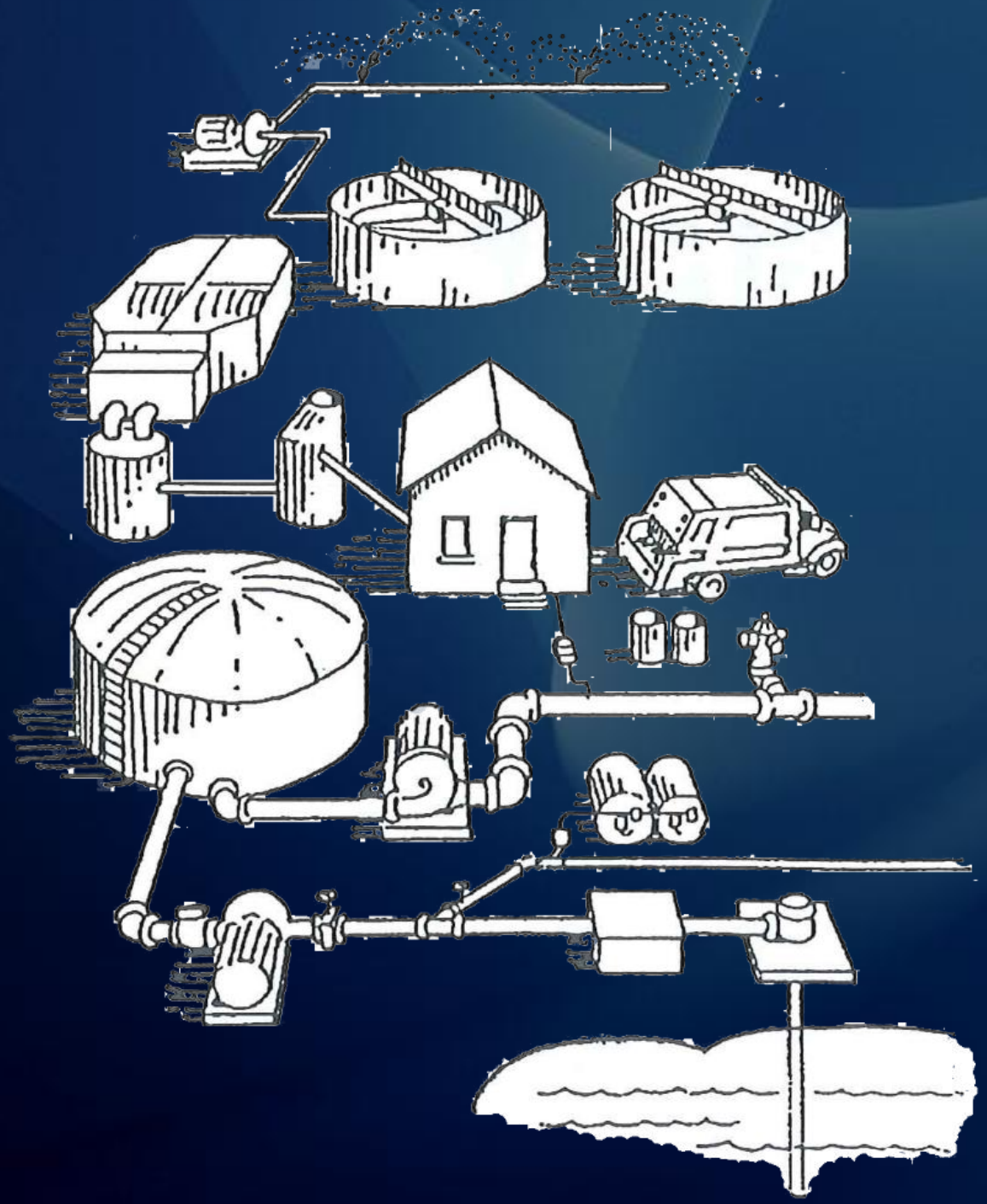
Construction Management 101

Sterling L. Carroll, P.E.
FRWA State Engineer
Florida Rural Water Assn



Types of Water & Wastewater Construction Projects

- Wells
- Water Treatment Plants
- Storage Tanks
- High Service Pump Stations
- Water Distribution
- Wastewater Treatment Plant
- Residuals Disposal
- Sewage Collection System
- Lift Stations
- Force Mains
- SCADA / Telemetry

Project Stages

1. Project Conception / Initiation / CIP
2. Planning / Funding
3. Preliminary Design
4. Design / Permitting
5. Pre-Construction
6. Procurement – Bidding & Award
7. Construction
8. Post-Construction & Certification
9. Plant Start-Up & Turnover
10. Operation

Construction management is BOTH an Art & Science

Public Sector Project Manager Role & Function

Construction Management (or construction project management) is overall planning, coordination & control of a project from beginning to completion.

Project Manager / Owner Responsibilities

Key to a successful project!

Planning

- Conceptualizes the project

Preliminary

- Define scope of project
- Acquires project approval from governing board
- Selects consultant
- Performs preliminary study (with consultant)
  - Reviews, directs & focuses project scope & budget
- Obtains funding (with consultant)

Project Manager / Owner Responsibilities

Engineering Design, Land Acquisition, Permitting

- Hire consultant to generate drawings, specs & bidding documents
- Negotiate scope & budget
- Review consultant's progress & invoices
  - Is the engineer actually doing the work or just billing you for it?
- Meets to resolve any questions that arise
- Makes sure project stays within scope & budget
- Ascertains that design meets expectations
- Provides necessary design approvals
- Reviews design closely

The Project Manager is in Charge

Don’t let your Consultant drive the project…

- Engineering solution looking for a problem?
- Does the engineer’s approach match your utility’s needs? Yes / No

Is your consultant listening?

- **Or dictating?**

Set clear goals & objectives and follow through.

The Project Manager is in Charge

- To have a successful project
- All must have access to information concerning current status of work during planning, design & throughout construction

St. Johns Harbor Water Assn

RO WTP Case Study

- Engineer stopped talking to owner & contactor when project when awry

The Project Triangle

To bring in the finish date (time)

- spend more resources (money) to finish work faster or
- cut features (scope) so there's less work to do

To finish the project under budget (cost)

- get rid of overtime &finish the project later (time) or
- cut features (scope)

To add features to a product (scope)

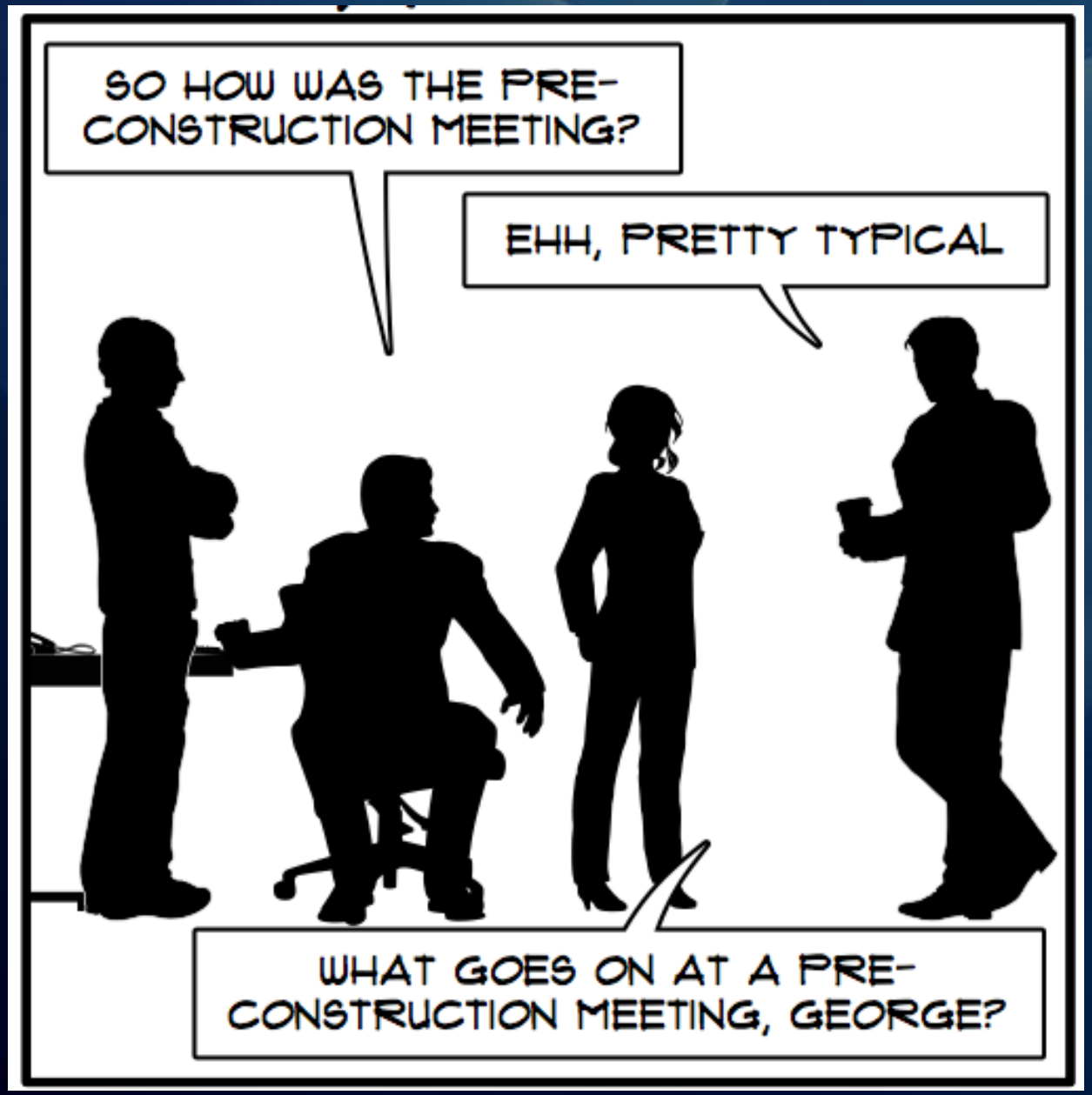
- Extend deadline to make time for new work (time) or
- add people to get it done faster (cost)
- You could also do both!

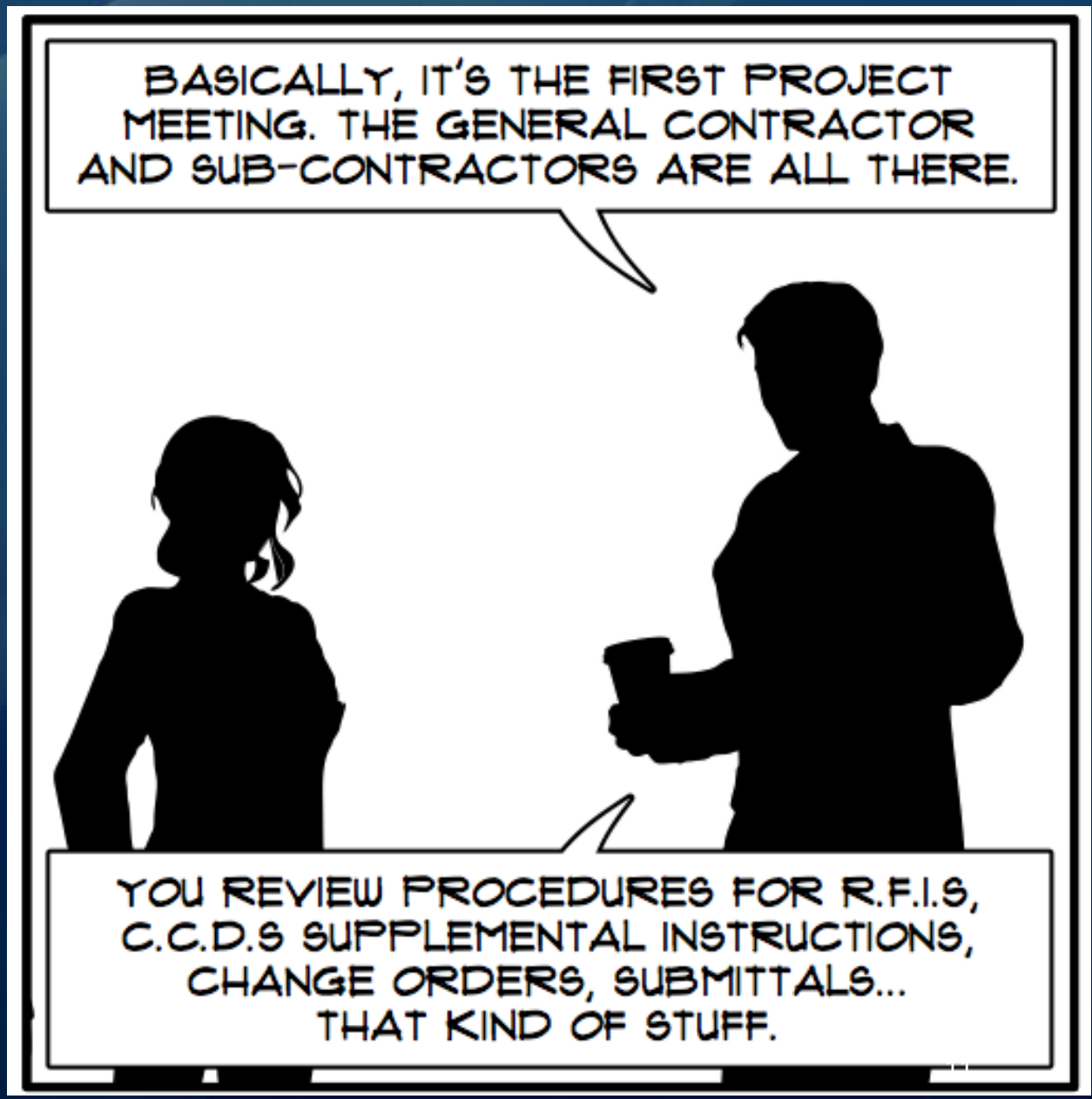
Project Manager / Owner Responsibilities

Bidding

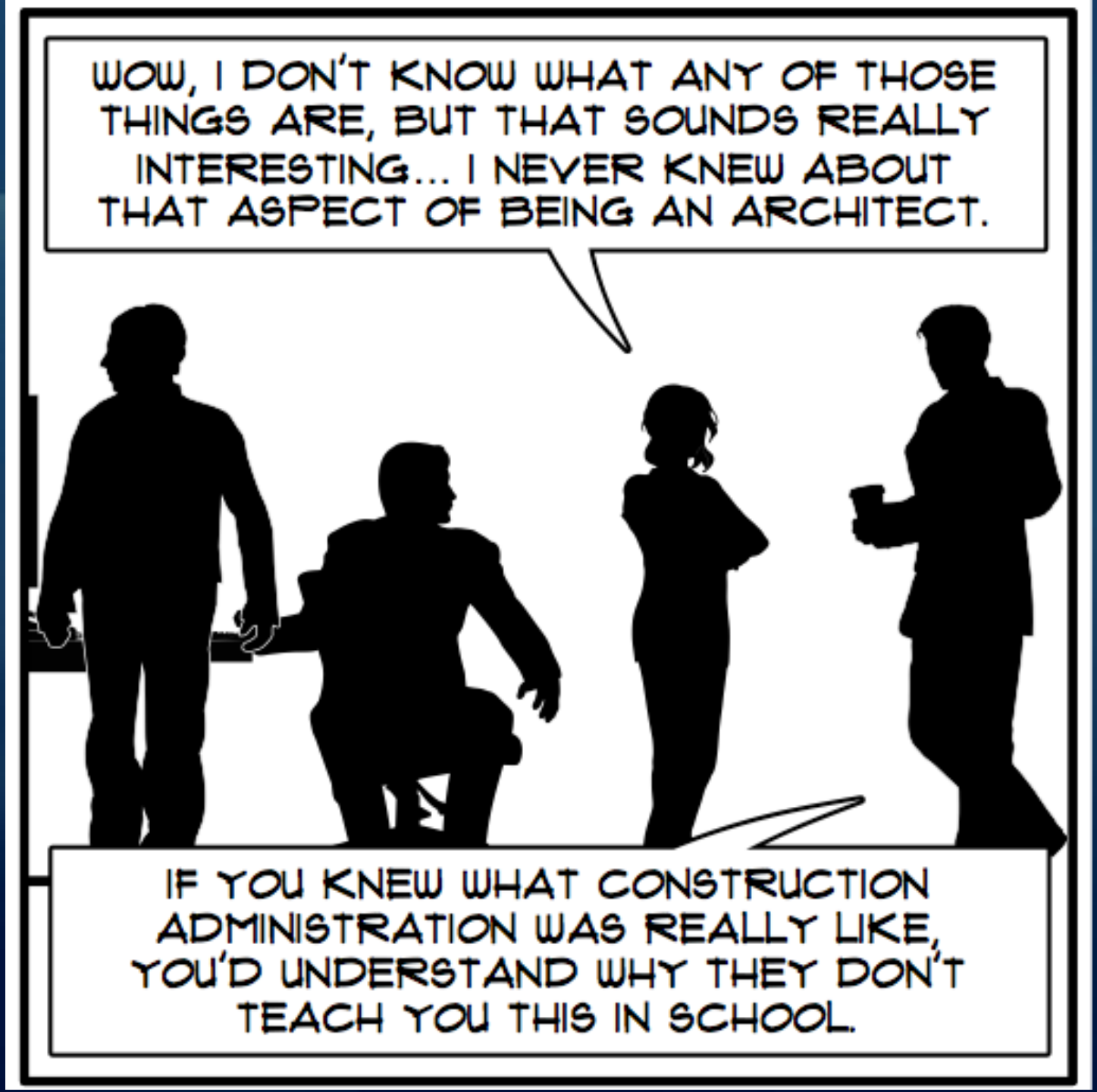
- Public Bid Notices
  - Local newspapers & Construction Bulletins
  - 4 weeks min. to 6 weeks
- Pre-bid Conference
  - Consultant receives questions from contractors & issues clarifications
- Bid Opening
  - bids are opened & read - no comments
- Notice of Award
  - Consultant recommendation lowest responsive bid
  - Governing board approval

Pre-Construction Meeting





Pre-Construction Meeting



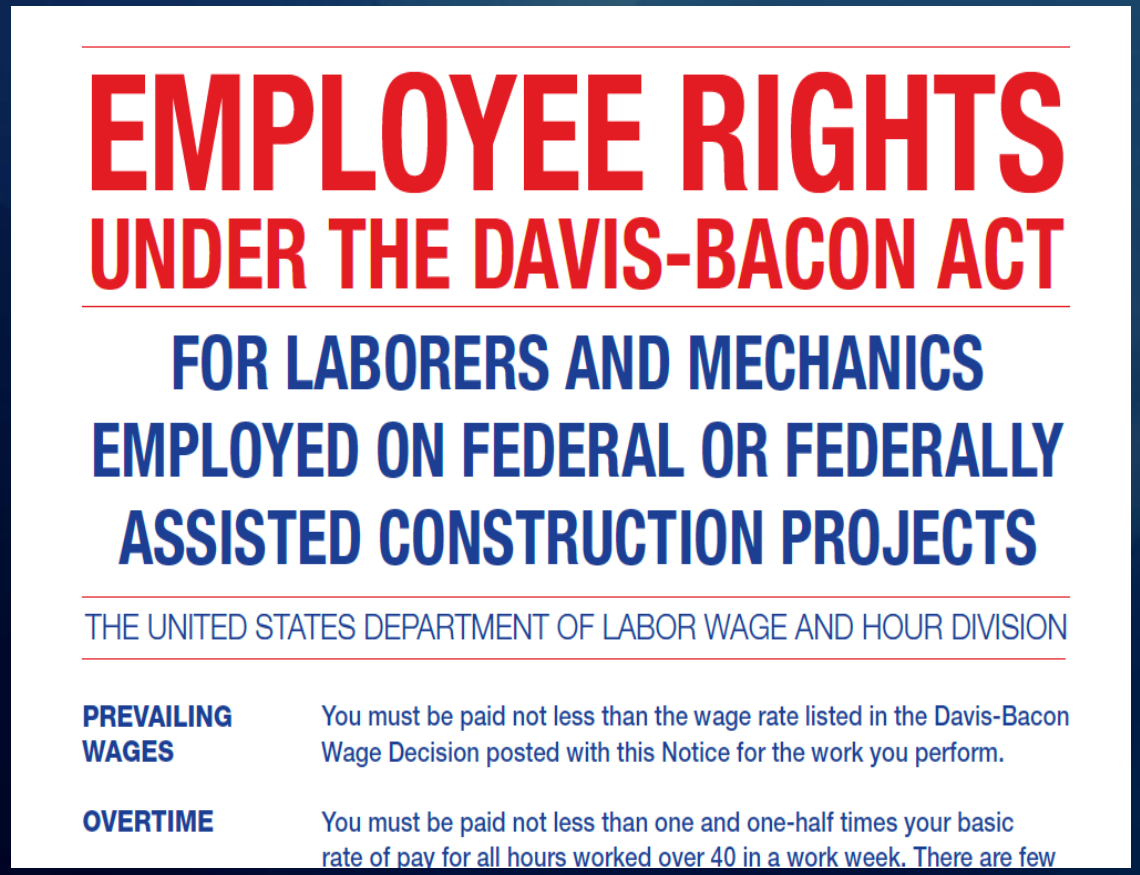
Project Manager / Owner Responsibilities

Start Construction

- After **NOTICE OF AWARD …**
- Execution of Contract
- Contractor signs & provide construction bonds, insurance certificates, etc.
- Owner also signs / executes the agreement
- Holds **PRECONST MEETING**
- Issues **NOTICE TO PROCEED**
  - Defines start date & completion period
  - Clock starts ticking…

SRF, USDA & CDBG Requirements

Davis-Bacon Wages



EMPLOYEE RIGHTS
UNDER THE DAVIS-BACON ACT

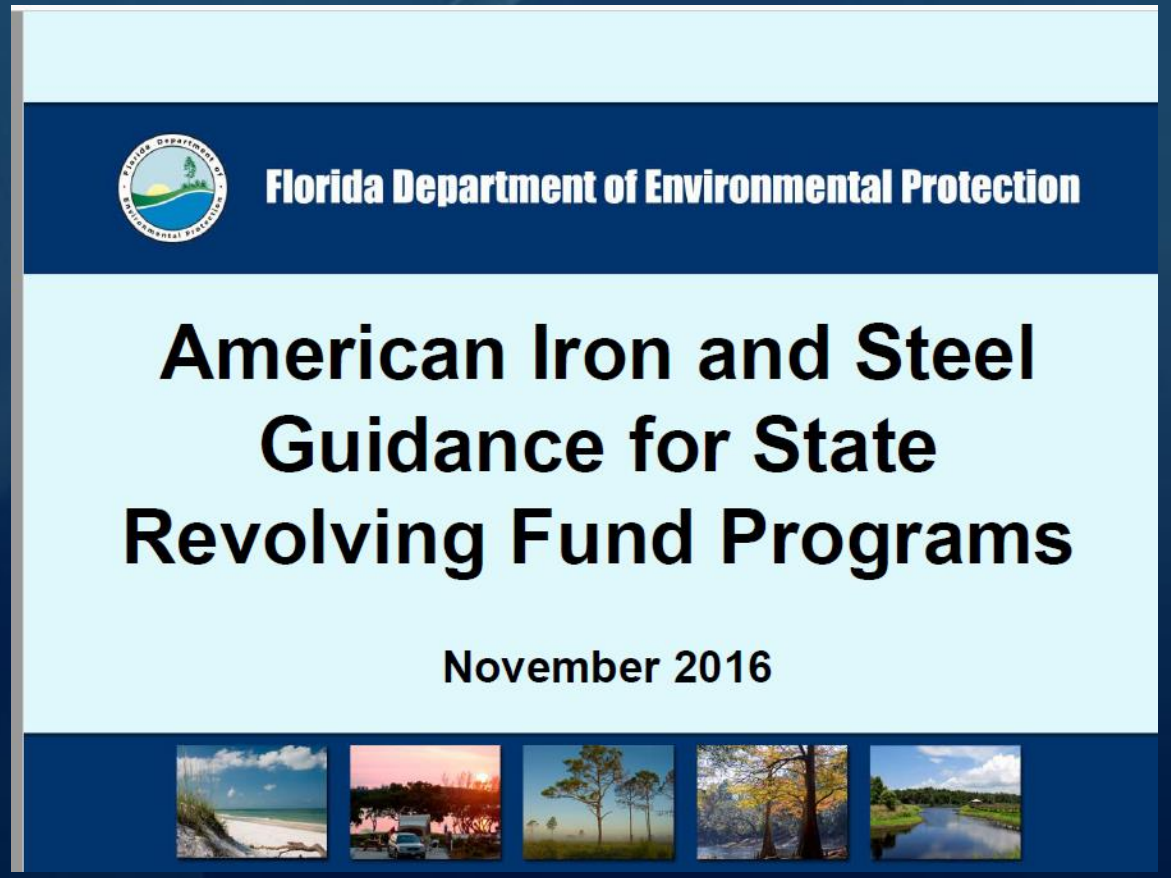
FOR LABORERS AND MECHANICS
EMPLOYED ON FEDERAL OR FEDERALLY
ASSISTED CONSTRUCTION PROJECTS

THE UNITED STATES DEPARTMENT OF LABOR WAGE AND HOUR DIVISION

PREVAILING WAGES — You must be paid not less than the wage rate listed in the Davis-Bacon Wage Decision posted with this Notice for the work you perform.

OVERTIME — You must be paid not less than one and one-half times your basic rate of pay for all hours worked over 40 in a work week. There are few

American Iron & Steel



Florida Department of Environmental Protection

American Iron and Steel
Guidance for State
Revolving Fund Programs

November 2016

Project Manager / Owner Responsibilities

During Construction

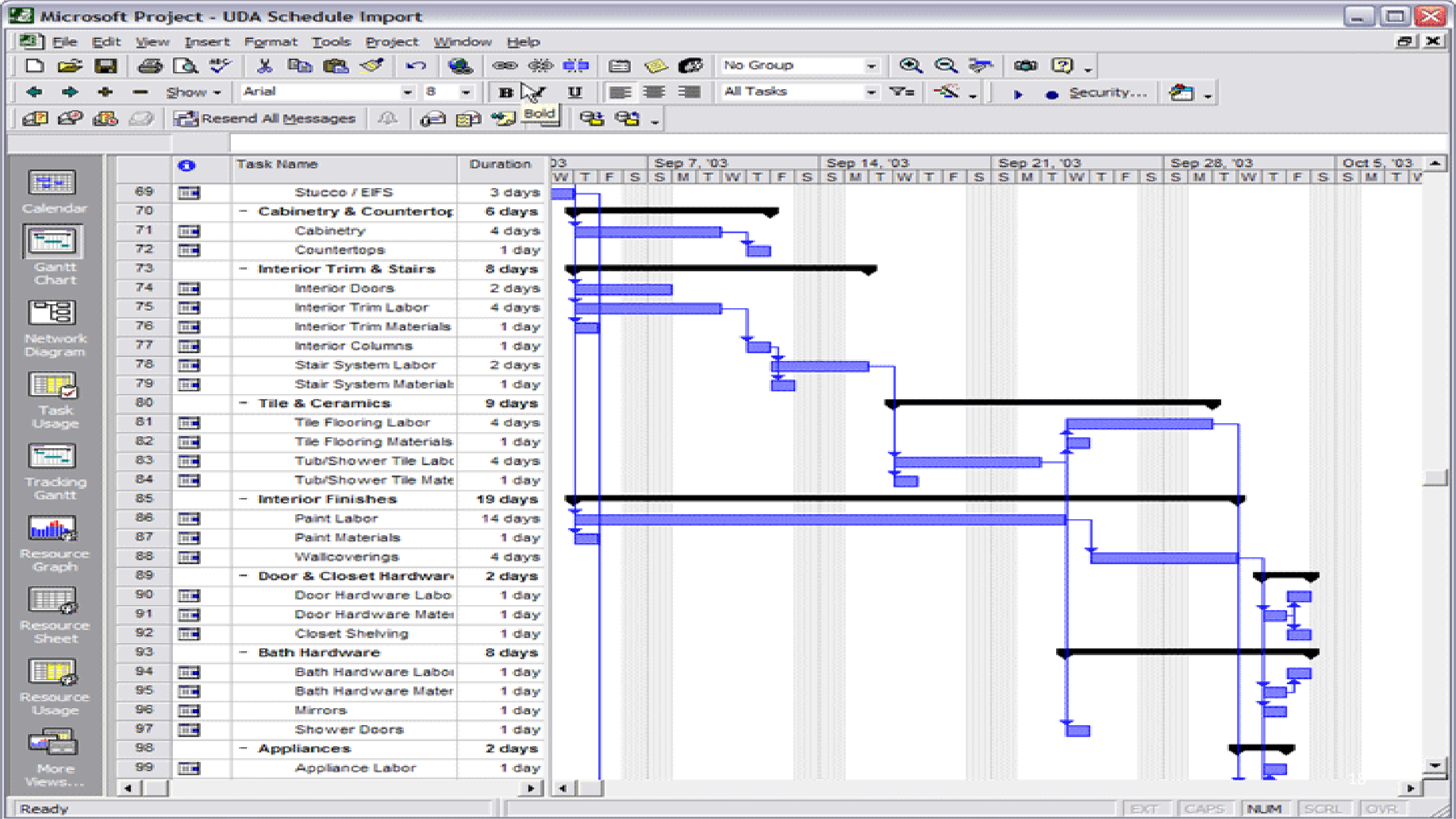
- Project completed in compliance with reqm’ts of all contract docs
- Do **NOT** change design in field
  - Everything in writing & NO VERBAL ORDERS
- Follow clearly established change approval procedures
  - Owner documents progress, meetings & inspections
  - Approves appropriate changes
    - Working with design consultant if changes involve design

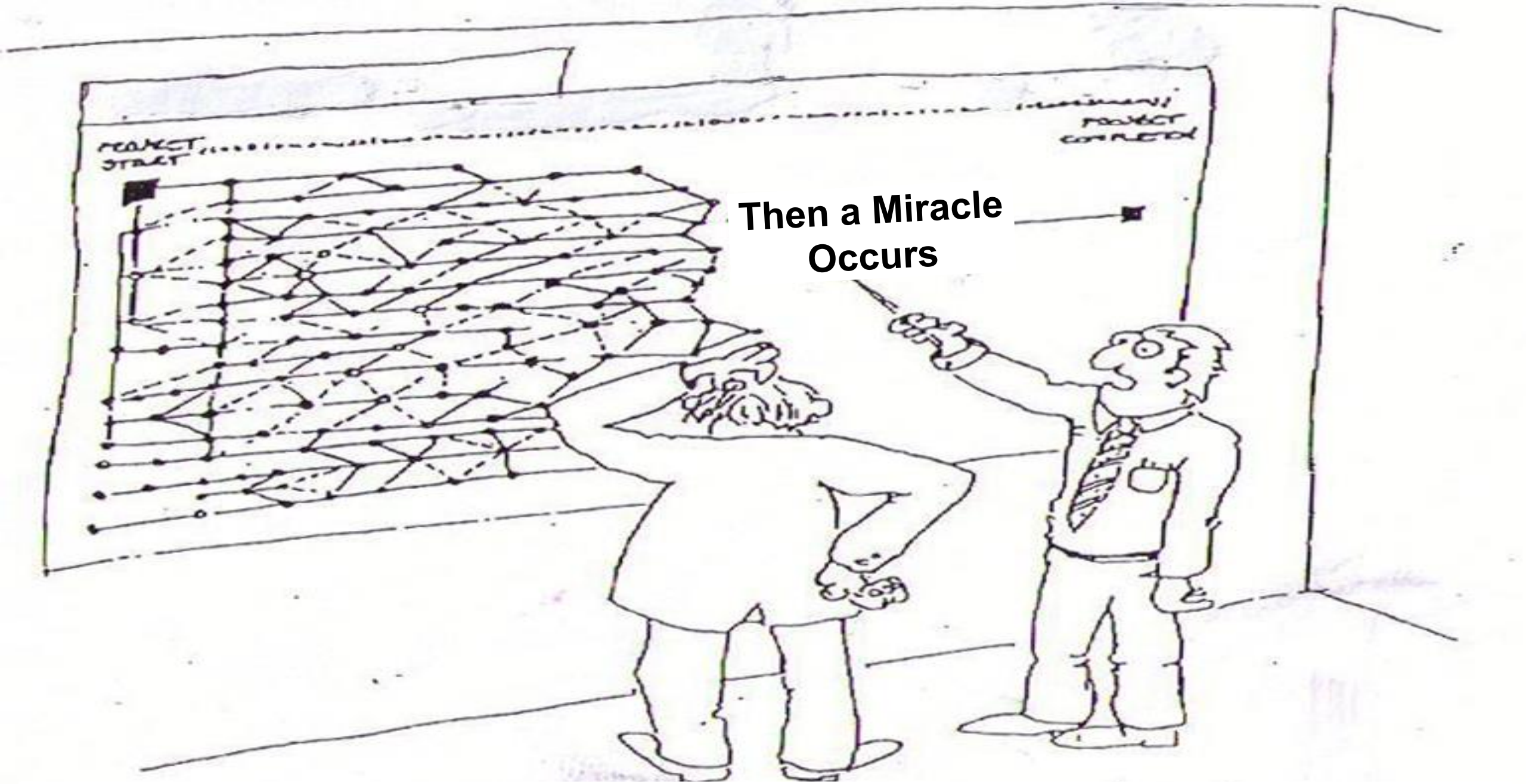
Periodic Inspections

- Inspect the following inspections
  - SEVERAL times during construction
- Do NOT approve pay requests if these things are not kept up to date!
  - **As-Built Drawings**
    - Look for accuracy and legibility
  - **O&M Manuals**
    - Collection of manufacturer O&M manuals & drawings
  - **Warrantees**

Project Schedule

- Workable project schedule is absolutely essential for a successful project (CM 601)
- prepared by general contractor
  - input from major subcontractors & suppliers
- Effective scheduling incorporates following concepts
- Network diagram showing CRITICAL PATH
  - construction scheduling software – *Primavera, project management…*


Microsoft Project - UDA Schedule Import
File Edit View Insert Format Tools Project Window Help
No Group
Show Arial 8 All Tasks Security...
Resend All Messages
Bold
Calendar
Gantt Chart
Network Diagram
Task Usage
Tracking Gantt
Resource Graph
Resource Sheet
Resource Usage
More Views...
Task Name
Duration
69 Stucco / EIFS 3 days
70 Cabinetry & Countertop 6 days
71 Cabinetry 4 days
72 Countertops 1 day
73 Interior Trim & Stairs 8 days
74 Interior Doors 2 days
75 Interior Trim Labor 4 days
76 Interior Trim Materials 1 day
77 Interior Columns 1 day
78 Stair System Labor 2 days
79 Stair System Material 1 day
80 Tile & Ceramics 9 days
81 Tile Flooring Labor 4 days
82 Tile Flooring Materials 1 day
83 Tub/Shower Tile Labo 4 days
84 Tub/Shower Tile Mate 1 day
85 Interior Finishes 19 days
86 Paint Labor 14 days
87 Paint Materials 1 day
88 Wallcoverings 4 days
89 Door & Closet Hardwar 2 days
90 Door Hardware Labo 1 day
91 Door Hardware Mate 1 day
92 Closet Shelving 1 day
93 Bath Hardware 8 days
94 Bath Hardware Labo 1 day
95 Bath Hardware Mater 1 day
96 Mirrors 1 day
97 Shower Doors 1 day
98 Appliances 2 days
99 Appliance Labor 1 day
Sep 7, '03
Sep 14, '03
Sep 21, '03
Sep 28, '03
Oct 5, '03
Ready
EXT CAPS NUM SCRL OVR



Good work, but I think we need a little more detail right here

Construction Activity Documentation

- Daily Field Reports / Diaries
- Monthly Construction Reports
- Project Meetings
- Telephone Conversations
- Transmittals / Shop Dwgs
- Visual Records / photos
- Web Cameras???

PUT EVERYTHING IN *WRITING*

Project Manager / Owner Responsibilities

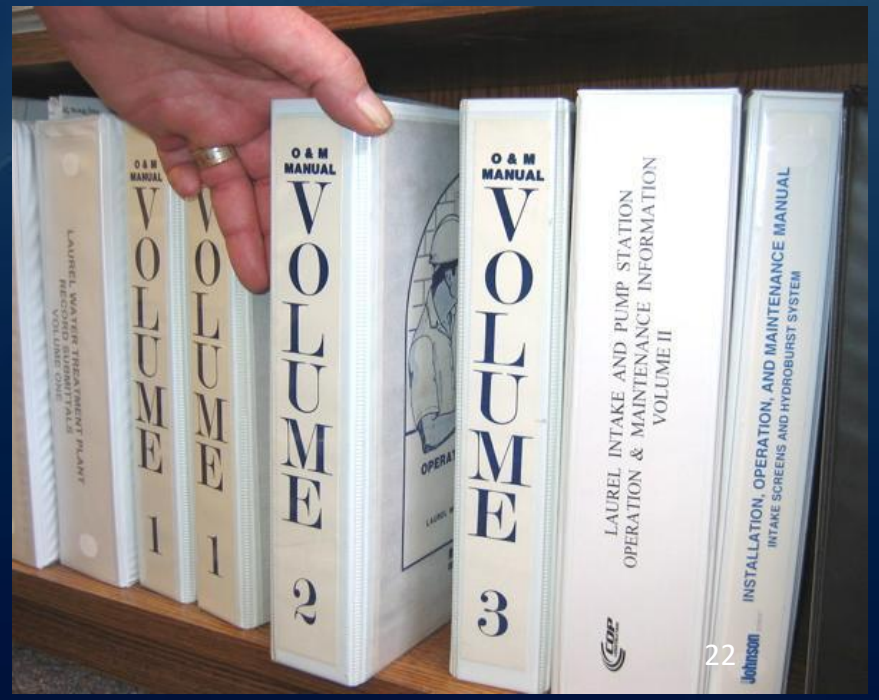
Construction Completion

- Project completion
  - Reviews & approves punch-list
  - Reviews & approves O&M Manual
  - Retainage
  - Accepts work - issues a project completion statement
    - Date establishes beginning of warranty period
  - Contract documents must define terms of acceptance

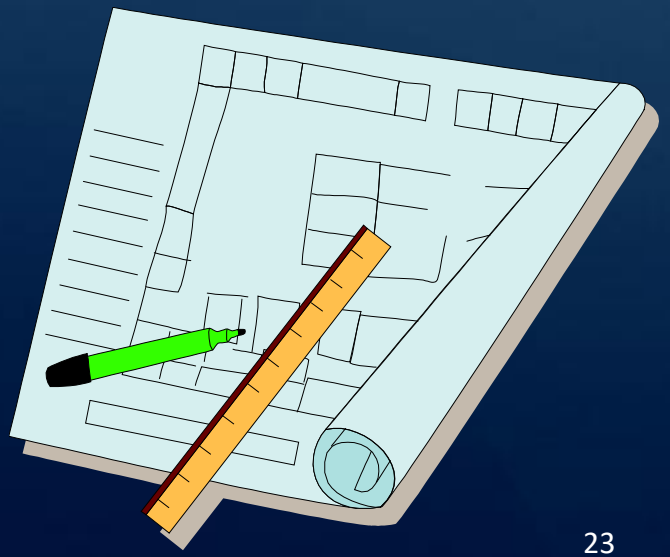
Project Manager / Owner Responsibilities

Post-Construction

- When components become ready during latter stages of project
- Staff receives training for component operation
- Owner becomes responsible for O&M



Managing Engineers, Design, Permitting & Bidding Process



Working with Engineering Consultants

Most obvious characteristics of the engineering personality…

- Those who gravitate to engineering are precise, meticulous, pay attention to detail
- Intelligence & training to solve any problem
- Engineering schools – produce engineers

Working with Engineering Consultants

Engineers need to “be right”
- avoids being criticized
- wants to be in control

Difficulty seeing forest for trees
- can get lost in minutiae
- lose focus on project goals

Difficulty in showing design in development stages
- when project changes most impact cost

Working with Engineering Consultants

- Be gentle but firm- insistent
- At various stages of design, review plans & specs
- Put directions in writing & copy other team members

The Fridge & the Engineer

- Engineer gets home from work & sees a note on fridge from his wife…

The Fridge & the Engineer

He opens fridge, checks light, then grabs a soda & feels it cold.

Engineer thinks to himself.

“She’s crazy, the fridge works just fine!"

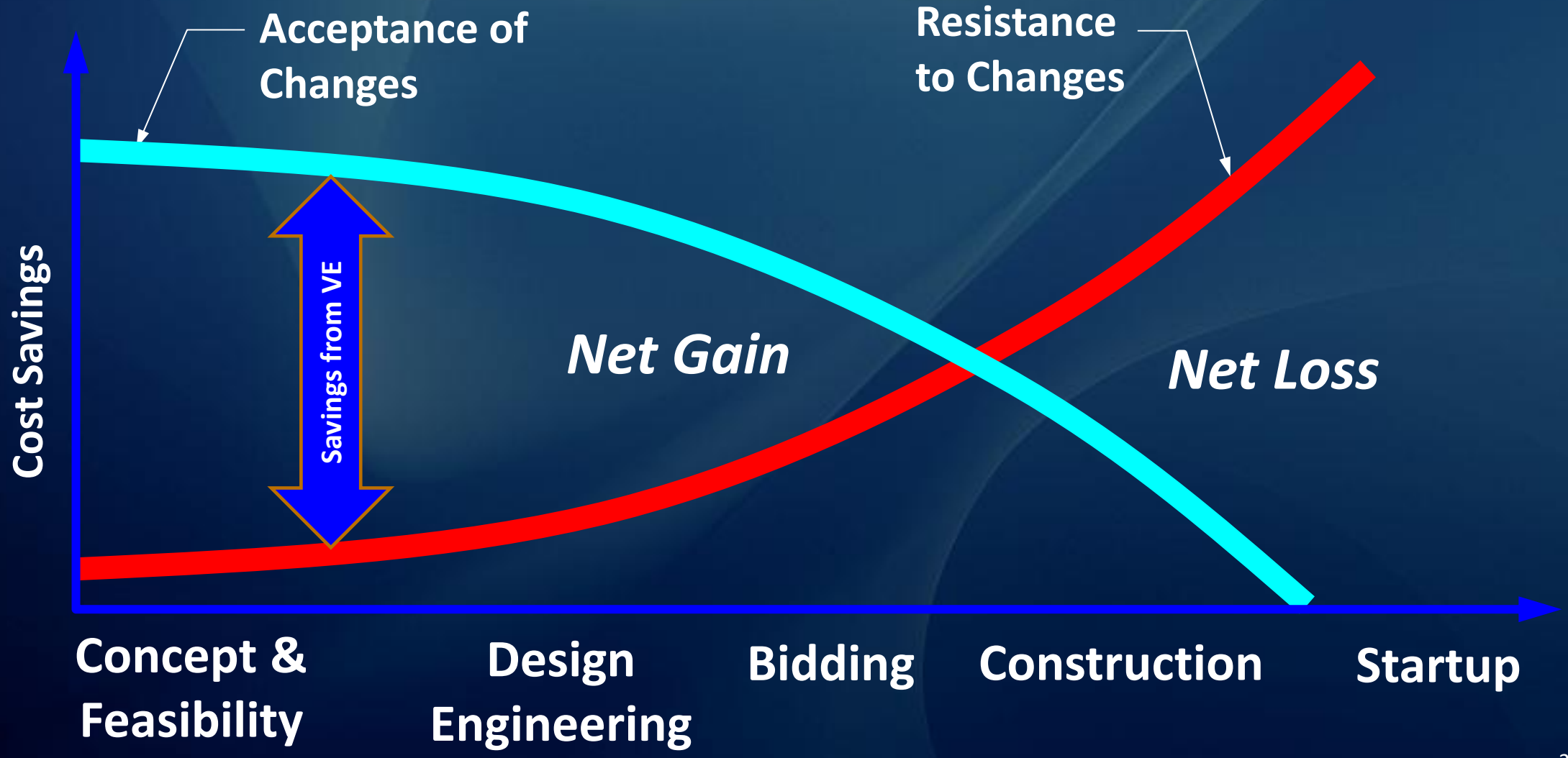
Consultant Responsibilities

- Main responsibility prepare project plans & specs
- Recent years / more complex projects role has come to include
  - Performing preliminary studies
  - Generating final reports
  - Performing financial studies
  - Conducting bidding
  - Providing construction contract administration
  - Assisting with project startup
  - Assisting with O&M

Consultant Design

- Generate project drawings & specs
- Have owner review design at various
- Obtain design approval from local & regulatory agencies
- Furnish estimate of probable cost
- Prepares bidding documents & construction contract

Potential Savings from Value Engineering



What is a Constructability Review?

Answers the Following Questions:

- ✓ Can the project be built, using industry accepted means and methods, as designed?
- ✓ Can the project be bid using the information provided in the contract documents?
- ✓ Can the project be built in the specified timeframe, with the specified quality, with safe work practices?

Provides a comprehensive QA/QC Check

The Difference Between a Constructability Review and Value Engineering?

Constructability Reviews

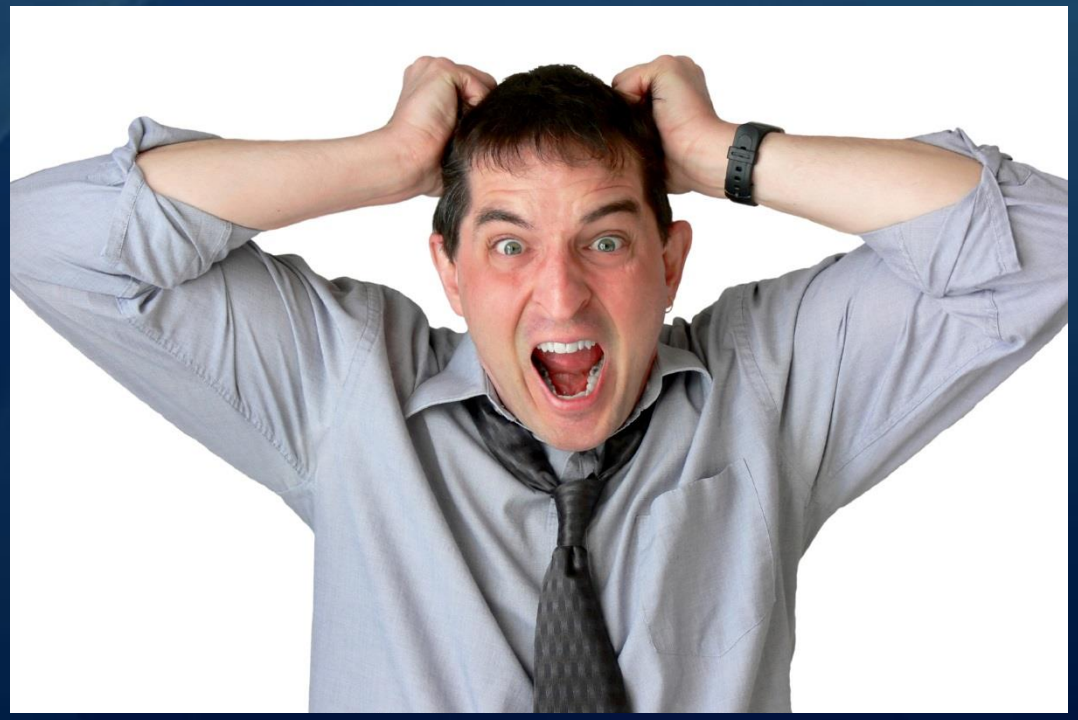
- Performed by construction professionals experienced in constructing similar projects
- Performed throughout the design and construction document preparation process
- Focuses on inconsistencies in the contract/bid documents to reduce propensity for changes/claims

Value Engineering Reviews

- Performed by construction professionals and engineers
- Focuses on function over form/life cycle costs
- Performed earlier in the design process to have the maximum benefit

Major Factors that cause Constructability Problems

1. Faulty, ambiguous or defective drawings
2. Incomplete specifications / contract docs
3. Adversarial relationships
4. Budget & Scope



East Stuart CDBG Infrastructure Replacement Case Study

Consultant Construction Activities

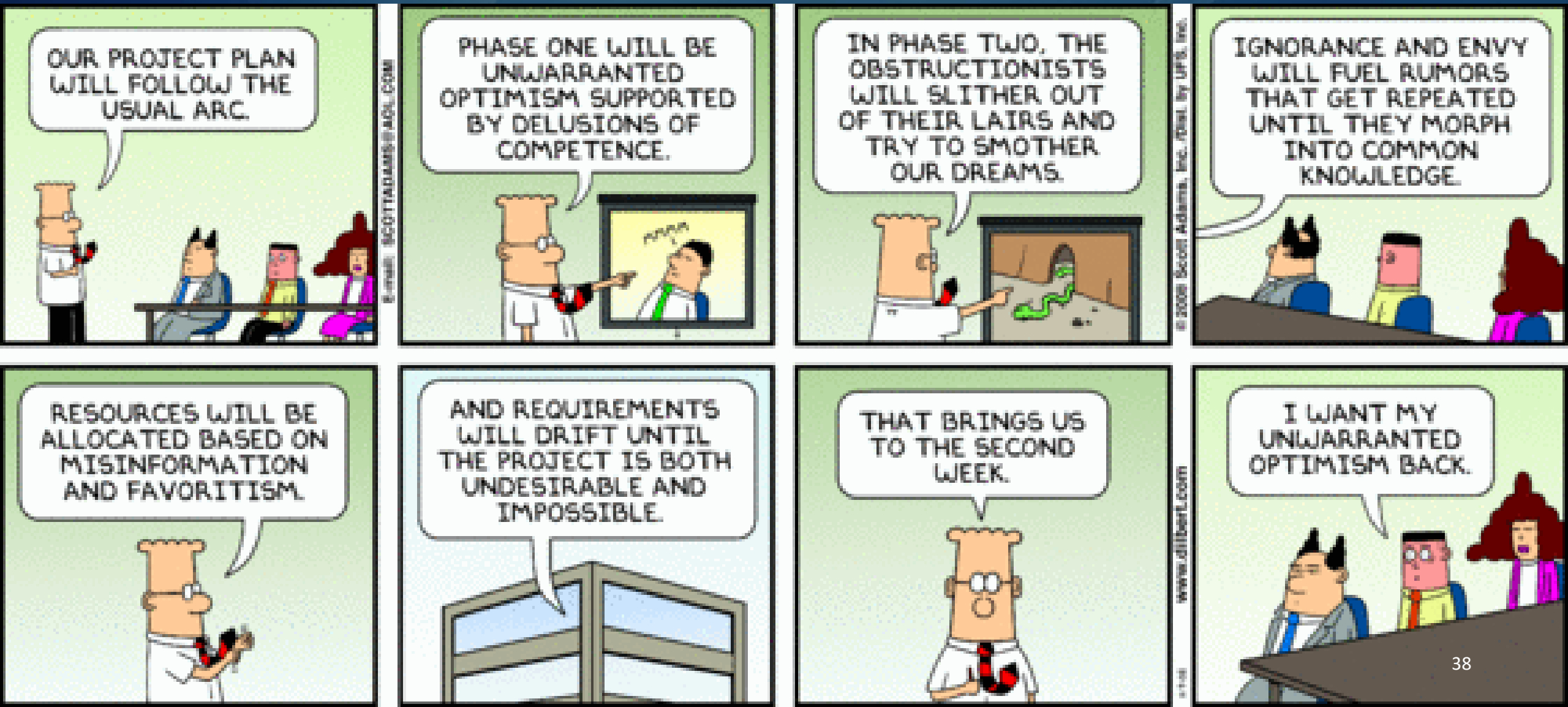
- Consultant may **or may NOT** be retained to perform construction contract administration
  - Not required by FDEP or State Statute
- Perform periodic observation of construction
  - For compliance with intent of design
- Provide full- or part-time construction observation
- Evaluate construction progress
- Process progress payment requests for submittal to owner for approval
- Provide information & clarification

Controlling Project Conception, Budgeting & Financing

Six Phases of a Big Project

1. Enthusiasm,
2. Disillusionment,
3. Panic and hysteria,
4. Hunt for the guilty,
5. Punishment of the innocent, and
6. Reward for the uninvolved.

Dilbert


OUR PROJECT PLAN WILL FOLLOW THE USUAL ARC.
PHASE ONE WILL BE UNWARRANTED OPTIMISM SUPPORTED BY DELUSIONS OF COMPETENCE.
IN PHASE TWO, THE OBSTRUCTIONISTS WILL SLITHER OUT OF THEIR LAIRS AND TRY TO SMOTHER OUR DREAMS.
IGNORANCE AND ENVY WILL FUEL RUMORS THAT GET REPEATED UNTIL THEY MORPH INTO COMMON KNOWLEDGE.
RESOURCES WILL BE ALLOCATED BASED ON MISINFORMATION AND FAVORITISM.
AND REQUIREMENTS WILL DRIFT UNTIL THE PROJECT IS BOTH UNDESIRABLE AND IMPOSSIBLE.
THAT BRINGS US TO THE SECOND WEEK.
I WANT MY UNWARRANTED OPTIMISM BACK.
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www.dilbert.com

Construction Management

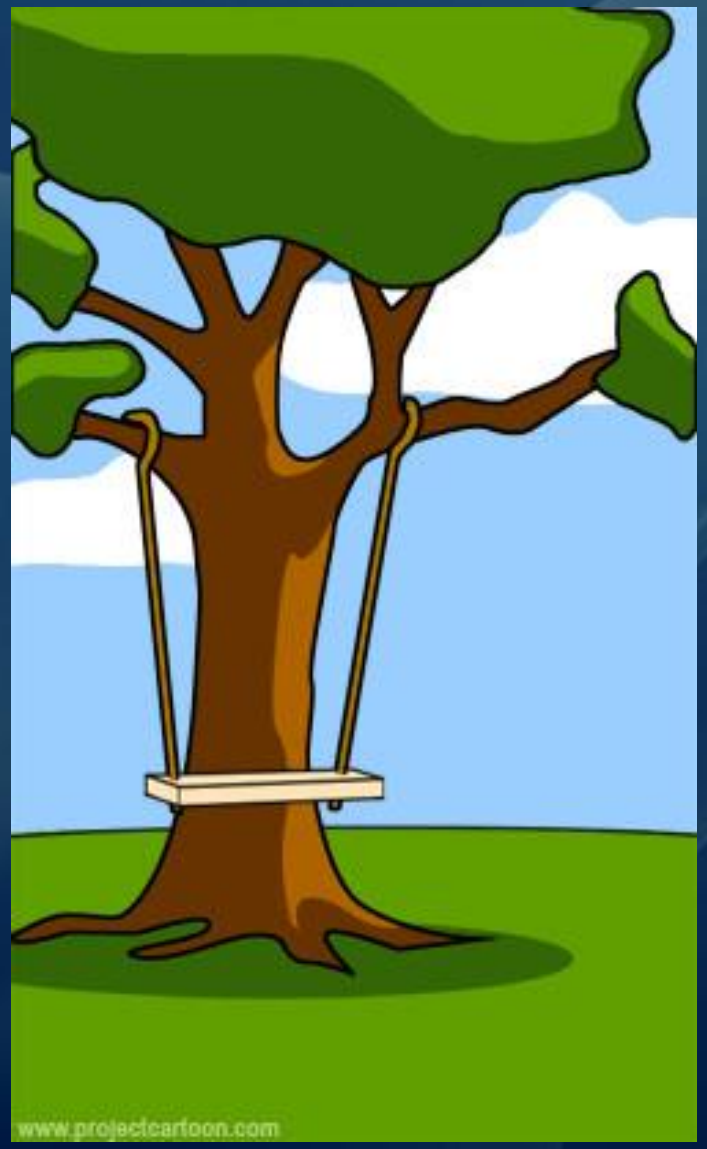
Contractual Arrangement

Construction Management Personnel can represent

- Engineer
- Owner
- Contractor

CM manages the basic resources of construction

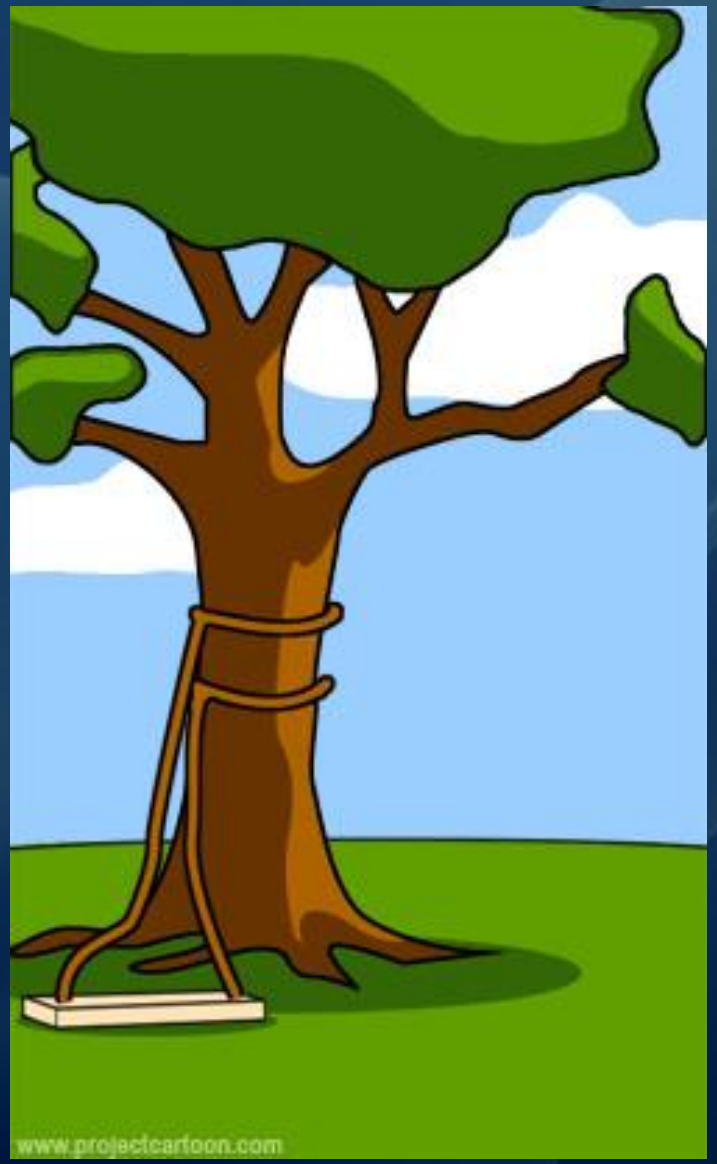
How the project was originally explained



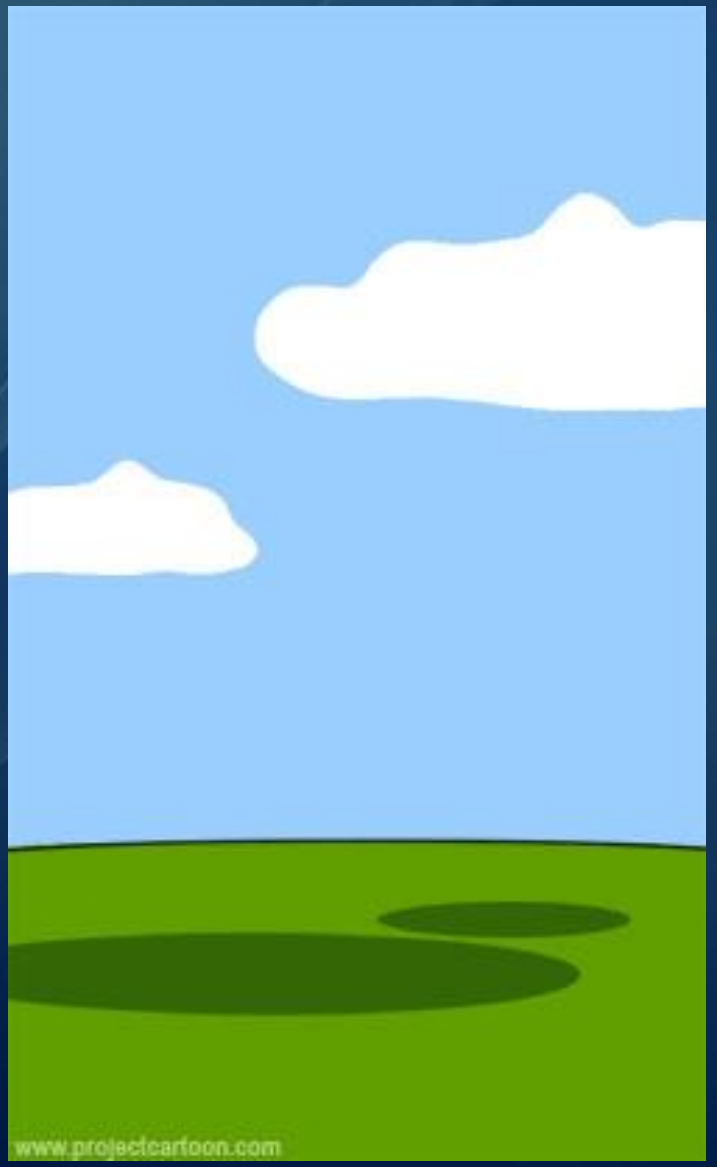
How the engineer understood it

How the engineering manager described it

How the project engineer designed it

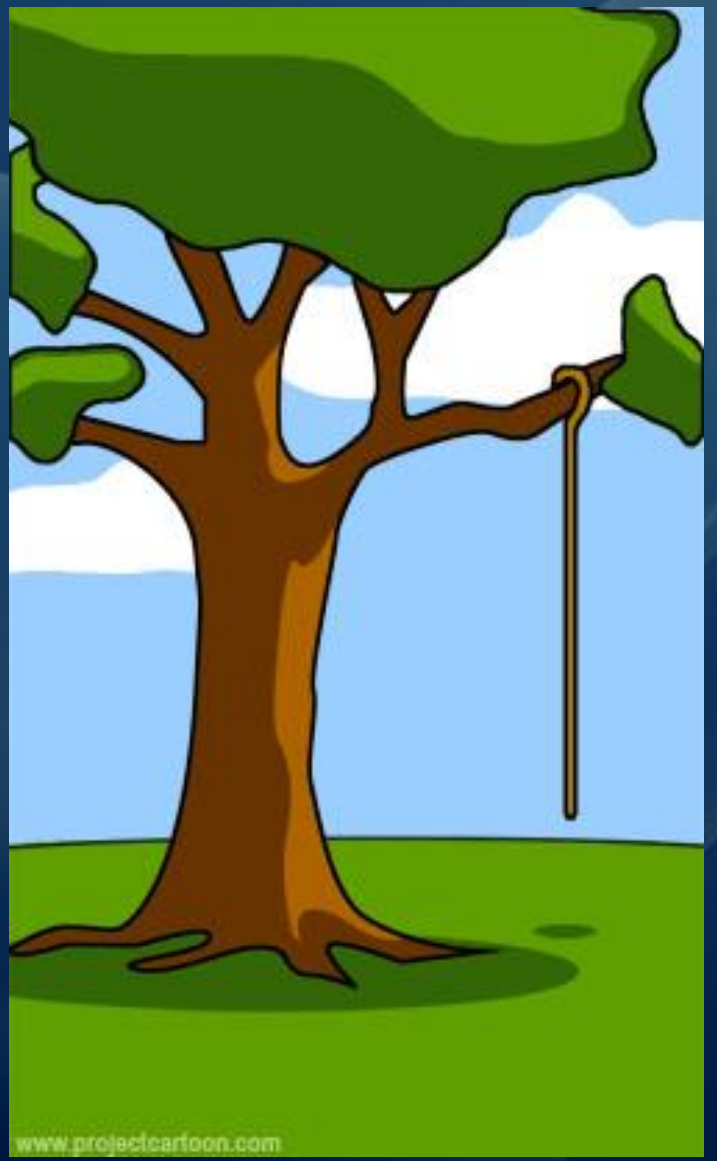


How the specs where written



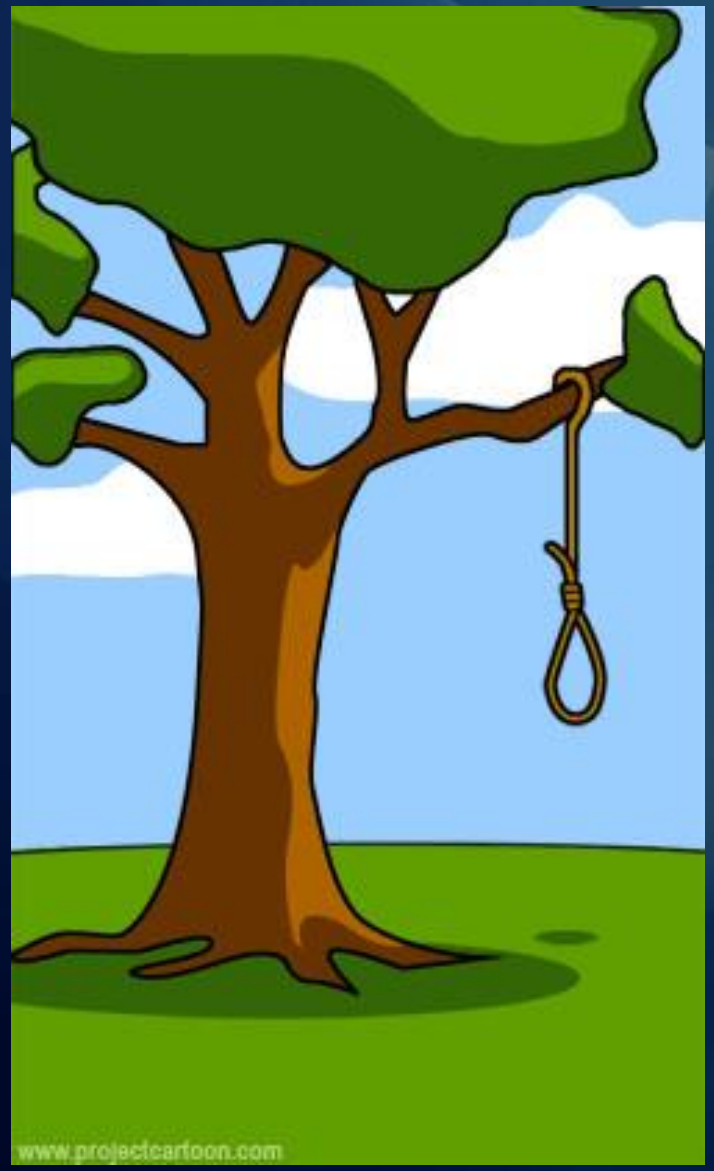
How the project was documented

How it was estimated and scoped

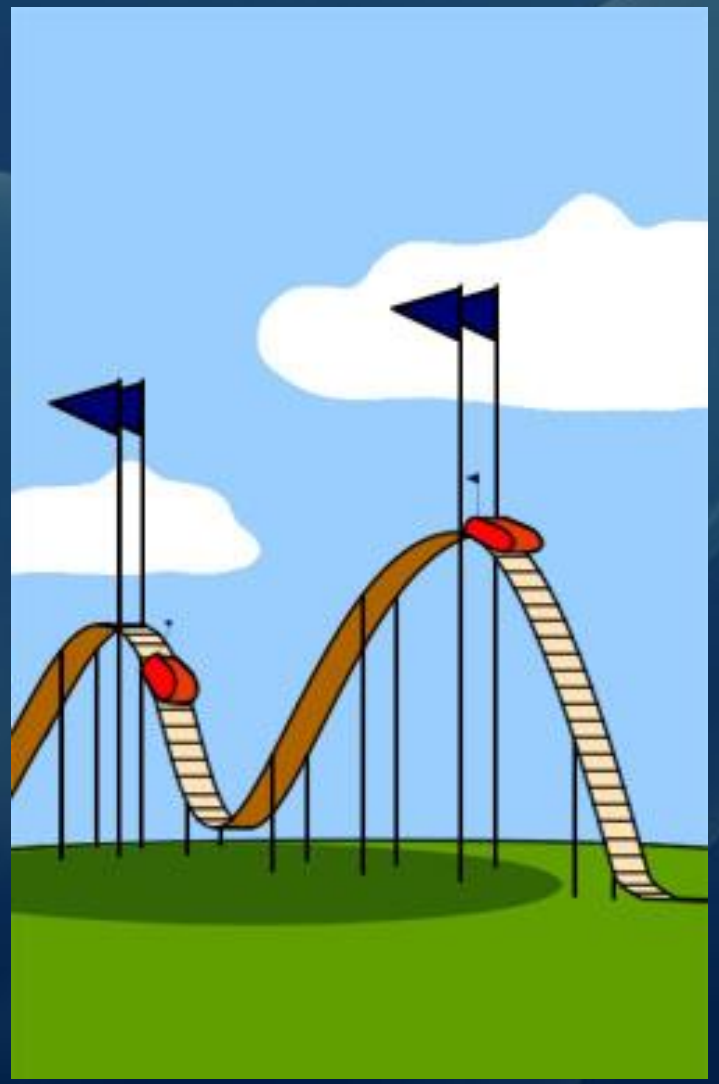


What the contractor installed

What FDEP thought about it



What the operators felt about it



How the utility was invoiced by the consultant & contractor

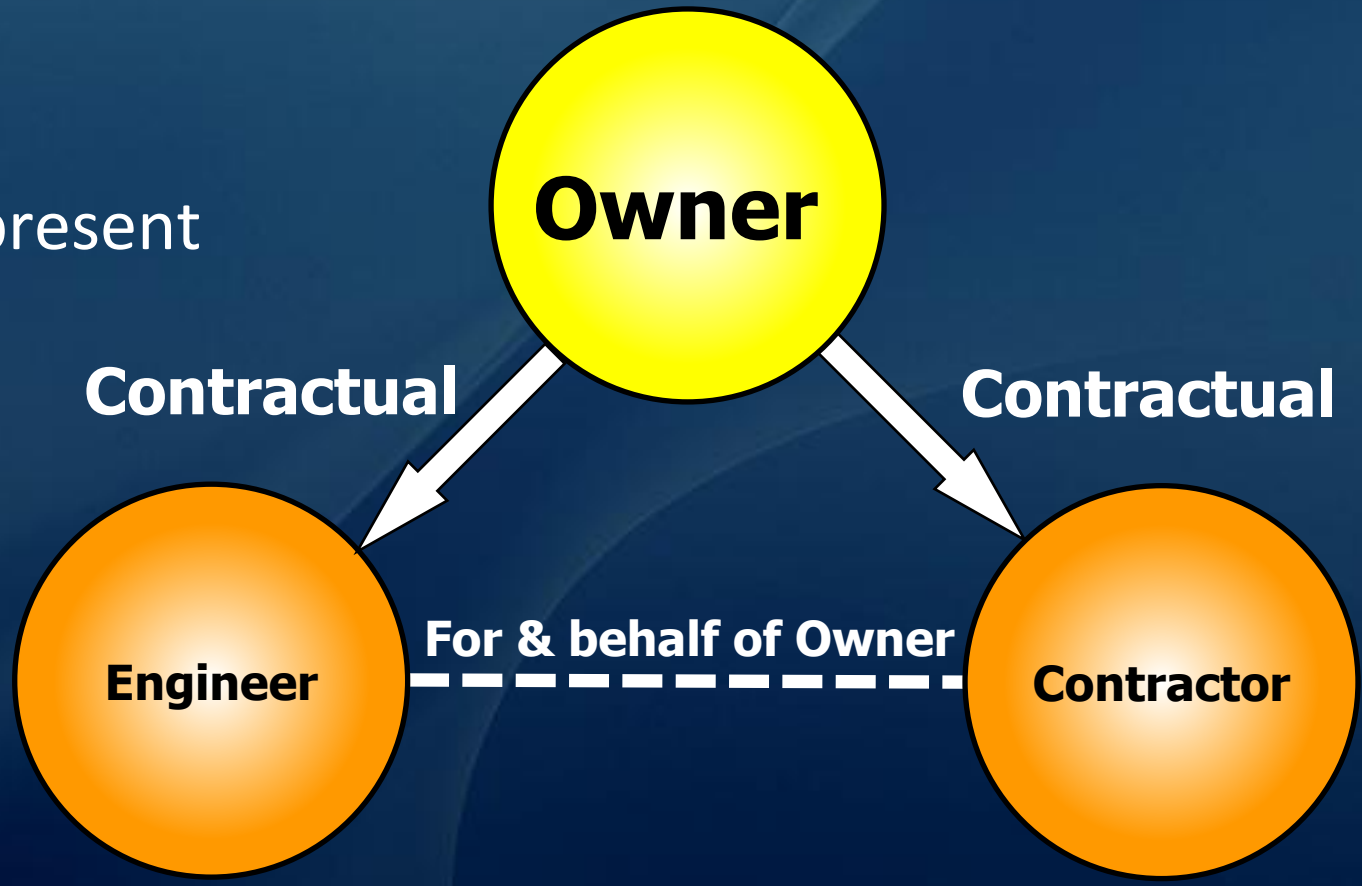
What the utility wanted

Construction Relationships

Contractual Arrangement

Const. Mgmt Personnel can represent

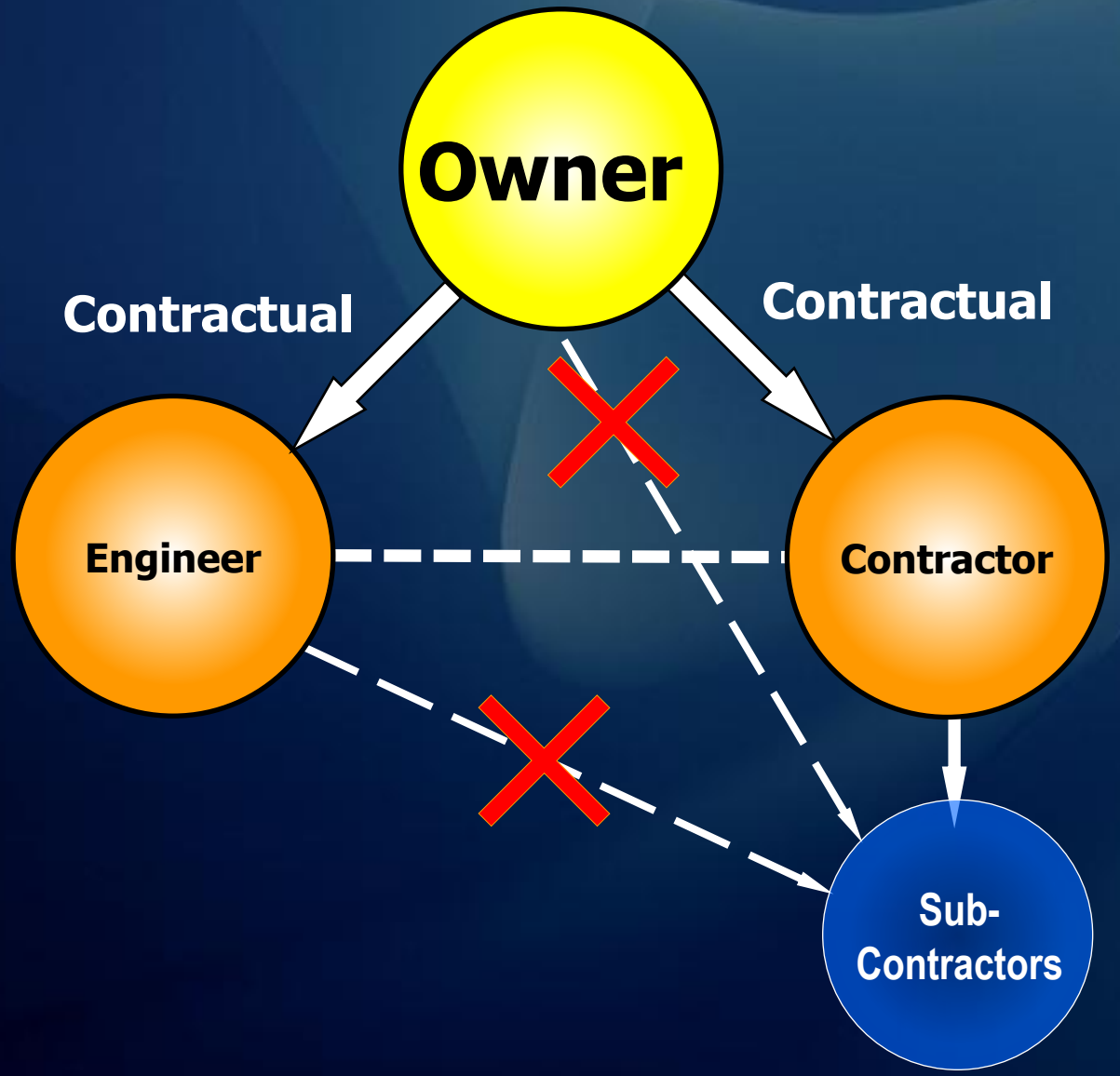
- **Engineer**
- **Owner**
- **Contractor**



Berrydale Munson Water Main 2005

Location	Description	Est. Qty	Comments
Highway 191	8-in PVC WM	2,880-ft	Pipe installed insufficient cover (18” to 24”), located in middle of drainage swale, continues to wash out.
Christmas Tree Rd	6-in PVC WM	200-ft	Pipe installed insufficient cover (18” to 24”)
Neal Kennington Rd	6-in PVC WM	875-ft	Pipe installed insufficient cover (18” to 24”)
Neal Kennington Rd	6-in PVC WM	1,150-ft	Pipe installed insufficient cover (18” to 24”) on one section of road – has had dirt piled on of pipe at present
Hwy 191 – Across from Coogle Road	Valves & Covers	2	Valves & Valve Covers Washed Out
Major Water Meters	3-in Meters	3	Buried 3- ft deep. Unable to read and continually getting buried with debris.
Water Meters	Brass Meters	238	Installed Plastic instead of Brass Water Meters

Construction Relationships

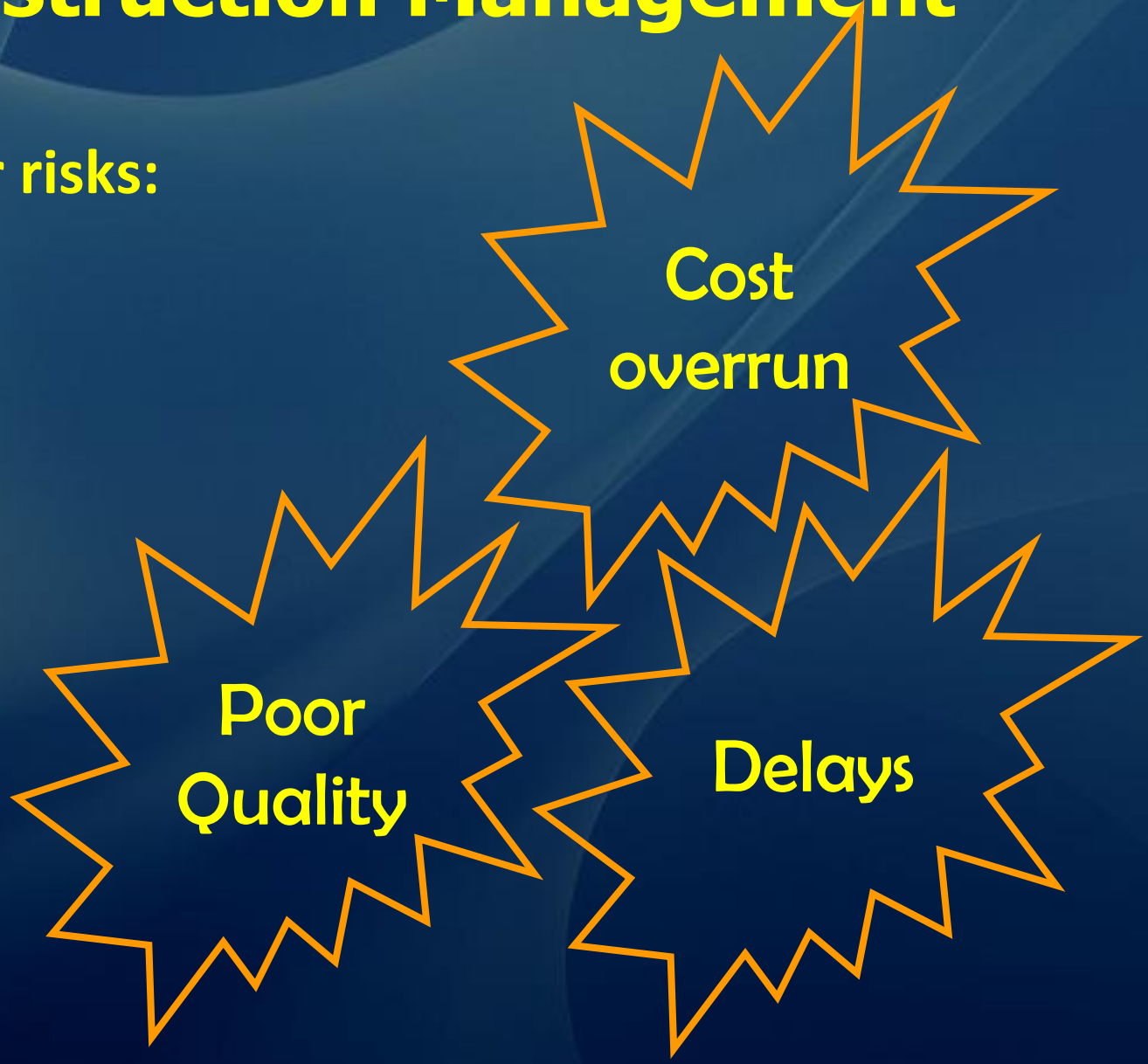


Problems when commissioner / board member (not Owner's CM) talks to contractor

Problems when Owner or Engineer talks to Sub-Contractors

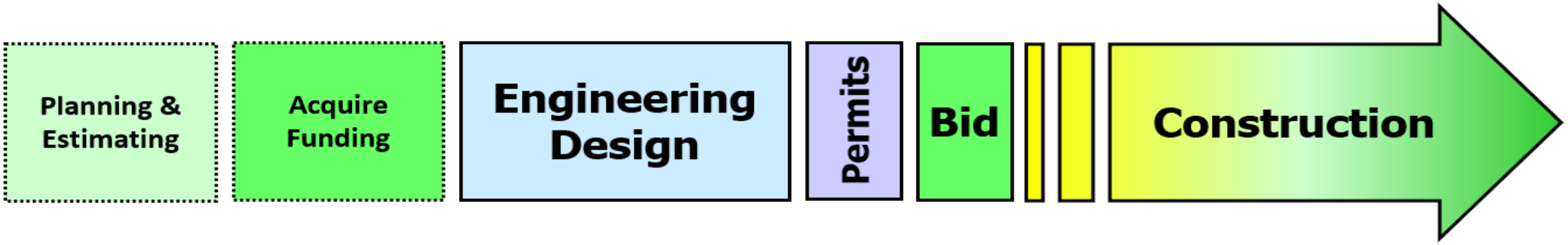
Construction Management

MINIMIZE three major risks:

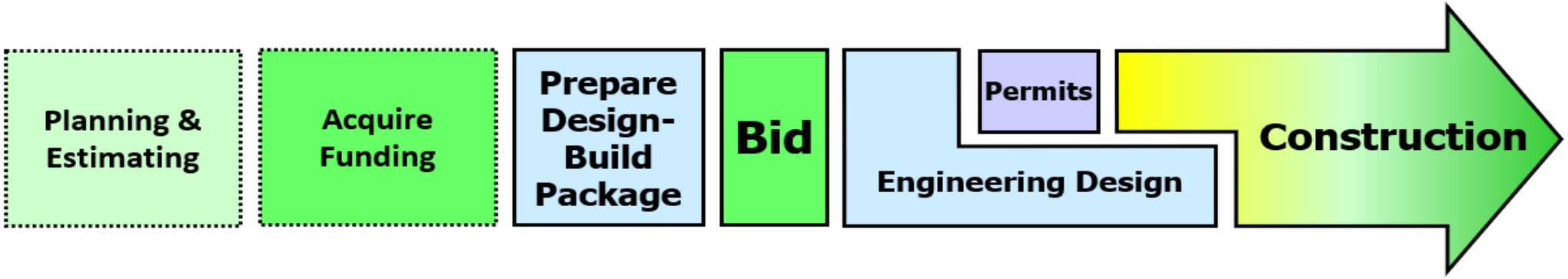


Methods of Project Delivery Methods

Traditional Design-Bid-Build Method



Design-Build Method



Construction Management Phases

1. Conception - problem identification & alternative selection
2. Preliminary cost estimation
3. Financing
4. Project approval
5. Preliminary design
6. Land acquisition / clearing
7. Rights-of-way & easement acquisition
8. Final design, permitting, bidding
9. Construction
10. Closeout & final project startup

The Construction Manager seeks ways to minimize construction inspection disputes & find resolutions

- See that contractor follows the contract & specs
  - Shop Drawings comply with specs
  - Everything is in writing (no verbal orders)
  - Warranties are collected & carefully monitored
  - Pay Requests are handled diligently
  - Monitors construction progress

Shop Drawings

Shop Drawings

- Vendors & mfrs of equipment & materials prepare shop drawings
- Shop drawings detail equipment & materials
  - ✓ To be provided for comparison to specs
  - ✓ Quick turnaround of shop drawings
  - ✓ **15 to 30-days**

Submittals & Shop Drawings

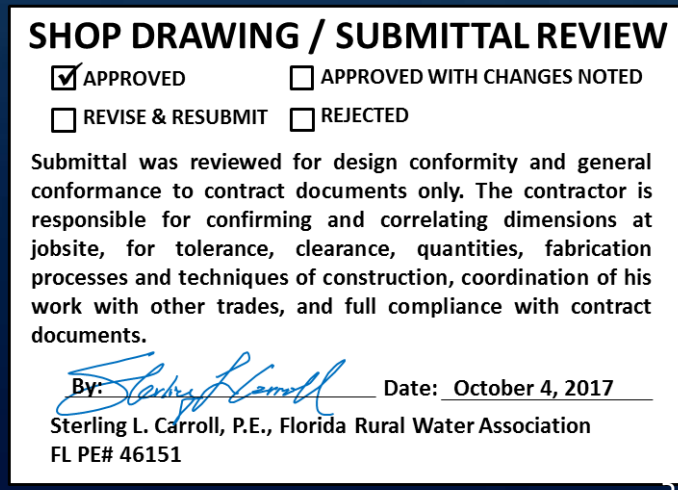
- Submittal Control Sheet ~ CM 308
  - Note warranties spec'ed under "Certificates"
- Contractor Submittal Log ~ CM 303
- Shop Drawing Review ~ CM 305
- Request for Clarification ~ CM 308

Shop Drawings

- Warranty conditions & reqm’ts
  - Shipping, unloading, long-& short-term storage, installation, startup & testing reqm’ts
  - Mothball reqm’ts
- Factory representative present?
  - Failure may void warranty

Shop Drawings

- Shop drawings reviewed & approved by engineer
  - examine conformance with design concept
  - compliance with specs / contract documents
  - approved shop drawings carry out original intent of plans



SHOP DRAWING / SUBMITTAL REVIEW

☑ APPROVED ☐ APPROVED WITH CHANGES NOTED

☐ REVISE & RESUBMIT ☐ REJECTED

Submittal was reviewed for design conformity and general conformance to contract documents only. The contractor is responsible for confirming and correlating dimensions at jobsite, for tolerance, clearance, quantities, fabrication processes and techniques of construction, coordination of his work with other trades, and full compliance with contract documents.

By: _____ Date: October 4, 2017

Sterling L. Carroll, P.E., Florida Rural Water Association

FL PE# 46151

Construction Claims Arising from Shop Drawings

- Against **Contractors, Suppliers & Engineers** arise in a variety of situations…
- A few judicial rulings which interpret liability
  - various shop drawing review participants
- Contractors held liable for incorrect dimensions
  - where shop dwgs prepared from contractor supplied plans
  - Supplier requested verification of dimensions
- Unless contract between contractor & supplier requires supplier to verify field measurements

Construction Claims Arising from Shop Drawings

- Another situation…
- engineer may be liable is if he /she fails to promptly act on submittals from general contractor
- engineer can be liable for any resulting delays

Shop Drawings Engineer's Liability

- Approves submittal that does NOT comport with projects specs…
  - if contract requires certain construction materials
- Acts beyond his/her contractual duties
  - Example: engineer generally not contractually responsible for means & methods
    1. Engineer reviews & approves means & methods
    2. Damages result, legal liability may be imposed

Shop Drawing Process Conclusion

- Presents risks must be carefully managed
  - problems during submittal review
  - lead to incorrect installations & delays
- Contractors & engineers can minimize liability
  - clear & unambiguous contract language
  - describes exact purpose & limitations
  - review & approval of shop drawings

Shop Drawing Process Conclusion

- Proper scheduling of shop drawing review
  - assure timely turnaround
  - avoid delay claims

- Compliance with contractual duties
  - best protection against legal liability
  - use, review or approval of shop drawings

Equipment / Materials Receipt & Storage

Equipment / Materials Receipt & Storage

- Must be thoroughly examined by contractor & owner's representative
  - When arrive at project
  - **BEFORE it is off loaded!**
  - Determine if proper materials or equipment were shipped
  - No damage in shipment
  - No readily apparent defects, damage or problems
- Could affect ultimate use of equipment or materials

Equipment / Materials Receipt & Storage

- Document initial inspection should
- Filed for potential warranty issues in future
- Periodic inspections equipment & materials in storage
- Periodic maintenance per mfr's reqm'ts
- If potential problems, inform contractor in writing
  - Give specific directions correct deficiencies
  - Maybe notify mfr

Installation Equipment & Materials

- Follow mfr's reqm'ts
  - normally included with shop drawings
  - copy of installation reqm'ts to all parties (O, E &C)
- Some of concerns during installation
  - handling
  - placement
  - connections
- Backfilling

Complex Projects = Formal Startup & Test Plan

- verify total facility meets spec reqm’ts
- executed ensure warranty reqm’ts met
- each spec reqm’t fulfilled
- integrated facility works properly
- conforms with contract documents

Warranties

Warranties guarantee materials & work supplied by contractor

- More stringent warranties often result in higher costs
  - water heaters having 5-year & 10-year warranties
  - only difference - length of warranty & price
  - no difference in construction / materials

Owner Warranty Responsibilities

- Often with assistance of consultant
- Defining desired Warranty Reqm’ts
  - duration of warranties
  - special warranty reqm’ts
  - warranty bonds & factory representative maintenance & inspections
- Warranty Period begins at completion & acceptance

Owner Warranty Responsibilities

- To keep a warranty in effect
  - correctly operate & maintain facility / equipment
  - according to mfrs' reqm'ts
- follow correct notification procedures
  - when potential warranty-covered problems encountered

Engineer Warranty Responsibilities

- specifies warranty reqm’ts
- engineer / construction manager verifies
  - equipment & material are in proper condition
  - received after shipment
  - properly stored
  - protected during construction
  - correctly installed
  - properly started up by contractor
- consultant advise owner on warranty issues

Contractor Warranty Responsibilities

- provides a warranty on all construction
  - it has performed / subcontracted
- contractor is responsible for
  - purchasing
  - receiving
  - storing
  - installing
  - starting up equipment & materials
  - according to construction specs & suppliers' reqm'ts

Mfr / Supplier Warranty Responsibilities

- When required mfr or supplier may assist or supervise
  - Installation, startup, testing & maintenance

Acceptance of Substantial / Final Completion

Acceptance of Substantial / Final Completion

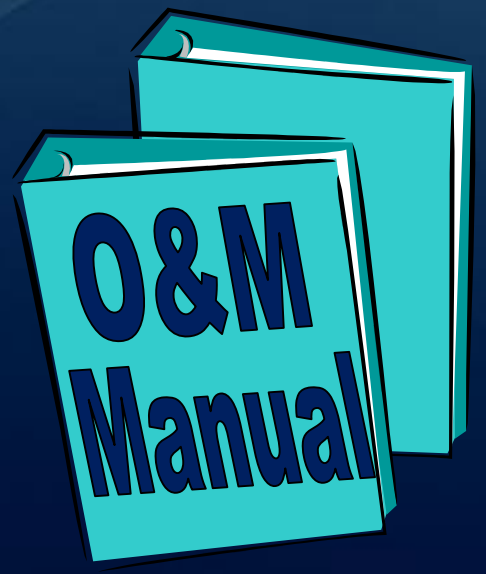
- Owner Letter of Acceptance of Substantial / Final Completion
- NOT the engineer
- After equipment installed, started & tested
- And project successfully completed
- After acceptance letter issued
  - responsibility for proper maintenance & operation
  - passes from contractor to owner
  - date of letter of acceptance
  - normally date warranty period begins

Operations & Maintenance

- Improper O&M most frequent cause of voiding warranty
- owner must O&M according to mfrs' reqm'ts
- Ensuring proper O&M
  - owner receives & maintains functional library all mfrs' O&M instructions
  - owner develops & implements facility-wide O&M programs including operator training manuals
  - owner performs initial & periodic operator training

Operations & Maintenance

- Mfrs' O&M Instructions
- collected during construction
- placed in formal library system
- indexed for use by O&M supervisory & engineering staff
- master kept for making additional copies
  - when operations copies are lost or worn
  - working copies for use by O&M staff



Warranty Claims

- Any apparent warranty problem
- inform contractor both verbally & in writing immediately
  - certified mail is advisable
- Document potential warranty problems

Responses to Claims

- If contractor not adequately respond
  - inform mfr (if applicable) to correct problem
- If neither contractor / mfr respond
  - owner may be required to correct warranty problem
  - take subsequent legal action to evoke warranty claim

Liquidated Damages

- liquidated damages is appropriate
  - when actual damages are hard to calculate / prove
  - don’t change liquidated damage amount after contract is signed
  - courts may declare void if “penalty”
  - if highly disproportionate to damages actually incurred
- Liquidated damages clauses
  - never use term penalty
  - set forth sound reasons why choose liquidated damages

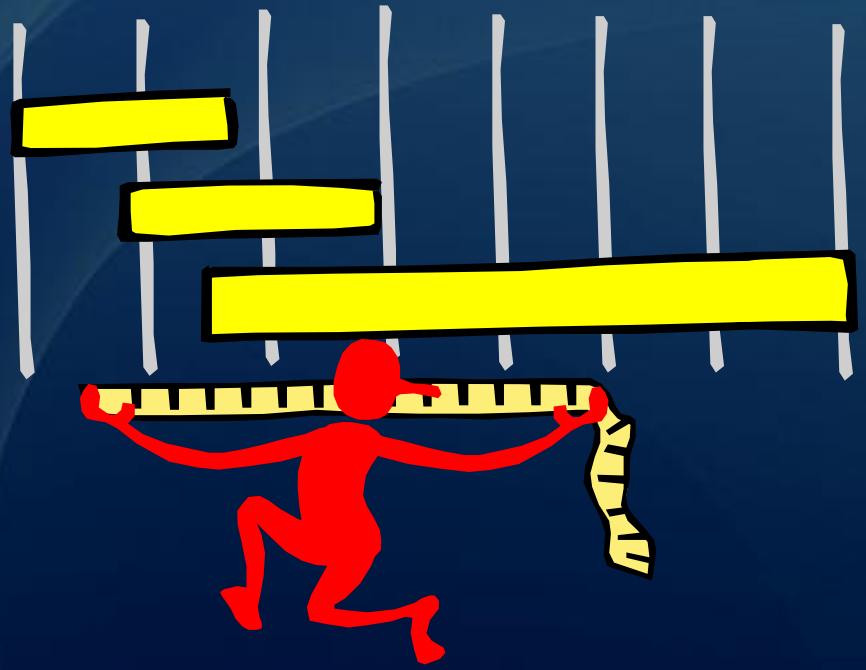
Reduced Retainage

- Reduced retainage may be used as an incentive for early completion
- retainage is usually a percentage of pay estimate for
  - error in estimating work required
  - unknowable poor quality work / errors
- total retainage is usually paid after completion

Pay Requests

Pay Requests

- **Do NOT pay more than percent complete**
  - If payments gets ahead of percent complete
  - Hard time holding the contractor responsible
- Watch project status closely



Pay Requests

- **Do NOT sign without carefully reviewing**
  - You may be busy, but this is IMPORTANT
  - Review pay requests **NOW**

Pay Requests

- **If you are NOT satisfied with quality or progress**
  - Communicate this immediately
  - Develop a broken hand until things change

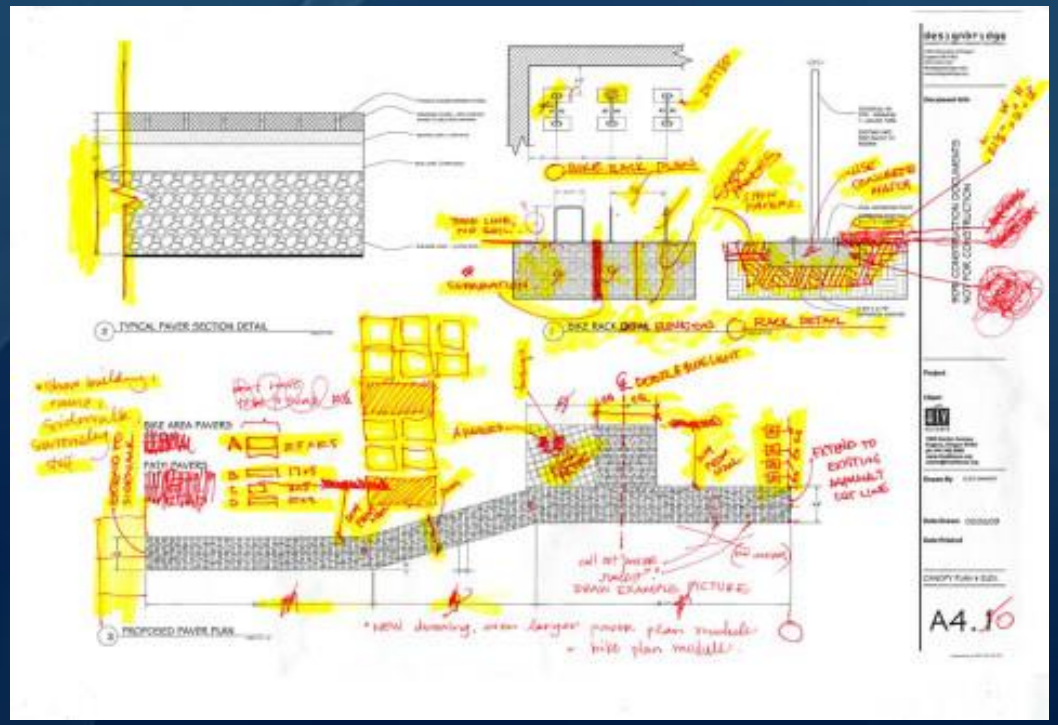
Change Orders

- Can significantly delay project's completion
- Realistic time to complete change
- Owner should consider whether original completion date needs to be revised to maintain consistency

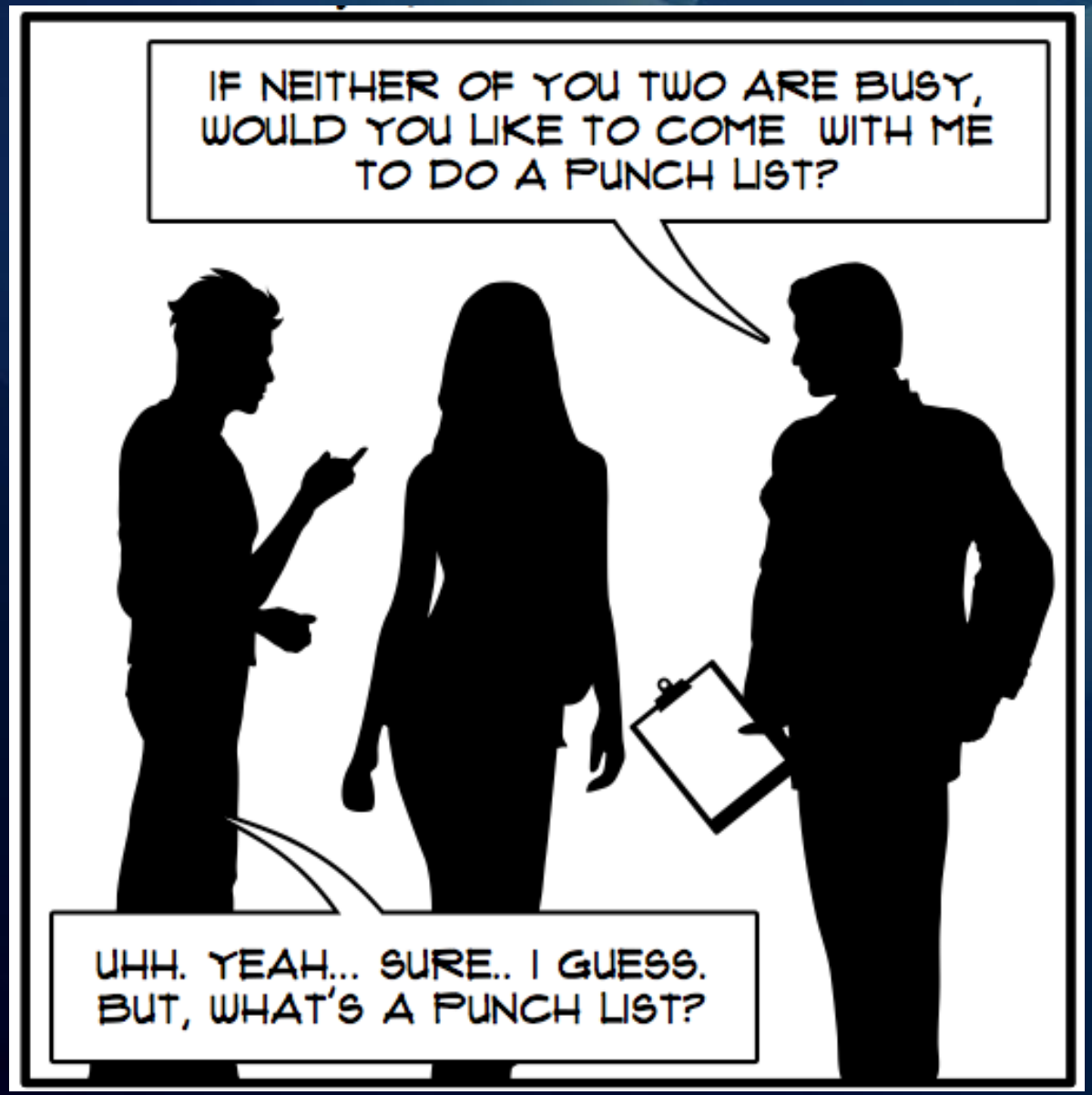
Project Close Out

Project Manager / Owner Responsibilities

- Inspect work for **Final Acceptance**
- Punch List
  - incomplete work
  - require corrective work
- O&M Manuals
- Training
- Final As-Builts
- Retainage
  - Very important to motivate contractor to finish the job



Punch Lists


IF NEITHER OF YOU TWO ARE BUSY, WOULD YOU LIKE TO COME WITH ME TO DO A PUNCH LIST?
UHH. YEAH... SURE.. I GUESS. BUT, WHAT'S A PUNCH LIST?


IT'S WHEN WE GO TO A JOB SITE NEAR THE END OF CONSTRUCTION AND CREATE A LIST OF CONTRACTORS AND SUBCONTRACTORS YOU NEED TO PUNCH IN THE FACE FOR NOT DOING THEIR JOB RIGHT.
REALLY?

Punch Lists

Construction Management 101

Sterling L. Carroll, P.E.
FRWA State Engineer
Florida Rural Water Assn