic booms cause price escalation.
Contractor cash flow	Limited lines of credit or the unavailability of credit can cause delays in material buyouts, subcontractor payments, and workflow.
Interest rate increases	If lines of credit are utilized by the contractor or the client to fund projects, then any increase in interest rates would have an adverse effect on the project.
Insufficient client funds	If a client is unable to make timely payments to the contractor, it will shut down the job.
Subcontractor/ supplier bankruptcy	Both large and small subcontractors can get into financial trouble. When this happens, every project the sub has a contract on will also be impacted. If bankruptcy should occur, the general contractor will have to hire another subcontractor to take over the job, causing major delays, cost overruns, and headaches for the project.

Risk identification – Financing risks

Environmental Risks	Description
Environmental permits and approvals	Environmental permit approvals are delayed or require more time to negotiate than expected.
Hazardous materials or site contamination	Unknown site contaminates or hazardous materials are discovered after the work has commenced.
Archeological findings/ unknown burial sites	Unknown artifacts are discovered or an unknown burial site or cemetery is unearthed, requiring the work to stop.
Endangered species	The project has known or unknown endangered species sightings that will require protection and special care during construction.
Wetlands, coastal protection, or flood plain issues	Wetlands, coastlines, and flood plains all require special protection and can impact overall construction approach.

Risk assessment

- Assess the possibility of happening and potential impacts with regards to usually
  1. Cost
  2. Time
  3. Quality
  4. Safety

- Usually done **qualitatively**, however some larger contractors use **risk analysis methods**.

Risk assessment

Project Risk Register

Project: NanoEngineering Building

Date: January 7, 2015

Risk Statement		Risk Analysis		Risk Response Strategy	
Description of Risk	Construction Phase in which Risk may occur	Risk Probability	Risk Impact	Risk Response	Trigger
Public safety during initial site utility construction	Initial site construction	High	Reduced productivity and potential public injuries	Install all site utilities including street and sidewalk trenching at night	Sitework subcontractor starting work
Erection of tower crane	Start of structure construction	High	Traffic impact of movement of crane components and erection with hydraulic crane	Install the tower crane on Saturday for minimum traffic interference with crane erection	Completion of site and foundation work
Traffic control during equipment and material deliveries	Throughout the project	High	Local pedestrian and vehicle traffic interfering with equipment and material deliveries	Hire retired Seattle police officer to control pedestrian and vehicle traffic enabling timely delivery of equipment and materials	Occupation of the project site
Cold weather concrete placement	Winter construction of concrete structure	High	Delayed placement of concrete components or cold temperatures during curing	Provide heaters and thermal blankets to protect concrete if cold temperatures occur	Cold temperatures during concrete placement
Late delivery of critical materials	Any phase requiring contractor purchased materials	Moderate	Delay in construction	Identify long-lead materials and place purchase orders early	Supplier notification of time required for delivery

Risk assessment

- Severity?
- **Monte Carlo simulations** are frequently used to find contingencies.
- *Risk exposure factor = Product of risk changes and impacts*

Risk assessment – Pre-bid risks

(0 = low risk, 3 = high risk)	Factor Scores	Total Score	Bid/No Bid Assessment
Contract Risks	**0–3**	**2/15**	**Risk Limitations**
Changes in work	0		4 or more total points: increase profit margin, 6 or more total points: consider not bidding, 9 or more total points: do not bid
Force majeure	0		
Payment process	0		
Retainage requirements	1		
Warranty requirements	1		
Owner Risks	**0–3**	**2/12**	**Risk Limitations**
Reputation	1		4 or more total points: increase profit margin, 6 or more total points: consider not bidding, 9 or more total points: do not bid
Ability to fund project	0		
Payment history	0		
Company culture	1		

continues

(0 = low risk, 3 = high risk)	Factor Scores	Total Score	Bid/No Bid Assessment
Price Risks	**0–3**	**4/21**	**Risk Limitations**
Cost of self-performed work	0		6 or more total points: consider joint venture partner, 9 or more total points: consider not bidding, 15 or more total points: do not bid
Cost of subcontract labor	0		
Cost of overhead	0		
Cost of equipment	0		
Cost of materials	0		
High price materials/ equipment	2		
Total project cost	2		
Time Risks	**0–3**	**2/12**	**Risk Limitations**
Overall contract time	1		4 or more total points: consider joint venture partner, 6 or more total points: consider not bidding, 9 or more total points: do not bid
Subcontractor reliability	0		
Time of year	0		
Regulatory bureaucracy	1		

Risk assessment – Pre-bid risks

(0 = low risk, 3 = high risk)	Factor Scores	Total Score	Bid/No Bid Assessment
Work/Labor Risks	**0–3**	**2/21**	**Risk Limitations**
Familiar work processes	0		6 or more total points: increase profit margin, 9 or more total points: consider not bidding, 12 or more total points: do not bid
State-of-the-art components	2		
Major demolition or site work	0		
Insufficient ground investigation	0		
Self-performed/sub work ratio	0		
Aggressive unions	0		
Adequate labor pool	0		
Location Risks	**0–3**	**1/12**	**Risk Limitations**
Proximity to office	0		6 or more total points: consider not bidding, 9 or more points: do not bid
Familiar with area	0		
Difficult/remote access	0		
Site congestion	1		

(0 = low risk, 3 = high risk)	Factor Scores	Total Score	Bid/No Bid Assessment
Estimate Prep Risks	**0–3**	**0/18**	**Risk Limitations**
Adequacy of pricing data	0		6 or more total points: consider not bidding, 9 or more points: do not bid
Familiarity of subcontractors	0		
Unable to visit the site	0		
Confusing/contradictory docs	0		
Excessive prep cost	0		
Insufficient time, personnel	0		

If the constructor decides not to pursue the contract, then all the additional risks associated with the project are a moot point. However, if after proper analysis and assessment the decision is to go forward with the bid, then there are several other types of risks to consider.

Risk assessment – Pre-bid risks

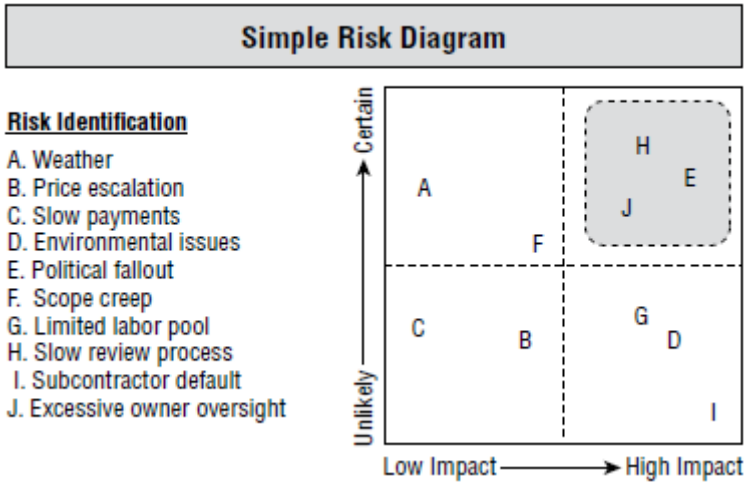
Quantifying Risks

Identified Risk	Probability	Impact	Rating
Confusing, contradictory, or incomplete plans and specs	2	1	2
Differing subsurface conditions	2	2	4
Adverse weather	1	1	1
Community protests	2	3	6

Once risks are rated, it can be determined which ones to focus on and how best to mitigate them.

Risk control and mitigation

- The **results of risk assessment** allow the construction team to recommend the **most appropriate method** for risk control and mitigation.
- **Mitigation strategies** can be categorized into **four groups:**
  1. Risk avoidance
  2. Risk retention
  3. Loss control
  4. Transferring/sharing risks



Difference with what has been said in PMBOK?

Risk control and mitigation – Risk avoidance

- When **a risk event** is considered probable and of high impact.
- Contractors may **avoid it** by changing the construction plan
- **Commonly selected** when the risk assessment returns high severity.
  - *For instance, a contractor may decide to **not bid on a large project** if they find out that the project owner lacks appropriate management of the financial cash flow, which would create financial stress on all project participants.*

Risk control and mitigation – Risk retention

- Two types:

1. **Active retention**
   - Occurs when a **contractor** evaluates a specific risk event and consciously decides to take it **without mitigating it**.
   - **Price** and **schedule** can be **adjusted accordingly**
2. **Passive retention**
   - **Contractor** is **retaining a risk** because they do not know about it, so they cannot do anything to select any of the other mitigation approaches.
   - This is the **most damaging outcome** from unknown risks.

Risk control and mitigation – Loss control

- Two types:

1. **Loss prevention**
   - Reducing the **chance** of a risk event occurring.
     - ✓ *Hand tools are missing and probably stolen. Solution?*
2. **Loss reduction**
   - Reducing the **severity** of the risk occurrence
     - ✓ *Raises some of the minimum requirements for safety to reduce the number of events that result in deaths, injuries, or lost time from work.*

Risk control and mitigation – Transferring/sharing risks

- This is one of the **most common methods** for mitigating construction risks and **mostly relies** on shifting risks from one party to another through **legal documents**.

- **Several approaches** exist for transferring risks to other companies or sharing them.

Risk control and mitigation – Plan

Risk Analysis Probability × Impact = Risk Rating

	Type of Risks	Probability	Impact	Risk Rating	Potential Consequences	Mitigation Strategy
Design Risks						
1	Incomplete drawings and specifications	2	2	4	Delays, rework, increased costs	Thoroughly check drawings for errors or omissions.
2	Owner-directed changes	3	2	6	Delays, rework, increased costs	Develop a clear understanding of owner's objectives.
3	Incomplete or incorrect soil/geotechnical data	1	1	1	Delays, rework, increased costs	Hire a pre-qualified expert consultant.
4	Non-compliance to standards and codes	1	2	2	Delays, redesign, increased costs, re-work	Integrate code reviews into the design process.
5	Design defects affecting constructability	1	1	1	Delays, rework, increased costs	Integrate construction knowledge into the design process.

continues

Risk control and mitigation – Plan

Risk Analysis Probability x Impact = Risk Rating *(continued)*

	Type of Risks	Probability	Impact	Risk Rating	Potential Consequences	Mitigation Strategy
Construction Risks						
6	Availability of materials	3	2	6	Delays, increased costs, material changes	Proper material management with emphasis on long lead items.
7	Safety	2	2	4	Worker injury, litigation, project delay	Injury Illness Prevention Plan (IIPP), consult OSHA.
8	Weather	3	2	6	Delays, material damage, increased costs	Follow accurate weather reports, include weather days in schedule.
9	Earthwork issues	2	2	4	Need for special equipment, delays, increased costs	Proper site research, add contingency (%).
10	Re-work, defective work	2	1	2	Delays, re-work, increased costs	Hire qualified subcontractors, maintain documentation.
11	Supplier delays	1	2	2	Delays, increased costs	Collaborate with suppliers/ manufacturers during design process.
12	Workforce availability	1	2	2	Increased labor costs, possible decrease in construction quality	Implement effective QA/QC personnel that remain independent of the construction operations of the company.
13	Constructability issues	2	1	2	Decrease in construction quality, possible construction rework	Integrate construction knowledge into the design process, implement effective QA/QC personnel.

Risk control and mitigation – Plan

Risk Analysis Probability x Impact = Risk Rating *(continued)*

	Type of Risks	Probability	Impact	Risk Rating	Potential Consequences	Mitigation Strategy
14	Trade quality	2	2	4	Potential construction rework, decreased owner satisfaction	Implement effective QA/QC personnel that remain independent of the construction operations of the company.
Financial Risks						
15	Material price escalation	1	1	1	Increased costs, material changes	Lock in prices as soon as the job is secured.
16	Gas prices	2	1	2	Increased costs	Purchase local materials to reduce shipping, use energy-efficient vehicles.
17	Lack of owner funding	1	1	1	Project shutdown, delays, litigation	Thoroughly research source of funds and verify stability before job start.
18	Damage to property or theft	1	2	2	Increased costs, decreased profits, delays	Fence the job site, lock all equipment, hire security.
Political/Legal/Regulatory Risks						
19	LEED-NC 2.2 Rating System Change over to LEED-NC 3.0	3	3	9	LEED Certification delay, certification fee increase	Train personnel in office and in field on LEED 3.0.
20	Community protests	1	1	1	Delays, increased costs, negative publicity	Organize community information sessions and install a hot line for questions.
Environmental Risks						
21	Unforeseen site/ facility contamination	1	2	2	Delays, fines, increased costs	Remain familiar with local environmental abatement contractors.

continues

Risk control and mitigation – Plan

Risk Analysis Probability x Impact = Risk Rating *(continued)*

	Type of Risks	Probability	Impact	Risk Rating	Potential Consequences	Mitigation Strategy
22	Wetlands	3	3	9	Delays, fines, increased costs	Investigate site conditions before work begins, consider wetlands banking option.
23	Endangered species	2	2	4	Delays, increased costs, project stop order	Check on seasonal sightings and investigate regulation requirements before work begins.

Risk monitoring

- Once a **set of mitigation strategies** has been selected and implemented on a project, it is the role of the construction manager and superintendent to **continue monitoring how** they are working, as well as the occurrence of **unknown risks**.

TRANSFERRING OR SHARING RISKS

Introduction

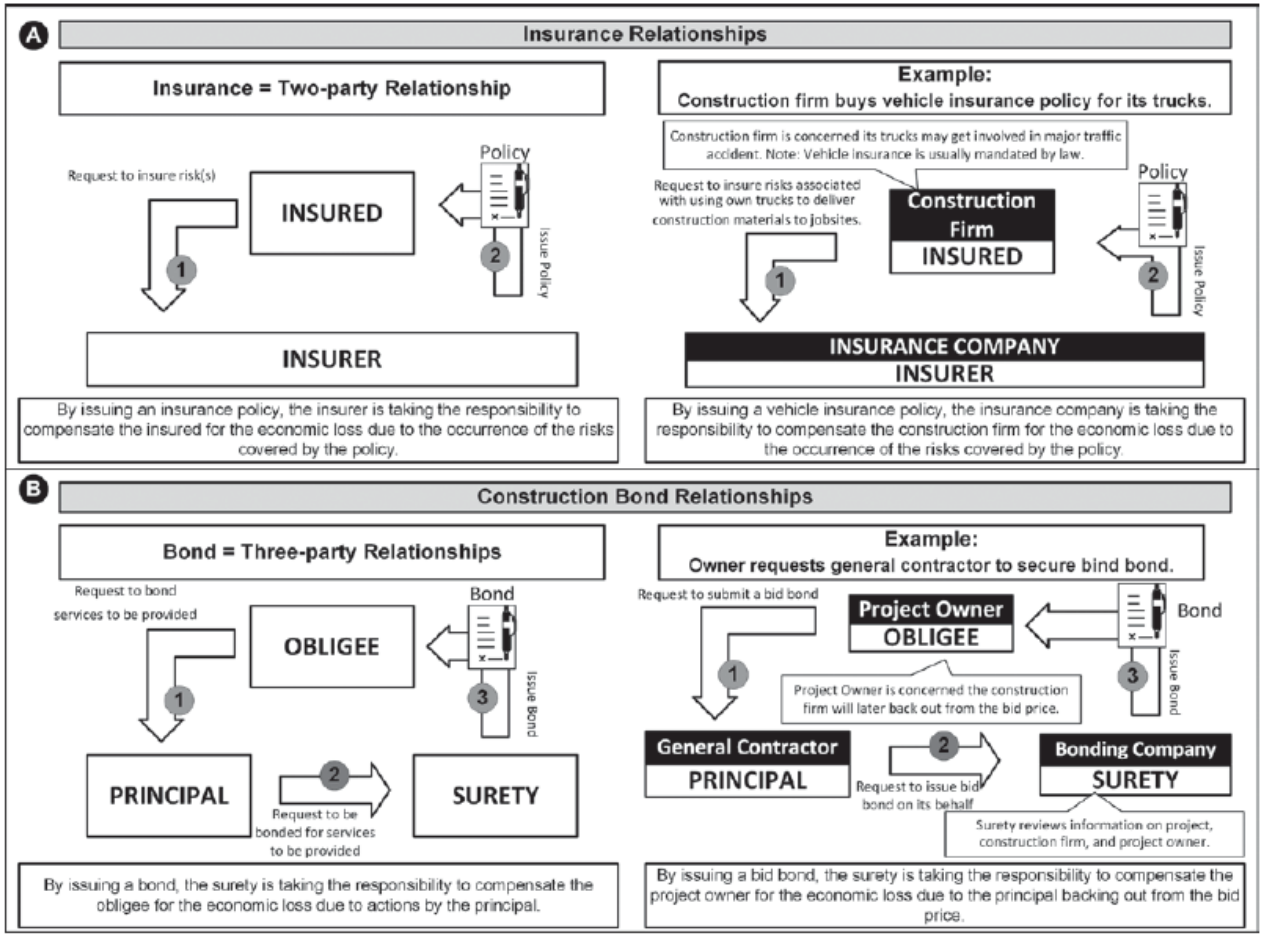
- The **transfer or sharing** of risks with other organizations is one of the **most common methods** for mitigating construction risks, and

  it **mostly relies** on shifting risks from one party to another through **legal documents.**

- Some of these approaches are:
  1. Contract surety bonds
  2. Insurance
  3. Contracting and subcontracting
  4. Joint ventures

Contract surety bonds

- Common approaches
  1. Bid bond
  2. Performance bond
  3. Payment bond



Construction Insurance and Construction Bonds

Insurance

- Contractor **securing an insurance policy** creates a two-party relationship where the **insurance company** will take certain risks from the contractor in exchange for the payment of a premium.
  - *Examples of standard insurance policies for the **built environment** include professional liability insurance, errors and omission insurance, general liability insurance, property insurance, builder's risk insurance, business owner insurance, worker compensation insurance, and construction vehicle insurance.*

Insurance

- *For example, a general contractor working on a new hotel in a coastal area may purchase builder's risk insurance with additional coverage for damages from hurricanes, typhoons, and high wind.*
- *The policy has a $5,000 deductible for damages to installed material, but it does not cover loose material.*
- *The construction is nearly complete when the hotel is hit by a mild typhoon that results in $50,000 damages to the exterior cladding, as well as the loss of $20,000 in materials stored on the ground.*
- *The insurance company accepts its obligation to pay up to $45,000 in repairs for the damages to the cladding but declines to replace the damaged materials, because the policy placed the responsibility to secure loose material on the contractor.*

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Contracting and subcontracting

- The **most common risk management** approach is contracting/subcontracting, with the **contract being used** as a risk shifting tool between the contractual parties.
- Hiring a GC or multi-prime contracting
- Self-perform or subcontract out the work or portion of the work.
- Risk mitigation through subcontracting is **better performed** through **meaningful subcontractor selection.**

Contracting and subcontracting

- Overall, the **golden rule** for equitably allocating risks among contractual parties would be to **allocate**

  "each particular risk to the party that is best equipped to handle it"

  (CII, 2006; p.v),

  which sometimes **means sharing responsibilities**

  instead of fully transferring them.

- Because contracting and subcontracting are some of the **most adopted approaches** for mitigating risks, the previously mentioned CII study that identified the most common 107 construction risks **also identified 14 "hot button" risks** that are often inappropriately allocated through contracting and

  should be **carefully analyzed during contract negotiation.**

Contracting and subcontracting

#	*Risk*	*Description*
1	No damages for delay	A project may be delayed due to the owner's fault, which is outside of the contractor's control. Some contracts make it difficult for contractors to seek damages for owner-caused delays.
2	Consequential damages	Failing project objectives may result in damages beyond the project. For instance, delay in the completion of a warehouse would result in a loss of revenue or in rental costs for the project owner. Similarly, a contractor may not be responsible for a project failure, but its reputation can be affected by it.
3	Indemnity	On a construction project, it is highly possible that people or property will be damaged during construction.
4	Ambiguous acceptance criteria	Quality is a critical pillar to project success. Unclear quality expectations, including for testing and inspections, are expected to increase disputes between project parties and impede success.
5	New or unfamiliar technology	In the attempt of building the best and most up-to-date facility, it is common for project owners and designers to specify new products or technologies. However, what is new is often risky. It is important for the parties to discuss the risks associated with the adoption of the new technology and to allocate them to the party that can best handle them.
6	Force majeure	Projects can be affected by unpredictable and catastrophic events, such as floods, earthquakes, and tornadoes.
7	Schedule acceleration	Some tasks may be delayed that would force the performance of later tasks to be accelerated. Acceleration is conducive to inefficiencies and extra costs in the form of overtime and extra labor. The contract should discuss this risk and the possibility for the contractor to receive compensation when the delay is not of its responsibility.

Contracting and subcontracting

8	Cumulative impact of change orders	Similarly to schedule acceleration, the occurrence of many changes on a project produces a loss in productivity and inefficiencies. The contractual approach for recognizing extra costs and extra time is important for mitigating this risk.
9	Owner-mandated subcontractors	Selecting the right subcontractor is paramount for a general contractor's ability to succeed. However, there are cases where project owners prefer certain specialty contractors to handle some scope. The contract should discuss who should retain the risk of these owner-mandated subcontractors.
10	Insurance allocation	Certain risks are better transferred to an insurance carrier. The contract should clarify which contractual party is responsible for obtaining insurance and paying deductibles.
11	Differing site conditions	Independently from the survey work done in advance, once construction commences there are chances of finding something different from what was expected. Risks associated to these unknowns should be allocated in the contract.
12	Design responsibility	Design is often performed by multiple parties, including specialty contractors and consultants. Risk of deficient design should be allocated through language in the prime contract and subcontracts.
13	Waiver of claims	The timing and circumstances for obtaining a waiver of claims are conducive to potential risk for contractors. These details should be reviewed while negotiating a contract to ensure that they are reasonable and satisfy the parties.
14	Standard of care	The success of a built environment project relies on the professionals involved. Oftentimes, contracts adopt vague language to require the "highest and best industry standards" or "workmanlike manners." These expressions are ambiguous and should be replaced when possible by unambiguous terms and possibly measurable benchmarks.

Adapted from (CII 2006)

Joint ventures

- Create a **project-specific joint venture** with other contractors.
- A joint venture is a **business entity** created for a **specific project** to pool resources without requiring individual investments.
  - Therefore, an **individual contractor** with adequate bonding capacity could **pursue a large project alone**,

    but this approach **may force them** to acquire additional human or physical resources that the **contractor may not have**.

NOTE

Joint venture
When two or more construction companies enter into an agreement for a one-time, single-project commitment and share resources and risks to manage and build the project.

Joint ventures

It is quite common to see two construction companies create a *joint venture* on large projects, particularly if the project is complicated or high risk (large hospitals, large bridges, high-tech facilities, and so on). A joint venture is a legal partnership in which each company contributes resources, expertise, manpower, and management expertise. Usually the majority partner (the one with the largest investment) in the joint venture will be assigned as the managing partner. However, both parties are usually involved in the decision-making process throughout the project. For example, during the estimating phase of the project, both companies will prepare their own independent estimates. Then the two companies will come together to reconcile their numbers and agree to a single estimated cost for the project.

NOTE

Joint venture
When two or more construction companies enter into an agreement for a one-time, single-project commitment and share resources and risks to manage and build the project.

CM ROADMAP
RELATED TO THIS SECTION

CM Roadmap – Hard skills

مهارت‌های سخت (Hard Skills) - سطح کارشناسی و اجرایی

دپارتمان‌ها	سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
مدیریت پروژه	مدیریت پروژه‌های صنعت ساخت	راهنمای PMBOK	متدولوژی Prince2	استاندارد مدیریت ساخت CMAA	
مدیریت مالی و هزینه	مدیریت مالی و هزینه پروژه ارزیابی اقتصادی پروژه			تامین مالی پروژه	
مدیریت برنامه‌ریزی و زمان‌بندی	برنامه‌ریزی و کنترل پروژه نرم‌افزار MSP نرم‌افزار P6				
مدیریت کیفیت			مدیریت کیفیت پروژه		
مدیریت قرارداد	آنالیز تاخیرات پروژه	مدیریت ادعاء و اختلافات			اجرای پروژه به روش CM
مدیریت ایمنی			مدیریت ایمنی پروژه		
مدیریت طرح و برنامه		مدیریت پروژه به روش Lean دفتر مدیریت پروژه (PMO)	مدیریت چابک Agile		مدیریت طرح
مدیریت پایداری			مدیریت پایداری پروژه		
مدیریت ریسک		مدیریت ریسک پروژه			
مدیریت اطلاعات	مدیریت اسناد و مدارک پروژه	نرم‌افزار Power BI			
مدیریت مدل‌سازی اطلاعات ساختمان (BIM)		نرم‌افزارهای BIM		مدیریت BIM در پروژه	

Relevant comprehensive courses

https://dralavipour.com/general-course/risk1

CM Roadmap – Hard skills

مهارت‌های سخت (Hard Skills) - سطح ارشد استراتژی

دپارتمان‌ها	سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
مدیریت پروژه			منشور اخلاق در مدیریت پروژه		
مدیریت مالی و هزینه		استراتژی مدیریت هزینه و مهندسی ارزش			
مدیریت برنامه‌ریزی و زمان‌بندی		استراتژی مدیریت برنامه‌ریزی و زمان‌بندی			
مدیریت کیفیت				استراتژی مدیریت کیفیت	
مدیریت قرارداد	اصول مدیریت ساخت		استراتژی مدیریت قرارداد		
مدیریت ایمنی				استراتژی مدیریت ایمنی	
مدیریت طرح و برنامه					استراتژی مدیریت طرح و برنامه
مدیریت پایداری				استراتژی مدیریت پایداری	
مدیریت ریسک			استراتژی مدیریت ریسک		
مدیریت اطلاعات			استراتژی مدیریت اطلاعات		
مدیریت مدل‌سازی اطلاعات ساختمان (BIM)					استراتژی مدیریت BIM

Relevant comprehensive courses

Strategy to Risk Management
Next years…

https://dralavipour.com/general-course/strategic-risk-management

CM Roadmap – Management skills

منتورینگ (Management Skills) - سطح مدیریتی

سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود
دارای مدرک کارشناسی در زمینه مهندسی	داشتن مدرک مدیریتی سطح ۱	داشتن مدرک مدیریتی سطح ۲	داشتن مدرک مدیریتی سطح ۳	داشتن مدرک مدیریتی سطح ۴
تسلط بر مباحث مهارت‌های سخت و نرم سطح ۱	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۲	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۳	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۴	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۵

CM Roadmap – Consulting skills

مشاوران (Consulting Skills) - سطح مشاوره

سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
	برنامه‌ریزی پروژه	جلوگیری و حل اختلاف در پروژه	مدیریت کیفیت پروژه	مدیریت درس آموخته‌های پروژه
	مدیریت تغییرات پروژه			
	آنالیز و اجرای ساخت‌پذیری پروژه	آنالیز و مدیریت ریسک پروژه	مدیریت ایمنی پروژه	

Relevant comprehensive courses

Advanced Risk Analysis and Management (Best Practice)
Next years…

https://dralavipour.com/general-course/advanced-risk-management

مدیریت پروژه‌های صنعت ساخت

(ساختمانی، زیرساختی و صنعتی)

فصل هشتم: مدیریت کیفیت

ایجاد سیستم مدیریت کیفیت

ارائه دهنده:

سید محمدرضا علوی‌پور

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

What we will learn?

- Developing the quality management plan
- Implementation of QA/QC
- Quality control documentation and reporting
- CM roadmap related to this section

ACEMI

Introduction

- Quality **not only impacts** aesthetics, appearance, and durability—
  it also impacts **performance**.

- The characteristics of a good quality management plan and a good safety management plan are **quite similar**.

- Although each is defined by **distinct concepts** and **specific mechanisms** of control,
  it makes **sense to administer** quality and safety plans as one integrated management function.

CM in quality management

*The **construction manager** must have a **quality management plan** in place long before the **first shovel of dirt** is turned on the job.*

DEVELOPING THE QUALITY MANAGEMENT PLAN

ACEMI

Defining quality

- In **construction**, quality is defined as meeting or exceeding the **requirements** established in the design documents.
- Fundamentally, the **quality of the construction project** is set through the plans and specifications provided by the **architects and engineers.**

Price Differences Based on Quality

Project Type	Square Footage	Low Quality	Medium Quality	High Quality	Difference High/Low
Apartment	70,000	$4,732,000	$5,605,000	$6,806,000	30%
High School	120,000	$6,999,000	$8,966,000	$11,345,000	38%
Warehouse	50,000	$1,520,000	$2,218,000	$3,091,000	51%
Parking Garage	90,000	$2,543,000	$3,737,000	$6,436,000	60%

Primary objectives of the plan

- The **goal** of the **construction manager** is to produce a project with as few defects, failures, and complaints as possible. So, how do you do that?
- Fundamentally, your plan must **focus on three primary** objectives:

1. Doing things right the first time
2. Preventing things from going wrong
3. Continually improving the process

rework
A term used to describe defective construction work that must be redone or corrected.

callback
A request from an owner that a contractor return to the job site to correct or redo some item of work.

Let's consider these objectives one at a time.

Primary objectives of the plan – Doing things right the first time

- The first goal of the quality management plan is to get things done **right the first time**.
  - Getting it **right in construction** doesn't always mean getting it **perfect**.
    - ✓ *For example, it is rare to find a concrete floor slab that is perfectly level.*
    - ✓ *But it is commonly expected that a floor slab be level or flat within certain tolerances.*
- Workers **can't do the job right** the first time if they **don't have**
  1. Proper skills,
  2. Necessary level of experience,
  3. Adequate supervision, and
  4. Tools and equipment needed to perform the task.

In most cases, the **superintendent** is responsible for seeing to it that the workforce is prepared and motivated to complete the **task at hand**.

Primary objectives of the plan – Preventing things from going wrong

- Meeting this objective requires a high sense of awareness, adequate preparations, and clear communications.
- To **prevent** things from going wrong,

  the **team must stay one step ahead** of the work in terms of oversight and supervision.
- A **preparatory inspection** is one of the **best ways** to avoid miscues and rework that can disrupt the schedule and negatively impact the budget.

preparatory Inspection
Inspections, sometimes called *pre-inspections* are designed to check progress and make sure everything is ready for the next stage of construction.

Primary objectives of the plan – Continually improving the process

- The **third goal** of the quality management plan is to **continually improve** the work processes and systems that **support the work.**
- The concept of **continuous improvement** is grounded in the work of **Edward Deming** and is commonly known as **Total Quality Management (TQM).**
- His theories suggest that **no matter how good** your product, process, or performance is, it can always and forever be enhanced.
  - The key is to **approach quality** as a never-ending, incremental, continuous improvement process.

Total Quality Management (TQM)
A recognized quality control and quality assurance program based on continuous quality improvement practices.

Primary objectives of the plan – Continually improving the process

- Here are the **steps** that could be used when **implementing TQM** in firms and on the job:

1. Identify the problem.
2. Break the work down into its smallest pieces or steps.
3. Identify the weak link.
4. Determine the remedy.
5. Apply the remedy.
6. Measure the results.

ACEMI

Primary objectives of the plan

- The following is a simple technique for tracking improvement efforts:

Problem	Hairline cracks in drywall where wall and ceiling meet
Goal	Reduce number of customer callbacks to make drywall repairs
Remedy	Replace paper drywall tape with fiber-glass flex tape
# of callbacks before remedy (Jan. to June)	47
# of callbacks after remedy (July to Dec.)	9

Primary objectives of the plan

NOTE

The Construction Industry Institute (CII) published *Guidelines for Implementing Total Quality Management in the Engineering and Construction Industry.* The manual is based on the results of a research study conducted earlier that showed that the implementation of TQM practices resulted in improved customer satisfaction, reduced cycle times, documented cost savings, and a more satisfied and productive workforce. This document is available on the CII website at https://www.construction-institute.org/resources/knowledgebase/best-practices/quality-management/topics/rt-031#.

IMPLEMENTATION OF QA/QC

ACEMI

Introduction

- You must consider quality **first** from a **"project" perspective** and then from a **"process" perspective.**
- The **two approaches** may be categorized as
  1. Quality control at the project level
  2. Quality assurance at the process level
- The **industry** often **lumps the two concepts** together, referring to the quality control function as the **QA/QC function**.

Let's consider the differences.

Introduction

quality control
A quality management approach that addresses quality at the project level and deals with conformance to the plans and specs through submittals, mock-ups, shop drawings, inspections, and testing.

quality assurance
A quality management approach that addresses quality at the process level and deals with policies and procedures associated with hiring, training, safety, subcontracting, and procurement.

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Quality assurance

- **Quality assurance (QA)** takes a **long-range view** toward developing systems that produce **high-quality work** consistently over time.

- To be effective, a **good quality assurance plan** must **influence every aspect** of the company,

  from the **management to the field.**

- The concept implies that **if the proper** procedures, policies, and systems are institutionalized **throughout the organization up front**,

  the **outcome** at the **project level** will be much **more reliable**.

ACEMI

Quality assurance

- Let's look at the ways some **construction company practices** can affect quality for **better or worse**:
  1. Hiring practices
  2. Training programs
  3. Safety
  4. Subcontracting practices
  5. Procurement methods
  6. Employee incentives

ACEMI

Quality control

- To **manage quality** on a project, a contractor will need to **implement several tasks** as part of their **QC plan**, including:
  - Studying the **prime contract agreement** for contract **quality expectations**,
  - Reviewing and adapting **QA processes**,
  - Developing a **site-specific QC plan** that includes clear expectations and roles for all team members, including the project owner and designers,
  - Submitting the **site-specific quality plan** to the project owner and design team for review and approval,
  - Employing **best value quality subcontractors**,
  - Requiring **subcontractors** to also submit **project-specific QC plans**,
  - Utilizing **in-house QC resources/specialists** supplemented on an **as-needed basis** by **third-party inspectors**,

ACEMI

Quality control

- To **manage quality** on a project, a contractor will need to **implement several tasks** as part of their **QC plan**, including:
  - Reviewing the **design for gaps** and **promptly submitting requests** for information **(RFIs)** to the project owner and design team for review and approval,
  - Inspecting materials before unloading,
  - Developing pre-installation mock-ups,
  - Conducting in-process pre-inspections,
  - Documenting non-conforming work and seeking remedy of any through contractor's punch lists,
  - Performing formal punch list inspection and resolution, and
  - Preparing for post-project warranty management.

ACEMI

Quality control

- **Quality control (QC)** addresses quality at the **project level** and is implemented on the **job site**.

- **Quality control** primarily deals with **issues** relating to **conformance** to the plans and specs.

- All of the materials, systems, and workmanship applied to the project must **conform** to the **requirements** set forth in the contract documents.

ACEMI

Quality control

- **Quality control** is accomplished using a number of **different mechanisms**:
- submittals, mock-ups, shop drawings, inspections, and testing, which are all called for in the project manual.
  - Submittals
  - Mock-ups
  - Shop drawings
  - Testing standards
  - Independent testing and inspections
  - Building code inspections

Quality control

2.06 Concrete Mix

A. Mix Design: Select proportions for normal weight concrete in accordance with ACI 211.1. The laboratory used to prepare the mix design shall meet the requirements of ASTM 1077.

B. Ready Mix Concrete: Mix and deliver ready mix concrete, in accordance with ASTM C94.

C. Requirements: Provide concrete to comply with the following criteria:

1. Flexural strength (ASTM C78)
   a. Modulus of rupture at 28 days to be 650 psi minimum
   b. Modulus of rupture at 90 days to be 90 psi minimum
2. Compressive strength (ASTM C39): As determined by mix design for 7 and 28 days
3. Water/cement ratio: 0.45 maximum by weight
4. Cement content: 520 lbs./cubic yard minimum
5. Air entrainment (ASTM C231): 3–4%
6. Slump (ASTM C143): 3 inches maximum without plasticizer and 4 inches maximum with plasticizer

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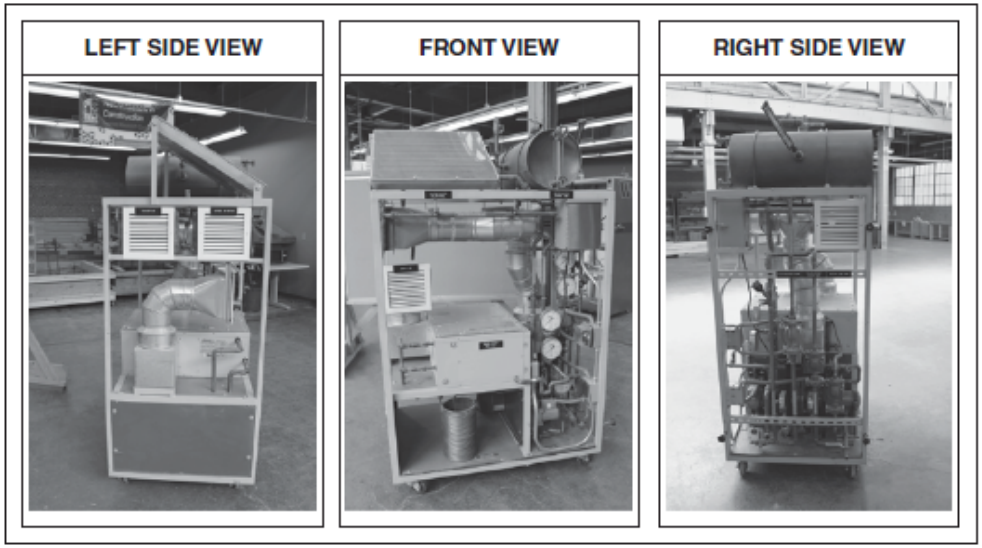
Quality control



Example of a Mock-Up

Quality control - Checklist

Reliable Construction Company
1401 Waterfront Avenue
Portland, OR 97210

QUALITY CONTROL CHECKLIST

Spec: 09680 System: Vinyl Plank Flooring, First Floor Only

Date: 9/27/2019

Project: Rose MXD Collective, Job 414

		Conforms?	
		Yes	No
1	Verify gypcrete moisture content is acceptable	Y	
2	Clean subsurface before application	Y	
3	No other subcontractors in area at this time	Y	
4	No exposed glue shown		Minimal
5	No turned-up edges or corners		No
6	No scuffs on tiles	OK	
7	No gaps between tiles	OK	
8	Finish close to wall to allow base to be covered	w/I 1/8"	
9	Direction consistent (N-S) or (E-W)	N-S	
10	Transition strips	Y	Replace 1
11	Surplus material left for owner's use		Open
12			

Notes: Subcontractor will correct deficiencies within one week

Surplus materials will be turned over after the fourth floor is completed

Inspector(s): David Arnold/QC, Joseph Wilson/Foreman, Jennifer Forsythe/PE

Quality control - Checklist

ABC Construction
Peppermill, AZ

Job Name: Jefferson Natl. Bank
Location: 561 Piedmont Street
Jefferson, AZ 90777

Contractor: Smith Excavating Service
Contact: Bob Smith
Phone: 555-714-3122

Quality Checklist – Backfill

X	Work complies with local, state, and national codes.
X	Foundation voids, cracks, or honeycombs patched and sealed watertight.
X	Wall ties in poured concrete foundation broken off and all tie holes filled with black plastic cement.
X	Seam between foundation and footing sealed watertight.
X	Basement foundation dampproofing completed according to quality standards.
X	Footing drains installed properly according to plans.
X	Debris and trash removed from trenches around foundation.
X	Utilities and plumbing connections approved and inspected, as required.
CR	Foundation properly braced.
HOLD	Backfill done in 8″ lifts and compacted as required.
HOLD	Fill dirt clean and free of rocks and debris.
HOLD	Backfill surface is at least 8″ down from the top of the foundation.

Superintendent's Signature: J.W. Jackson Date: June 8, 2019

Correction Required (CR):
South elevation requires additional bracing. Do not backfill until all bracing is properly installed. Contacted Bob Smith on Tuesday, 6/8/19 at 3:30 p.m.

Quality control - Checklist

QC inspection checklist

NORTHWEST CONSTRUCTION COMPANY
1242 First Avenue, Cascade, WA 98202
(206) 239-1422

INSPECTION CHECKLIST
03-10-00 – Concrete Formwork

Date: 9/16/15
Project: *NanoEngineering Building*

	Conforms? Yes	No
1. Location, dimensions, and grades are as required:	X	
2. Formwork materials as specified:	X	
3. Re-used formwork is properly conditioned for re-use:	X	
4. Completed formwork provides structural sections:	X	
5. Temporary spreaders are removed:	X	
6. Forms secured against concrete pressure:	X	
7. Forms are aligned:	X	
8. Forms properly cleaned and treated:	Need wash down	
9. Shoring checked for location and bearing:	NA	
10. Free movement of expansion joints:	X	
11. Filler installed and secured:	X	
12. Ties are of proper size and spacing:	NA	

Notes: *Inspector noted: 1) Dirt on rebar, 2) Rebar on ground, 3) Scrap wood in form. All these conditions were corrected the same day. Photographs are in the file.*

Inspector: ***Jim Bates**, Project Superintendent*

ACEMI

Quality control – Subcontracted work

- **Subcontractors** perform **most of the work** on a construction project.
- The **general contractor's reputation** for quality work, therefore, is greatly **affected** by the quality of each subcontractor's work.
- **Quality subcontractors** are **not necessarily** the least-cost subcontractors but, in the long term, they will provide a **superior project**.
  - The term **best-value subcontractors** applies here as well.
- The project superintendent must ensure the **jobsite is ready** for subcontractors **before scheduling them** to start work.
- **Quality requirements** should be **emphasized** at subcontractor preconstruction meetings.
- Subcontractors may be required to **prepare mock-ups** for exterior or interior finishes to establish the **required level of workmanship**.

ACEMI

Quality control – Subcontracted work

- **Subcontractors** should **not be allowed** to build over work that has been improperly installed by a **previous subcontractor**.
- The **superintendent** should walk the project **when each subcontractor finishes** its portion of the work to identify any needed rework.
- **Any deficiencies** noted should be listed in the **log** shown later in this section.
- **All rework** should be completed **before follow-on subcontractors** are **allowed to start** work.
- **Deficiencies** should be **corrected** as the **work progresses** to minimize the size of the **punch list** at the **pre-final inspection**.

ACEMI

Quality control – Testing and inspection

- **QC starts** first with diligent subcontractor selection and second with the submittal process.
- All **materials** and **equipment** should be **inspected** as they are being delivered to the **project site.**
- They should be **examined** and **compared** to the appropriate purchase orders and submittal documentation.
- Once the **work starts**, the inspector conducts an **initial inspection.**
- **Daily follow-up inspections** are conducted to ensure continuing co**mpliance with contract requirements.**

ACEMI

Quality control – Testing and inspection

- **QC inspectors** prepare daily reports, similar to the one mentioned later, to **document their inspection** activities and any **deficiencies identified**.

- These **daily inspection reports** should be reviewed both by the superintendent and by the project manager.

- **Outstanding deficiencies** should be entered in the deficiency log and tracked until they have been **corrected**.

QUALITY CONTROL DOCUMENTATION AND REPORTING

ACEMI

Documentation and reporting

- The **quality system** must be simple and easy to implement so that it **doesn't hinder** the production process.

- It must be **easy enough** for the construction staff to understand the **requirements** and **correctly complete** the documentation, and
  it shouldn't be a time-consuming process.

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Documentation and reporting

- Non-conformance reports
- Quality of materials
- Punch lists

ACEMI

Documentation and reporting

- **Reports** provided by testing agencies are reviewed by

  QC inspectors and

  filed with their **daily inspection reports** to the general contractor's superintendent.

- The **contract** may require that **copies of the reports** also be submitted to the owner.

- **Materials not meeting** specified standards must be **replaced**.

ACEMI

Documentation and reporting

- When the project is **nearing completion**, the **construction manager schedules** the pre-final inspection.

- Generally, this **inspection** is conducted by the superintendent, an owner's representative, and a representative of the design firm.

- **All deficiencies** noted are **recorded** on a punch list, which is a list of items to be **completed or corrected**.

- If an **active quality management system** has been used on the project, the **size of the punch list** should be **minimal**.

ACEMI

Documentation and reporting

- When **all deficiencies** listed on the punch list have been corrected,

  the **construction manager** schedules the **final inspection** to verify that all required work has been completed in **conformance with contract requirements**.

- The final inspection is also conducted by
  1. Superintendent
  2. Owner's representative
  3. Representative of the design firm

ACEMI

Documentation and reporting

- **Project owners** commonly require **formal QC reports** from the GC and **expect the GC** to proactively manage them.
- These reports **list any deficiencies** that have been identified as a part of the ongoing **testing and inspection process**.
- **All deficiencies** identified should be listed on a deficiency list, non-conformance-report (NCR), or QC log.
- The **superintendent** will utilize the NCR log and **discuss progress** on open items during the **weekly owner–contractor coordination meeting**.

ACEMI

Documentation and reporting

- The **superintendent**, **foreman**, or **quality control inspector** will walk the project when **each subcontractor finishes** its portion of the work to **identify necessary rework.**

- Any deficiencies noted should be listed in the **NCR or QC log**.

- **Deficiencies** should be **corrected promptly** to **minimize** the size of the official punch list.

Quality deficiency log

ABC Construction
Peppermill, AZ

Job Name: Kramer Medical Lab
Job Number: 22-04

Superintendent: JWJ
Quality Engineer: CWP

Quality Deficiency Log

No.	Initial Inspection	Description	Location	Responsible Party	Contact	Date Corrected	Re-inspected	By
1	6/08/19	Stair riser height is not per plans and spec.	West entrance	Baylor Bros. Concrete	Bob Smith	6/23/19	6/24/19 OK	CWP
2	6/08/19	Exterior light fixture has cracked globe.	West entrance	Carvel Lighting	Karen Jones	7/01/19	7/02/19 OK	CWP
3	6/17/19	Dent in metal toilet partition door–stall 3.	Men's room	Westside Specialties	Mike Davis	6/29/19	7/02/19 OK	CWP

Quality deficiency log

QC deficiency log

PROJECT DEFICIENCY LOG

PROJECT: *NanoEngineering Building* SUPERINTENDENT: *Jim Bates* PAGE: *1 of 1*_PROJECT
NUMBER: *9821*

No.	Description	Location	Responsible Party	Date Identified	Date Corrected	Date Re-Inspected
1	*Silt fence blew down this weekend*	*West and south*	*NWCC*	*9/15*	*9/15*	*9/15*
2	*Mud on foundation rebar*	*Grids 4 and 5*	*Rebar Sub*	*9/15*	*9/16*	*10/18*
3	*Rebar stored on ground and wet*	*Shakeout yard*	*Rebar Sub*	*9/16*	*9/16*	
4	*Wood debris in footing forms*	*Footings F5 and F6*	*NWCC*	*9/16*	*9/16*	
5	*Concrete break at 2250 PSI*	*Elevator pit*	*NWCC*	*11/1*		
6	*EMT in SOG in lieu of PVC*	*SOG*	*Richardson*	*11/1*	*11/5*	*11/7*

Quality deficiency log

Reliable Construction Company

QUALITY CONTROL LOG

PROJECT: Rose Collective, Job 414 SUPERINTENDENT: Susan Thompson DATE: Aug 1, 2019
PAGE: 5 of 10

No.	Rework Description	Location	Contractor	Date Entered	Sub Corrected	GC Verified
111	Vinyl floor peeling	Unit 332	Wilson Floors	10/24/19		
112	Vandal broke storefront window	SW corner, street level	Greater Glazing	10/24/19		
113	Roof leak near stair tower	Grid C x 10	Rick's Roofing	10/24/19	10/31/19	ST
114	Concrete rock pockets in garage cols	Lower floor columns	Reliable CC	10/24/19	11/1/19	ST
115	Elevator call button malfunction	Cab #2	General Elevator	10/24/19		
116	Dead rhododendron on roof	Roof garden, NE	Green Thumb	10/24/19	10/26/19	ST

Daily inspection report

QC daily inspection report

NORTHWEST CONSTRUCTION COMPANY
1242 First Avenue, Cascade, Washington 98202
(206) 239-1422

DAILY INSPECTION REPORT

Date: *September 16, 2015*

Project: *NanoEngineering Building*

Weather: *Rain and Gray and 10MPH SW Wind*

Work Inspected: *Footing Forms prior to pour*

Work found generally to be in accordance with approved plans and specifications with exceptions as noted below. I talked to Superintendent Bates and these items will be corrected prior to the concrete placement scheduled for this Friday.

Deficiencies Noted:

1) *Some mud on the rebar*
2) *Some rebar laying on the ground, not yet hung, currently in a puddle since last week's rain storm*
3) *Minor wood and debris in footing forms requires removal prior to pour*

Inspector: *Jeremy Shaker, TTI Testing, Inc.*

Daily inspection report

Reliable Construction Company
1401 Waterfront Avenue
Portland, OR 97210

IN-PROCESS QUALITY CONTROL INSPECTION REPORT

Date: August 15, 2019

Project: Rose Collective MXD Apartments, Job 414

Weather: Sunny, 72 degrees

Work Inspected: Green Roof System
1) Acceptability of roofing underlayment
2) Roof paver laydown – flatness, tight joints, direction
3) Topsoil sieve analysis
4) Irrigation piping: Leaks? Test pressure?
5) Size and quantity of plants
6) Subcontractor tie-off and spotter for safety

Deficiencies Noted:
1) There are a few dead plants already, especially the rhododendrons
2) There is a ponding near the stair shaft, not sure if this is a green roof or a roof issue

Inspector(s): David Arnold/QC, and Jennifer Forsythe/PE

CM ROADMAP
RELATED TO THIS SECTION

CM Roadmap – Hard skills

مهارت‌های سخت (Hard Skills) - سطح کارشناسی و اجرایی

دپارتمان‌ها	سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
مدیریت پروژه	مدیریت پروژه‌های صنعت ساخت	راهنمای PMBOK	متدولوژی Prince2	استاندارد مدیریت ساخت CMAA	
مدیریت مالی و هزینه	مدیریت مالی و هزینه پروژه ارزیابی اقتصادی پروژه			تامین مالی پروژه	
مدیریت برنامه‌ریزی و زمان‌بندی	برنامه‌ریزی و کنترل پروژه نرم‌افزار MSP نرم‌افزار P6				
مدیریت کیفیت			مدیریت کیفیت پروژه		
مدیریت قرارداد	آنالیز تاخیرات پروژه	مدیریت ادعاء و اختلافات			اجرای پروژه به روش CM
مدیریت ایمنی			مدیریت ایمنی پروژه		
مدیریت طرح و برنامه		مدیریت پروژه به روش Lean دفتر مدیریت پروژه (PMO)	مدیریت چابک Agile		مدیریت طرح
مدیریت پایداری			مدیریت پایداری پروژه		
مدیریت ریسک		مدیریت ریسک پروژه			
مدیریت اطلاعات	مدیریت اسناد و مدارک پروژه	نرم‌افزار Power BI			
مدیریت مدل‌سازی اطلاعات ساختمان (BIM)		نرم‌افزارهای BIM		مدیریت BIM در پروژه	

Relevant comprehensive courses

Strategy to Quality Management
Next years…

https://dralavipour.com/general-course/quality-management

CM Roadmap – Hard skills

مهارت‌های سخت (Hard Skills) - سطح ارشد استراتژی

دپارتمان‌ها	سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
مدیریت پروژه			منشور اخلاق در مدیریت پروژه		
مدیریت مالی و هزینه		استراتژی مدیریت هزینه و مهندسی ارزش			
مدیریت برنامه‌ریزی و زمان‌بندی		استراتژی مدیریت برنامه‌ریزی و زمان‌بندی			
مدیریت کیفیت				استراتژی مدیریت کیفیت	
مدیریت قرارداد	اصول مدیریت ساخت		استراتژی مدیریت قرارداد		
مدیریت ایمنی				استراتژی مدیریت ایمنی	
مدیریت طرح و برنامه					استراتژی مدیریت طرح و برنامه
مدیریت پایداری				استراتژی مدیریت پایداری	
مدیریت ریسک			استراتژی مدیریت ریسک		
مدیریت اطلاعات			استراتژی مدیریت اطلاعات		
مدیریت مدل‌سازی اطلاعات ساختمان (BIM)					استراتژی مدیریت BIM

Relevant comprehensive courses

Strategy to Quality Management Next years…

https://dralavipour.com/general-course/strategic-quality-management

CM Roadmap – Management skills

منتورینگ (Management Skills) - سطح مدیریتی

سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود
دارای مدرک کارشناسی در زمینه مهندسی	داشتن مدرک مدیریتی سطح ۱	داشتن مدرک مدیریتی سطح ۲	داشتن مدرک مدیریتی سطح ۳	داشتن مدرک مدیریتی سطح ۴
تسلط بر مباحث مهارت‌های سخت و نرم سطح ۱	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۲	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۳	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۴	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۵

CM Roadmap – Consulting skills

مشاوران (Consulting Skills) - سطح مشاوره

سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
	برنامه‌ریزی پروژه	جلوگیری و حل اختلاف در پروژه	مدیریت کیفیت پروژه	مدیریت درس آموخته‌های پروژه
	مدیریت تغییرات پروژه			
	آنالیز و اجرای ساخت‌پذیری پروژه	آنالیز و مدیریت ریسک پروژه	مدیریت ایمنی پروژه	

Relevant comprehensive courses

Advanced Quality Management
(Best Practice)
Next years…

https://dralavipour.com/general-course/advanced-quality-management

مدیریت پروژه‌های صنعت ساخت

(ساختمانی، زیرساختی و صنعتی)

فصل نهم: مدیریت ایمنی

ایجاد سیستم مدیریت ایمنی

ارائه دهنده:

سید محمدرضا علوی‌پور

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

What we will learn?

- Needs for safety
- Economic costs and benefits
- Uninsured accident costs
- CM and safety manager roles
- Occupational safety and health administration requirements
- Safety record keeping
- Safety program
- CM roadmap related to this section

NEEDS FOR SAFETY

Need for safe practice

- Although the **fatality rate** in construction has been reduced in recent years,
  the **improvement in safety record** achieved by the construction industry **still lags seriously behind that achieved** in other hazardous industries.

- **Out of 4,379 worker fatalities** in private industry in the calendar year 2015,
  937 (21.4%) were in construction;
  that is, **one in five worker deaths** were in construction.

Construction is still a dangerous business

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Need for safe practice

- It is the **contractor's responsibility** to see that everything possible is done to provide a s**afe working environment** for the work force and for the **public in general**.

- The **factors that motivate** safe practices at the **job site** are generally identified as follows:
  1. Humanitarian concerns
  2. Economic costs and benefits
  3. Legal and regulatory considerations

Humanitarian concerns

- The **current safety legal framework** is summarized by the General Duty Clause of the United States Occupational Safety and Health Act (OSHA),

  which stipulates that "each employer shall furnish to each of **his employees employment** and a **place of employment**

  which are **free from recognized hazards** that are causing or are likely to cause **death** or **serious physical harm** to his employees" (OSHA 29 U.S.C. § 654, 5(a)1).

The burden of providing a safe environment has been firmly and increasingly placed on the employer.

ECONOMIC COSTS AND BENEFITS

Categories of safety costs

- Safety costs can be broken into **three categories:**

1. Direct cost of previous accidents

a. Insurance premiums and ratings

b. Mandatory accident prevention methods

c. Records, safety personnel

2. Direct cost of each accident occurrence

a. Delay to project

b. Uninsured damages

3. Indirect cost

a. Investigation

b. Loss of skilled workers

c. Loss of equipment

d. Lost production

Rating system – Manual rating

1. Manual rating
2. Experience modification rate (EMR)
3. Retrospective rating

Rating system – Manual rating

- **Manual rating** is based on the **past losses** of the **industry as a whole**.
- **Many states** are guided by or actually have **their rates** set by the National Council on Compensation Insurance (NCCI).
- The rates as **set and approved** by each state insurance commissioner are known as the manual (standard) rates.
- These **manual rates** are published periodically in the Engineering News Record (ENR) Quarterly Cost Roundup issues.

Rating system – Manual rating

State	Carpentry — general	Concrete Work — NOC	Concrete Work — flat (flr., sdwk.)	Electrical Wiring — inside	Excavation — earth NOC	Excavation — rock	Glaziers	Insulation Work	Masonry	Painting & Decorating	Pile Driving	Plastering	Plumbing	Roofing	Sheet Metal Work (HVAC)	Steel Erection — structure	Steel Erection — NOC	Tile Work — (interior ceramic)	Waterproofing	Wrecking
CA	30.29	11.42	11.42	7.84	13.27	13.27	17.86	12.98	17.53	16.24	15.03	27.23	12.47	51.93	18.17	17.31	20.57	8.69	16.24	20.57
CO	12.76	13.19	7.46	5.18	10.35	10.35	9.79	13.91	14.30	10.29	15.08	9.00	8.45	23.95	11.46	35.52	15.85	8.60	5.74	15.85
DC	10.82	9.43	12.00	6.35	12.14	12.14	17.96	9.67	15.03	8.37	14.12	12.98	11.77	21.47	8.93	43.78	18.27	21.67	4.05	43.78
FL	18.25	18.38	8.91	7.48	9.33	9.33	14.41	11.19	13.96	13.51	38.24	25.08	8.13	28.05	12.68	35.41	23.49	8.34	6.22	35.41
GA	24.91	14.49	10.83	9.87	17.01	17.01	15.94	22.44	19.68	18.93	26.79	18.55	10.89	44.56	20.76	52.69	41.28	10.07	8.65	52.69
IN	7.45	5.04	3.48	2.74	4.62	4.62	5.59	6.77	5.15	4.77	8.47	3.83	2.85	11.36	4.45	15.75	7.98	3.09	2.27	15.75
KY	22.00	15.75	8.00	6.00	10.40	10.40	20.44	20.69	9.50	12.50	25.37	15.33	7.00	45.00	19.58	46.98	23.88	11.89	6.75	46.98
NY	12.39	17.19	11.26	6.69	8.37	8.37	10.18	9.91	15.70	10.41	15.68	9.04	7.33	33.39	12.79	21.77	15.20	8.72	6.92	10.56
WY	8.93	8.93	8.93	8.93	8.93	8.93	8.93	8.93	16.00	8.93	8.93	8.93	8.93	8.93	8.93	8.93	8.93	8.93	8.93	8.93
AVG.	18.31	15.22	9.42		10.46	10.46	14.15	15.12	14.80	12.86	21.48	14.39	8.11	32.94	11.88	40.12	23.82	9.47	7.07	36.28

Compensation insurance base rates for construction workers (Selected states and crafts—these rates do not purport to be current but are shown here only as indicative of the rate structure.)
***Source*: R. S. Means Building Construction Cost Data.**

Rating system – Manual rating: Example

- Sears et al. (2005) illustrate this with the following example:

  - *Assume that a contractor's annual volume of work is $10 million a year.*
  - *Considering a typical amount of subcontracting and the cost of materials, this general contractor's annual payroll will be about $2.5 million.*
  - *If its present worker's compensation manual rate averages about 20%, the annual premium cost will be about $500,000.*

Rating system – Experience modification rate (EMR)

- **Most insurance carriers** use the experience rating method,

  which is based on the **company's record** for the **past three years**,

  not including the most recent preceding year.

- In this system, an **experience modification rate (EMR)** is multiplied by the **manual rate** to establish the **premium** for a given firm.
  - Data on losses, the actual project being insured, and other variables are considered in deriving the **experience modification rate (EMR).**

If the company has an EMR of 75%, it will pay only 75% of the manual premium.

Good experience ratings can lead to significant savings.

Rating system – Experience modification rate (EMR): Example

- Sears et al. (2005) illustrate this with the following example:
  - Assume that a contractor's annual volume of work is $10 million a year.
  - Considering a typical amount of subcontracting and the cost of materials, this general contractor's annual payroll will be about $2.5 million.
  - If its present worker's compensation manual rate averages about 20%, the annual premium cost will be about $500,000.
    - ✓ *Now assume that an effective accident prevention program results in an experience modification rate (EMR) of 0.7.*
    - ✓ *This will mean a reduction of the annual premium cost of its worker's compensation insurance to about $350,000.*
      - o *Annual savings of approximately $150,000 are thereby realized in the cost of this one insurance coverage alone.*

Rating system – Retrospective rating

- **Retrospective rating** is somewhat like **self-insurance**.
- It is basically the **same as experience rating** except for one point.
  - It uses the loss record of the contractor for the **previous year or other defined retrospective period** to compute the premium.
- This can **raise or lower** the premium cost based on performance during the retrospective period.
- The starting point or basis for this method is again the **manual premium**.

Rating system – Retrospective rating

- The retrospective rate is then calculated as:

$$\text{Retrospective rate} = (\text{Tax multiplier}) \times \{\text{Basic premium} + [(\text{Incurred loss}) \times (\text{Loss conversion factor})]\}$$

- A **percentage (usually 20%)** of the standard premium resulting from applying the experience modification factor to the **manual rate** is used to obtain the **basic premium**.
- The **incurred loss** is the amount **paid out to settle claims** over the retrospective period.
- The **loss conversion factor** is a percentage loading used to weigh the **incurred losses** to cover general claims investigation and adjustment expenses.
- The **tax multiplier** covers premium taxes that must be paid to the **state**.

Rating system – Retrospective rating: Example

- If the data for a given company are as follows:

Manual premium	$25,000
EMR (25% credit)	0.75

then

$$\text{Standard premium} = 0.75(\$25,000) = \$18,750$$
$$\text{Basic premium @ 20\% of standard} = 0.20(\$18,750) = \$3,750$$
$$\text{Loss conversion factor} = 1.135(\text{derived from experience})$$
$$\text{Tax multiplier} = 1.03(\text{based on state tax})$$
$$\text{Incurred losses} = \$10,000$$

Then

$$\text{Retrospective premium} = 1.03\left[\$3,750 + (1.135 \times \$10,000)\right] = \$15,553$$

- This is a **nice savings** over the standard premium of $18,750 and provides the contractor with a **clear incentive** to minimize the incurred losses.
- By so doing, the contractor can expect a **large premium rebate** at the end of the year.

UNINSURED ACCIDENT COSTS

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Accident costs

- In addition to the cost of insurance premiums,
  1. **Direct costs** for things such as the **salary of the safety engineer** and his or her staff
  2. Costs associated with the **implementation** of a **good safety program**

The **precise amount of the costs** associated with other safety cost categories is more difficult to assess, and these costs can be thought of as additional uninsured costs **resulting from accidents.**

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Accident costs

- **Typical uninsured costs** associated with an accident are shown in Table.

Injuries	Associated Costs
1. First-aid expenses 2. Transportation costs 3. Cost of investigations 4. Cost of processing reports	1. Difference between actual losses and amount recovered 2. Rental of equipment to replace damaged equipment 3. Surplus workers for replacement of injured workmen 4. Wages or other benefits paid to disabled workers 5. Overhead costs while production is stopped 6. Loss of bonus or payment of forfeiture of delays
Wage Losses	**Off the Job Accidents**
1. Idle time of workers whose work is interrupted 2. Man-hours spent in cleaning up accident area 3. Time spent repairing damaged equipment 4. Time lost by workers receiving first aid	1. Cost of medical services 2. Time spent on injured workers' welfare 3. Loss of skill and experience 4. Training replacement worker 5. Decreased production of replacement 6. Benefits paid to injured worker or dependents
Production Losses	**Intangibles**
1. Product spoiled by accident 2. Loss of skill and experience 3. Lowered production of worker replacement 4. Idle machine time	1. Lowered employee morale 2. Increased labor conflict 3. Unfavorable public relations

Source: From: Knack, L. E. (1980) Safety Procedures and Practices. In J. P. Frein (ed.), Handbook of construction management and organization. 2nd ed., New York, NY: Springer., ISBN 978-0442224752.

Accident prevention

NORTHWEST CONSTRUCTION COMPANY
1242 First Avenue, Cascade, Washington 98202
(206) 239-1422

JOB HAZARD ANALYSIS

Project: *NanoEngineering Building Project*

Phase: *Mass excavation*

Sequence of Construction Tasks	Potential Hazards	Hazard Mitigation Measures
Public safety	*Automobile and pedestrian traffic*	*1) Mark site perimeter with fence, signs, and caution tapes 2) Use full-time flagger wearing orange vest*
Unloading equipment	*Equipment sliding off trailer*	*1) Park trailer on firm solid surface 2) Set equipment brake while unloading 3) Use spotter to monitor vicinity*
Site excavation	*Struck by*	*1) Ground personnel wear high visibility vests 2) Ground personnel stay outside of equipment swing radius*
Site excavation	*Noise*	*1) Equipment operators and ground personnel wear hearing protection*
Loading earth into dump trucks	*Struck by*	*1) Ensure path is clear before swinging bucket*
Shutting down equipment	*Unexpected equipment movement*	*1) Block wheels 2) Set equipment brakes 3) Lower attachments to ground 4) Lock equipment*
Equipment to be Used	**Inspection Requirements**	**Training Requirements**
Track excavator Dump truck	*Hydraulics, mirrors, and clean windshield*	*Inspect every vehicle entering and leaving the job site*

Prepared by: *Jim Bates* Date: *March 30, 2015*

CC: subcontractors, employees, architect, owner, project manager, and project engineer

Accident prevention

NORTHWEST CONSTRUCTION COMPANY
1242 First Avenue, Cascade, Washington 98202
(206) 239-1422

Accident Investigation Form

Project Name: _____

Project Location: _____

1. Name of injured person: _____

2. Date and time of accident: _____

3. Job title of injured person: _____

4. Nature of injuries sustained by injured person: _____

_____

5. Describe the accident and how it occurred: _____

_____

6. What was the cause of the accident?: _____

_____

7. Were all company safety policies being followed? _____ If, no, explain: _____

_____

8. Was PPE required? _____ Was all required PPE being worn? _____If no, explain:

_____

9. Describe the job site conditions at the time of the accident: _____

_____

10. Had the injured person been properly trained to perform the assigned tasks? _____

11. Witnesses: _____

Prepared by _____ Date _____

Personal protective equipment

CM AND SAFETY MANAGER ROLES

CM role in terms of safety

- Construction managers and superintendents are responsible for the **overall safety** of
  1. **Their workers** on the job site
  2. All of the **equipment and materials** that they must handle

- They **must set** the **standards for safety** right up front and be forever diligent regarding **adherence to** the safety plan.

Safety manager

- However, the **day-to-day management** of the **safety plan** is usually assigned to an individual project team member.

- Because there is such a **close relationship** between quality and safety,

  it is **not uncommon** for the project manager to assign one person to hold the **position of both** the quality engineer and the safety officer.

  It depends on the size of the job

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Safety manager

- **Larger jobs** may require an independent quality engineer and safety officer.

- **On smaller jobs**, the assistant superintendent often covers the **responsibilities**.

But whether the functions are handled by one person, two persons, or someone in a dual role such as an assistant superintendent,

*it is very **important** that the individual(s) responsible for safety management take their job **seriously**.*

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REQUIREMENTS

What is OSHA?

Occupational Safety and Health Administration (OSHA)
The federal agency responsible for establishing safety standards for construction and all other industries in the United States. The agency also has the authority to enforce those standards through rigorous inspections at the job site and to issue citations to and assess fines against any contractor or subcontractor for violating these standards.

Employer's responsibilities

- Employers must "**make, keep and preserve, and make available** to representatives of the Secretaries of Labor, and Health and Human Services"

  records of recordable occupational injuries and illnesses

  (Williams-Steiger Act, 1970).

- Any fatal or serious accidents must be reported to **OSHA within eight hours**.

- Certain records of job-related fatalities, injuries, and illnesses must be **maintained by firms**

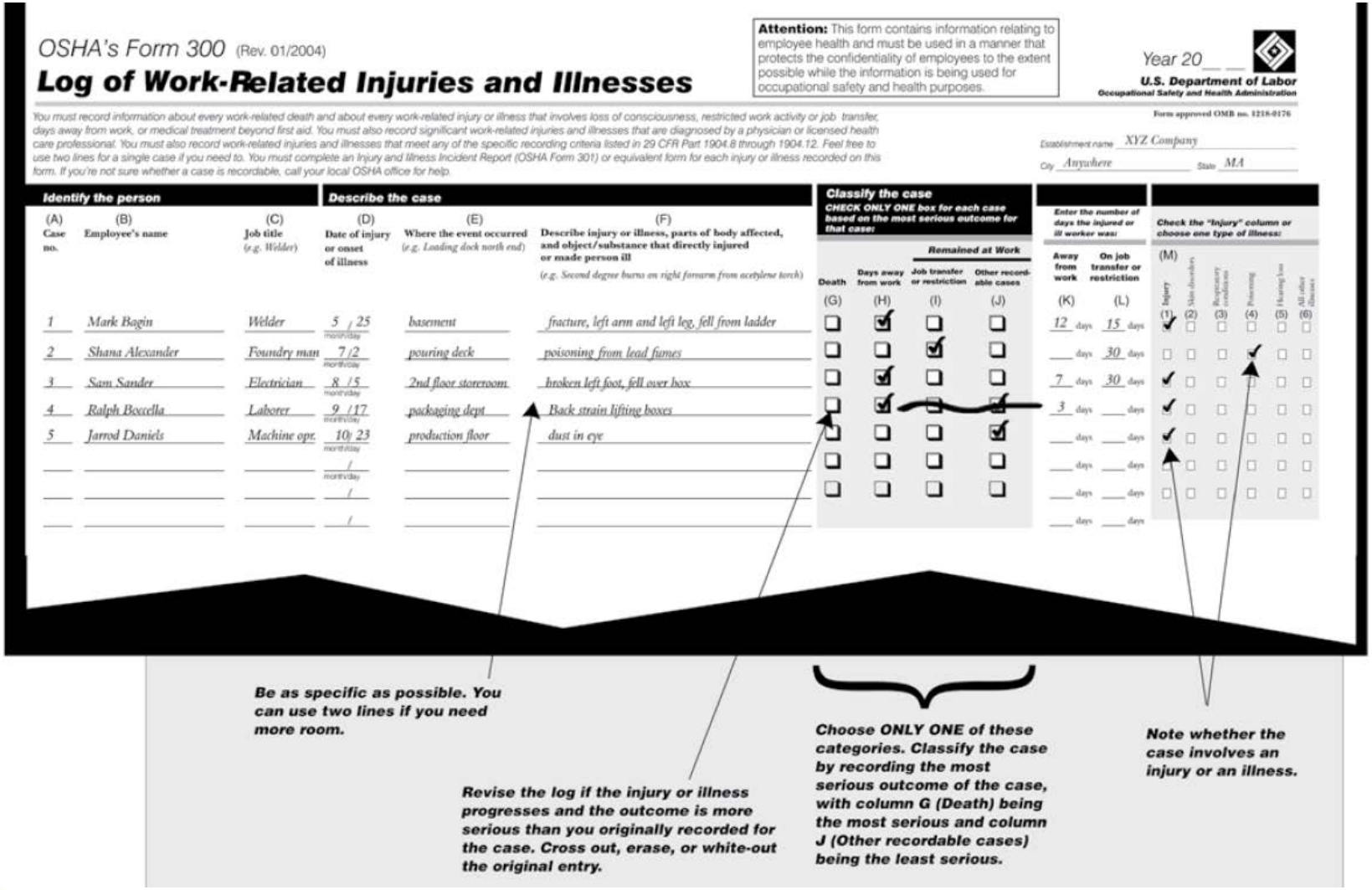
  having eight or more employees.

SAFETY RECORD KEEPING

Forms for review

- The **two key forms** that must be available for review when a **compliance officer** makes an inspection are as follows:
  1. **OSHA 300:** This is a **log** that summarizes each reportable case as a **single line entry** and must be posted for employee inspection.
     - ✓ OSHA allows the use of industry-generated forms similar to the OSHA forms as long as they have at least the same information as the OSHA forms.

OSHA form 300



OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name XYZ Company
City Anywhere State MA

Identify the person			Describe the case			Classify the case (CHECK ONLY ONE box for each case based on the most serious outcome for that case)				Enter the number of days the injured or ill worker was:		Check the "Injury" column or choose one type of illness:					
(A) Case no.	(B) Employee's name	(C) Job title (e.g. Welder)	(D) Date of injury or onset of illness	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	(G) Death	(H) Days away from work	(I) Remained at Work: Job transfer or restriction	(J) Remained at Work: Other recordable cases	(K) Away from work	(L) On job transfer or restriction	(M) Injury	(1) Skin disorders	(2) Respiratory conditions	(3) Poisoning	(4) Hearing loss	(5) All other illnesses	(6)
1	Mark Bagin	Welder	5/25	basement	fracture, left arm and left leg, fell from ladder	☐	☑	☐	☐	12 days	15 days	✓	☐	☐	☐	☐	☐	☐
2	Shana Alexander	Foundry man	7/2	pouring deck	poisoning from lead fumes	☐	☐	☑	☐	___ days	30 days	☐	☐	☐	☐	✓	☐	☐
3	Sam Sander	Electrician	8/5	2nd floor storeroom	broken left foot, fell over box	☐	☑	☐	☐	7 days	30 days	✓	☐	☐	☐	☐	☐	☐
4	Ralph Boccella	Laborer	9/17	packaging dept	Back strain lifting boxes	☐	☑	☐	☐	3 days	___ days	✓	☐	☐	☐	☐	☐	☐
5	Jarrod Daniels	Machine opr.	10/23	production floor	dust in eye	☐	☐	☐	☑	___ days	___ days	✓	☐	☐	☐	☐	☐	☐
			/			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐	☐
			/			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐	☐
			/			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐	☐

Be as specific as possible. You can use two lines if you need more room.

Revise the log if the injury or illness progresses and the outcome is more serious than you originally recorded for the case. Cross out, erase, or white-out the original entry.

Choose ONLY ONE of these categories. Classify the case by recording the most serious outcome of the case, with column G (Death) being the most serious and column J (Other recordable cases) being the least serious.

Note whether the case involves an injury or an illness.

Forms for review

- The **two key forms** that must be available for review when a **compliance officer** makes an inspection are as follows:
  2. **First report of injury:** Example in next slide.

First report of injury – Typical first report of injury/illness form

INDIANA WORKER'S COMPENSATION
FIRST REPORT OF EMPLOYEE INJURY, ILLNESS

State Form 34401 (R10 / 1-02)

Please return completed form electronically by an approved EDI process.

FOR WORKER'S COMPENSATION BOARD USE ONLY		
Jurisdiction	Jurisdiction claim number	Process date

PLEASE TYPE or PRINT IN INK

NOTE: Your Social Security Number is being requested by this state agency in order to pursue its statutory responsibilities. Disclosure is voluntary and you will not be penalized for refusal.

EMPLOYEE INFORMATION

Social Security number	Date of birth	Sex ☐ Male ☐ Female ☐ Unknown		Occupation / Job title	NCCI class code
Name (*last, first, middle*)		Marital status ☐ Unmarried ☐ Married ☐ Separated ☐ Unknown		Date hired / State of hire	Employee status
Address (*number and street, city, state, ZIP code*)				Hrs / Day / Days / Wk / Avg Wg / Wk	☐ Paid Day of Injury ☐ Salary Continued
Telephone number (include area code)		Number of dependents		Wage $ Per ☐ Hour ☐ Day ☐ Week ☐ Month ☐ Year ☐ Other	

EMPLOYER INFORMATION

Name of employer	Employer ID#	SIC code	Insured report number
Address of employer (*number and street, city, state, ZIP code*)	Location number	Employer's location address (*if different*)	
	Telephone number		
	Carrier / Administrator claim number	OSHA log number	Report purpose code
Actual location of accident / exposure (*if not on employer's premises*):			

First report of injury – Typical first report of injury/illness form

CARRIER / CLAIMS ADMINISTRATOR INFORMATION					
Name of claims administrator		Carrier federal ID number	Check if appropriate ☐ Self Insurance		
Address of claims administrator (*number and street, city, state, ZIP code*)		☒ Insurance Carrier	Policy / Self-insured number		
Telephone number		☐ Third Party Admin.	Policy period From To		
Name of agent McGowan Insurance Group, Inc.		Code number			
OCCURRENCE / TREATMENT INFORMATION					
Date of Inj. / Exp.	Time of occurrence ☐ AM ☐ PM ☐ Cannot be determined	Date employer notified	Type of injury / exposure		Type code
Last work date	Time workday began	Date disability began	Part of body		Part code
RTW date	Date of death	Injury / Exposure occurred on employer's premises? ☐ Yes ☐ No	Name of contact	Telephone number	
Department or location where accident / exposure occurred			All equipment, materials, or chemicals involved in accident		
Specific activity engaged in during accident / exposure			Work process employee engaged in during accident / exposure		
How injury / exposure occurred. Describe the sequence of events and include any relevant objects or substances.				Cause of injury code	
Name of physician / health care provider					
Hospital or offsite treatment (*name and address*)			INITIAL TREATMENT ☐ No Medical Treatment ☐ Minor: By Employer ☐ Minor: Clinic / Hospital ☐ Emergency Care ☐ Hospitalized > 24 Hours ☐ Future Major Medical / Lost Time Anticipated		
Name of witness	Telephone number	Date administrator notified			
Date prepared	Name of preparer	Title	Telephone number		

An employer's failure to report an occupational injury or illness may result in a $50 fine (IC 22-3-4-13).

WC 7703f (1-02) UNIFORM INFORMATION SERVICES, INC.

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Note

These records must be **preserved for 5 years**!

Reporting at the job site

- Reporting at the job site level breaks into six reporting levels as follows:
  1. First aid log
  2. First report of injury log
  3. Supervisor's accident investigation report
  4. Project accident report
  5. OSHA required Injury Report (OSHA 300)
  6. Fatality or major accident report

Project accident report

Job Name Peachtree Shopping Mall Job No. 10-100 Location Atlanta, Georgia Month April 20xx

This report should be completed and mailed to the Safety Branch of the Industrial Relations Department in the Atlanta office by the fifth day of the month.

Project Superintendent _____

This figure may be taken from payroll records. In the case of fractions use the nearest whole number. Do not include subcontractors or others.

1. Average number of employees _____

Figure actual hours worked whether straight time or overtime. Includes only those on our payroll.

2. Total hours worked by all employees _____

Record only those injuries that cause death, permanent disability (loss of a finger, etc.), or loss of time beyond the day on which the accident occurred. No matter what time of day the injury may occur, if the employee returns to his regular job at the start of his next regular shift, the injury is not counted. If he does not return at that time, it must be counted as a disabling injury.

3. Number of:
   Temporary disabling injuries _____
   Permanent disabling injuries _____
   Deaths _____
   Total disabling injuries for this month _____

For temporary injuries, count the actual calendar days lost, excluding the day of injury. If the injured employee has not returned by the end of the month, make an estimate of projected number of lost days. For deaths and permanent injuries, use the number of days specified in the standard table.

4. Number of days lost as a result of:
   Temporary disabling injuries _____
   Permanent disabling injuries _____
   Death _____
   Total days lost attributable to this month _____

Field observation report

NOTE

The field observation report can also be used to monitor and report any unsafe job conditions or work practices. Many quality control mechanisms double as safety control mechanisms.

SAFETY PROGRAM

Developing the safety management plan

- According to the **NAHB-OSHA Jobsite Safety Handbook**, an effective safety management plan includes four primary components:
  1. Management committment
  2. Job site analysis
  3. Hazard prevention and control
  4. Safety and health training

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Safety program

- A **good job site safety program** should be founded on:
  1. Safety training of all **new personnel** arriving on the site.
  2. **Regular and frequent** inspections for possible safety hazards.
  3. Regular briefings to increase the **safety awareness** of personnel at **all levels**.
  4. Written programs and documentation specifying **all safety activities**.

Safety program

- If workers or supervisors flagrantly **neglect safety rules and regulations**, **warnings** should be considered.

- It is good practice to **personally brief** each employee **arriving on site** regarding job procedures.

Job briefing sheet

PEACHTREE SHOPPING MALL
Atlanta, Georgia

Welcome to the job! ABC Construction Company is interested in you, and during your employment with us, we will exert every effort to make this job pleasant, with a good working atmosphere. On the other hand, your skills, ability, and performance are most important and essential to the successful completion of the project. To set up and complete a good job, certain rules and regulations must be established. For our mutual benefit, the rules and regulations are as follows:

WORKING RULES AND REGULATIONS

Employment
The Project Manager, or his duly authorized representative, will do all the hiring on the job.

Identification
Employees shall wear a company badge at all times, in full view, above the waist, on an outer garment. Badge numbers will be used in gate clearance, payroll, and timekeeping identification.

Hours of Work
The regular workday will begin as per individual instructions, with a lunch period of one-half hour at a designated time. The workweek shall be five days, Monday through Friday.
All employees will be at their work locations, ready to start work at work time. All employees are expected to remain at work until the authorized quitting time, at which time they may put up their tools and leave their place of work. Loitering in the change rooms and/or other places during working hours, or late starting of work and early quitting of work will be subject to proper disciplinary measures.

Checking In and Out
Employees are to check in and out at starting and quitting time. Infractions of this rule will be treated with appropriate disciplinary measures. Employees authorized to leave the project during regular working hours must check out with the timekeeper.

Issuing, Care, and Use of Tools
Certain company tools will be issued to journeymen and apprentices, or the foreman on a check or receipt system. Tools (while issued) must be properly used and maintained. A toolroom clearance will be required on termination. Loss or damage of tools will be noted on the employee's record.

A Day's Work
Each employee on the job is expected to perform a full day's work. Your willingness, cooperation, and right attitude will go a long way in accomplishing this objective.

Conduct on the Job
Good conduct on the job is essential to the overall welfare of all employees and the daily progress of the job. Therefore, conduct including, but not limited to, the following violations will be subject to appropriate disciplinary action or discharge.

- A briefing sheet is an effective aid for conducting this type of **briefing**.
- This **focuses** the **worker's attention** at the outset on the importance of safety and indicates management's interest in this phase of the job.

Job briefing sheet

Theft of company's or employees' property
Recurring tardiness
Leaving company's premises without proper authorization
Possession and/or use of intoxicants and/or narcotics on company's premises
Willful damage to company's materials, tools, and/or equipment
Engaging in horseplay (including shouting to passers-by)
Insubordination
Gambling
Fighting on company premises
Sleeping on the job
Failure to observe established safety rules and regulations

Housekeeping

Good housekeeping is essential to the safe and efficient construction of the job and is the responsibility of each employee. Work areas, stairways, walkways, and change rooms shall be kept clean at all times.

Safety Rules

Established safety rules and regulations will be observed and followed by all employees in the best interest of accident-free operations.

All unsafe working conditions should be reported to your immediate foreman, who in turn reports it to the company safety engineer.

All employees will be required to wear proper clothing above and below the waist. Hard hats must be worn by all employees and visitors while on the construction site.

Pay Period

Wednesday through Tuesday is the pay period, with pay day on Friday of each week.

Use of First Aid Facilities

First aid facilities are available at the job site and direct contracts have been established with local doctors, hospitals, and emergency crews for accidents of a serious nature. All injuries, regardless of severity, must be reported to the employee's supervisor, field safety supervisor, and/or first aid immediately upon occurrence. Insurance regulations make this requirement mandatory.

Sanitary Facilities

Adequate sanitary facilities are provided on the job site and are to be used by all employees. We request your cooperation in maintaining these facilities in a clean and orderly condition.

Raincoats and Boots

Raincoats and boots are supplied to employees where the conditions of the job being performed require them.

Remaining in Work Areas

Each employee must remain on the job site and at his work location at all times during regular working hours, unless authorized to leave by his supervisor.

Absenteeism

Unauthorized absenteeisms will result in termination of employment. An employee who must be absent or late should call 999-9000 and report to timekeeper.

Your cooperation in observing the rules and regulations for the job will show proper consideration for other employees and will be appreciated by the company.

If you agree to and will abide by the above, please sign and return to our field supervisor, Charles Hoarse.

Job Safety rules and regulations

760 Spring Street, N.W., Atlanta, Georgia 30308
(404) 999-9000

July 30, 20xx

Re: OCCUPATIONAL SAFETY & HEALTH ACT 1970 (Construction) (OSHA)

Employers, owner, contractors, subcontractors, superintendents, or foremen in charge shall not direct or permit an employee to work under conditions that are not in compliance with the above code.

Where one contractor is selected to execute the work of the project, he shall assure compliance with the requirements of this code from his employees as well as all subcontractors.

Every employee shall observe all provisions of the above codes that directly concern or affect his conduct. He shall use the safety devices provided for his personal protection and he shall not tamper with or render ineffective any safety device or safeguard.

1. *Overhead Hazards*	All employees shall be provided with hard hats and shall use hard hats.
2. *Falling Hazards*	Every hole or opening in floors, roofs, platforms, etc., into or through which a person may fall shall be guarded by a barrier sufficient to prevent falls.
3. *Slipping Hazards*	Scaffolds, platforms, or other elevated working surfaces covered with ice, snow, grease, or other substances causing slippery footing shall be removed, turned, sanded, etc., to ensure safe footing.
4. *Tripping*	Areas where employees must work shall be kept reasonably free from accumulations of dirt, debris, scattered tools, materials, and sharp projections.
5. *Projecting Nails*	Projecting nails inboards, planks, and timbers shall be removed, hammered, or bent over in a safe way.
6. *Riding of Hoisting Equipment*	No employee shall ride on or in the load bucket, sling, platform, ball, or hook.
7. *Lumber & Nail Fastenings*	Lumber used for temporary structures must be sound. Nails shall be driven full length and shall be of the proper size, length, and number. The proper use of double-headed nails is not prohibited.
8. *Guard Rail or Safety Rail*	Should be 2 × 4 at a height of 35″–37″ plus a midrail of 1 × 4. The hand rail shall be smooth and free from splinters and protruding nails. Other material or construction may be used provided the assembly assures equivalent safety.
9. *Toe Boards*	Shall extend 4″ above platform level and shall be installed where needed for the safety of those working below.
10. *Protection Eye Equipment*	Eye protection shall be provided by employers and shall be used for cutting, chipping, drilling, cleaning, buffing, grinding, polishing, shaping, or surfacing masonry, concrete, brick, metal, or similar substances. Also for the use and handling of corrosive substances.
11. *Protective Apparel*	Waterproof boots where required shall have safety insoles unless they are the overshoe type. Waterproof clothing shall be supplied to the employee required to work in the rain.
12. *Safety Belts & Lines*	Shall be arranged so that a free fall of no more than 6″ will be allowed.
13. *Stairways*	Temporary stairways shall not be less than 3 feet in width and shall have treads of no less than 2 inch x 10 inch plank. Must have hand rails. (See #8.)

- Safety rules and regulations should be available in **“handout” form** and be **conspicuously posted** around the job site.

Job Safety rules and regulations

14. *Smoking*	Prohibited in areas used for gasoline dispensing and fueling operations or other high hazard fire areas.
15. *Flammable*	Flammable liquid shall be kept in safety cans or approved use and storage containers.
16. *Sanitation*	Suitable grounding to prevent the buildup of static charges shall be provided on all flammable liquid transfer systems. Toilet facilities shall be provided and made available in sufficient number to accommodate all employees.
17. *Drinking Water*	A supply of clean and cool potable water shall be provided in readily accessible locations on all projects.
18. *Salt Tablets*	Shall be made available at drinking stations when required.
19. *Excavations*	Material and other superimposed loads shall be placed at least 3 feet back from the edge of any excavation and shall be piled or retained so as to prevent them from falling into the excavation. Sides and slopes of excavation shall be stripped of loose rocks or other material. Slopes shall be at an angle of 45 degrees or less (I on I slope).
20. *Structural Steel Erection*	When erection connections are made, 20% of the bolts in each connection must be drawn up wrench tight. At least two bolts must be used at each end of the member. No loads shall be placed on a framework until the permanent bolting is complete. Only employees of the structural steel erector engaged in work directly involved in the steel erection shall be permitted to work under any single-story structural steel framework that is not in true alignment and permanently bolted. Ladders shall be provided to give access to floors, stagings, or platforms.
21. *Use of Ladders*	Ladders shall be maintained in a safe condition at all times. Ladders shall he securely fastened top and bottom as well as braced where required. Ladders leading to floors, roofs, stagings, or platforms shall extend at least 3 feet above the level of such floors, stagings, or platforms.
22. *Scaffolds*	All scaffolding shall be constructed so as to support four times the anticipated working load and shall be braced to prevent lateral movement. Planks shall overhang their end supports not less than 6″ or more than 12″. Two-inch planking may span up to and including 10'. The minimum width of any planked platform shall be 18 inches. Guard rails and toe rails shall be provided on the open sides and ends of all scaffold platforms more than 8' high (see #8).
23. *Rigging, Ropes, and Chains*	All ropes, chains, sheaves, and blocks shall be of sufficient strength, condition, and size to safely raise, lower, or sustain the imposed load in any position. Wire rope shall be used with power-driven hoisting machinery. No rope shall be used when visual inspection of the rope shows marked signs of corrosion, misuse, or damage. All load hooks shall have safety clips. Loads that tend to swing or turn during hoisting shall be controlled by a tag line whenever practicable.
24. *Welding and Cutting*	Oxygen from a cylinder or torch shall never be used for ventilation.Shields or goggles must be worn where applicable. Cradles shall be used for lifting or lowering cylinders.
25. *Cranes & Derricks*	All cranes and derricks shall be equipped with a properly operating boom angle indicator located within the normal view of the operator. Every derrick and crane shall be operated by a designated person. A copy of the signals in use shall be posted in a conspicuous place on or near each derrick or crane. Cranes and derricks shall have a fire extinguisher attached.
26. *Trucks*	Trucks shall not be backed or dumped in places where men are working nor backed into a hazardous location unless guided by a person so stationed on the side where he can see the truck driver and the space in back of the vehicle.

Safety meeting minutes

ABC Construction Company
Job 10-100
Peachtree Shopping Mall
Atlanta, Georgia
Sept. 1, 20xx

GENERAL SAFETY MEETING #7

Safety Slogan for the Week:

"Be Alert, Don't Get Hurt."

C. Hoarse—Safety Supervisor
A. Apple—Carpenter Foreman
D. Duck—Surveyor
M. Maus—Laborer
D. Halpin—Field Engineer
R. Woodhead—Tool Room

Subcontractors Present:

Live Wire Electric
Henry Purcell
James Wallace

The First Aid Report for August 15 to August 31 Was Given. There Were:

First Aid	7
Doctor's Cases	0
Lost Time Injuries	0

SHORTCUTS

All of us, supposedly, at one time or another, have been exposed to possible injury by short cutting when a few extra steps would have meant the safe way. We did so as kids when we jumped the fence instead of using the gate and we do so as men when we cross streets by jaywalking instead of using the intersection. Accident statistics plainly indicate the fact that people disregard the fact that minor safety violations may have very serious results.

In construction work, short cutting can be deadly. All of us know of cases in which this kind of thoughtless act resulted in a serious injury. For instance, an ironworker tried to cross an opening by swinging on reinforcing rods, his hands slipped, and he fell about 20 feet to a concrete floor. If he had bothered to take a few moments to walk around the building, he would still be tying rods.

The safe way is not always the shortest way and choosing the safe way is your *Personal Responsibility*. When you are told to go to work in a particular area, you are expected to take the safe route, not an unsafe short route. We cannot be your guardian angel; that is one thing you will have to do for yourself.

If you are told to go to work in some place that has no safe access, report this fact to your foreman so that necessary means of access can be provided.

- **General safety meetings** conducted by the safety engineer should be held at least **once a month** with supervisors at the **foreman and job steward level.**
- The **objective** of these meetings is primarily to heighten the safety awareness of supervisors directly in charge of workers.
- These **foreperson-level personnel** in turn should hold at least one **"tool box" safety meeting** each week to transfer this awareness to the **work force** and discuss **safety conditions** with their crew.

Safety meeting minutes

Ladders and scaffolds are provided for high work; use them. Even though a high job may take only a few moments, DO NOT CLIMB ON FALSE WORK, or on some improvised platform.

Your first responsibility is to yourself. Remember that ladders, steps, and walkways have been built to save you trouble and to save your neck, too. Use them always.

Gambling a few minutes and a little energy against a possible lifetime of pain and misery is a poor bet.

GENERAL DISCUSSION

Flagmen must control all the back-up operations on this job.

Traffic—Be on the alert for moving vehicles, our area is slippery. *Don't* walk beside moving equipment.

Injuries—Report all injuries to your foreman immediately.

Charlie Hoarse

C. Hoarse, Safety Supervisor

CM ROADMAP
RELATED TO THIS SECTION

CM Roadmap – Hard skills

مهارت‌های سخت (Hard Skills) - سطح کارشناسی و اجرایی

دپارتمان‌ها	سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
مدیریت پروژه	مدیریت پروژه‌های صنعت ساخت	راهنمای PMBOK	متدولوژی Prince2	استاندارد مدیریت ساخت CMAA	
مدیریت مالی و هزینه	مدیریت مالی و هزینه پروژه ارزیابی اقتصادی پروژه			تامین مالی پروژه	
مدیریت برنامه‌ریزی و زمان‌بندی	برنامه‌ریزی و کنترل پروژه نرم‌افزار MSP نرم‌افزار P6				
مدیریت کیفیت			مدیریت کیفیت پروژه		
مدیریت قرارداد	آنالیز تاخیرات پروژه	مدیریت ادعاء و اختلافات			اجرای پروژه به روش CM
مدیریت ایمنی			مدیریت ایمنی پروژه		
مدیریت طرح و برنامه		مدیریت پروژه به روش Lean دفتر مدیریت پروژه (PMO)	مدیریت چابک Agile		مدیریت طرح
مدیریت پایداری			مدیریت پایداری پروژه		
مدیریت ریسک		مدیریت ریسک پروژه			
مدیریت اطلاعات	مدیریت اسناد و مدارک پروژه	نرم‌افزار Power BI			
مدیریت مدل‌سازی اطلاعات ساختمان (BIM)		نرم‌افزارهای BIM		مدیریت BIM در پروژه	

Relevant comprehensive courses

Strategy to Safety Management
Next years…

https://dralavipour.com/general-course/safety-management

CM Roadmap – Hard skills

مهارت‌های سخت (Hard Skills) - سطح ارشد استراتژی

دپارتمان‌ها	سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
مدیریت پروژه			منشور اخلاق در مدیریت پروژه		
مدیریت مالی و هزینه		استراتژی مدیریت هزینه و مهندسی ارزش			
مدیریت برنامه‌ریزی و زمان‌بندی		استراتژی مدیریت برنامه‌ریزی و زمان‌بندی			
مدیریت کیفیت				استراتژی مدیریت کیفیت	
مدیریت قرارداد	اصول مدیریت ساخت		استراتژی مدیریت قرارداد		
مدیریت ایمنی				استراتژی مدیریت ایمنی	
مدیریت طرح و برنامه					استراتژی مدیریت طرح و برنامه
مدیریت پایداری				استراتژی مدیریت پایداری	
مدیریت ریسک			استراتژی مدیریت ریسک		
مدیریت اطلاعات			استراتژی مدیریت اطلاعات		
مدیریت مدل‌سازی اطلاعات ساختمان (BIM)					استراتژی مدیریت BIM

Relevant comprehensive courses

Strategy to Safety Management
Next years…

https://dralavipour.com/general-course/strategic-safety-management

CM Roadmap – Management skills

منتورینگ (Management Skills) - سطح مدیریتی

سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود	پیش‌نیاز ورود
دارای مدرک کارشناسی در زمینه مهندسی	داشتن مدرک مدیریتی سطح ۱	داشتن مدرک مدیریتی سطح ۲	داشتن مدرک مدیریتی سطح ۳	داشتن مدرک مدیریتی سطح ۴
تسلط بر مباحث مهارت‌های سخت و نرم سطح ۱	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۲	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۳	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۴	تسلط بر مباحث مهارت‌های سخت و نرم سطح ۵

CM Roadmap – Consulting skills

مشاوران (Consulting Skills) - سطح مشاوره

سطح ۱	سطح ۲	سطح ۳	سطح ۴	سطح ۵
	برنامه‌ریزی پروژه	جلوگیری و حل اختلاف در پروژه	مدیریت کیفیت پروژه	مدیریت درس آموخته‌های پروژه
	مدیریت تغییرات پروژه			
	آنالیز و اجرای ساخت‌پذیری پروژه	آنالیز و مدیریت ریسک پروژه	مدیریت ایمنی پروژه	

Relevant comprehensive courses

Advanced Safety Management
(Best Practice)
Next years…

https://dralavipour.com/general-course/advanced-safety-management

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

دفتر آموزش

تهران، بلوار فردوس شرق، مجتمع آبگینه، طبقه سوم اداری، واحد C42

+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۵۰

+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۴۵

info@dralavipour.com

www.dralavipour.com

@alavipour_pm

@acemi_social

@alavipour_pm

@IRANACEMI