Project Management

For Consulting Engineers

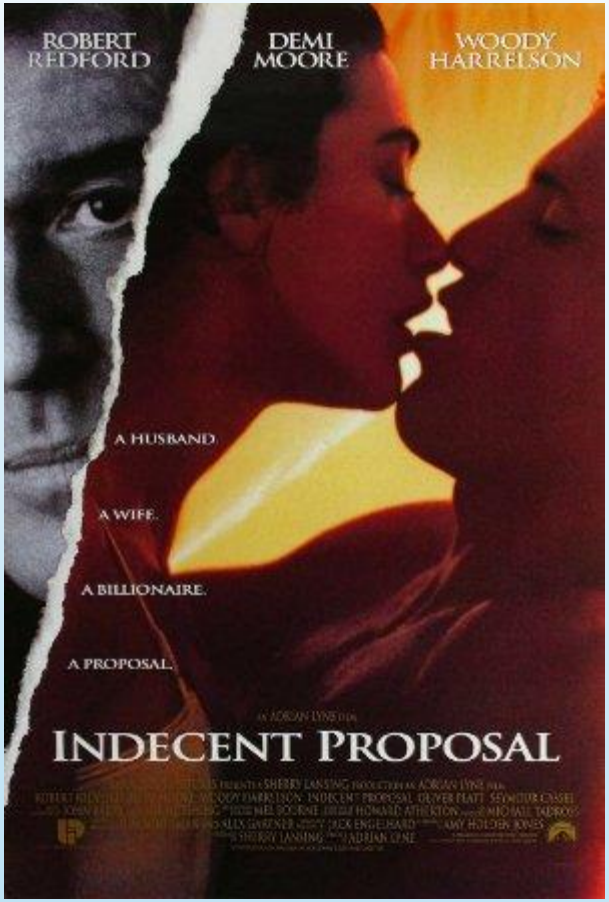
Peter A. Kraut, P.E.

- B.S. Architectural Engineering Technology
  - Wentworth Institute of Technology, Boston
- Professional Engineer, Mechanical
  - Arizona, California, Colorado, Connecticut, Georgia, Hawaii, Indiana, Maryland, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Texas, Utah, Virginia, Washington, Washington D.C., Wisconsin
- 20 years experience designing Piping systems
- Founded SCEG in 2001

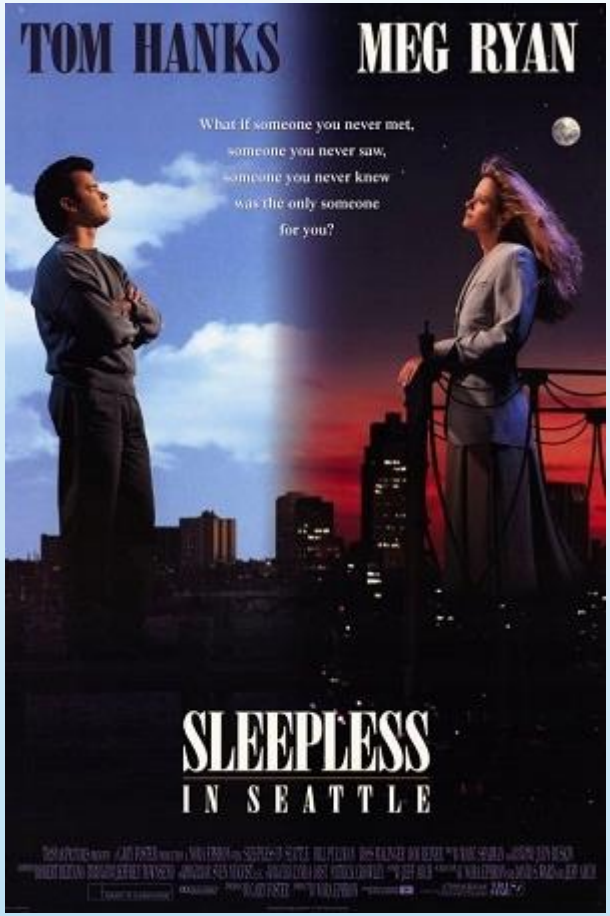
What is Project Management?

- For Consulting Engineers, Project Management is the process of designing and delivering a defined scope in a specific amount of time while adjusting to changes, keeping risk to a minimum and maintaining a profit.
- Clients are primarily Architects

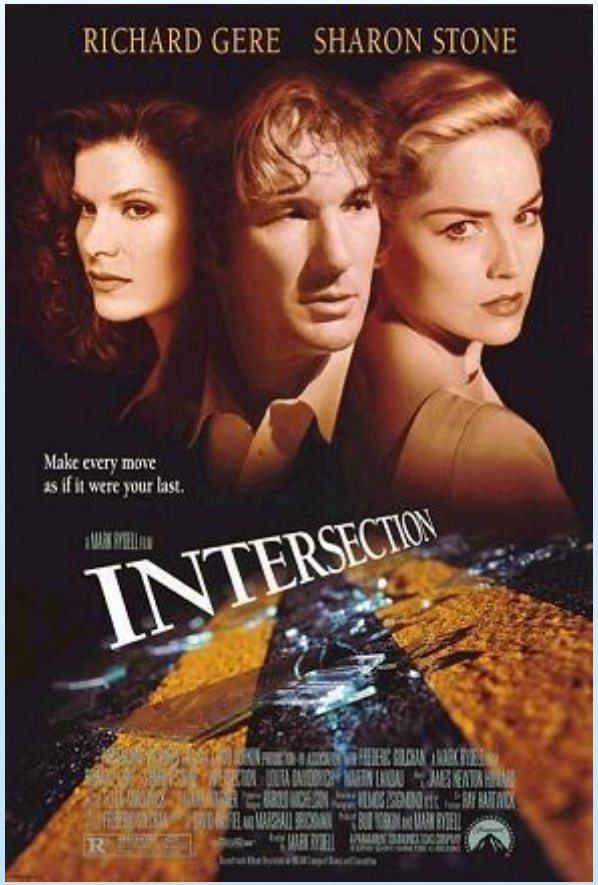
Name a movie with an Architect in the starring role



Name a movie with an Architect in the starring role



Name a movie with an Architect in the starring role



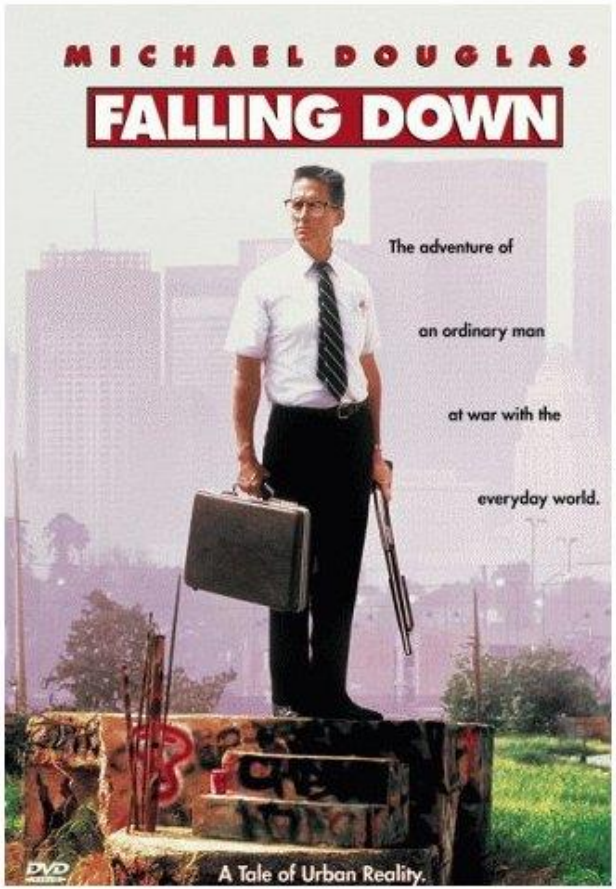
Name a movie with an Architect in the starring role

- Paul Newman in “The Towering Inferno”
- Keanu Reeves in “The Lake House
- Steve Martin in “House Sitter”
- Michael Keaton in “White Noise
- Gary Cooper in “Fountainhead”
- Jude Law (Landscape Architect) in “Breaking and Entering”
- Adam Sandler in “Click”
- Liam Neeson in “Love Actually”
- Wesley Snipes in “Jungle Fever”
- Luke Wilson in “My Super Ex-Girlfriend”
- Ashton Kutcher (Architecture Student) in “Butterfly Effect”

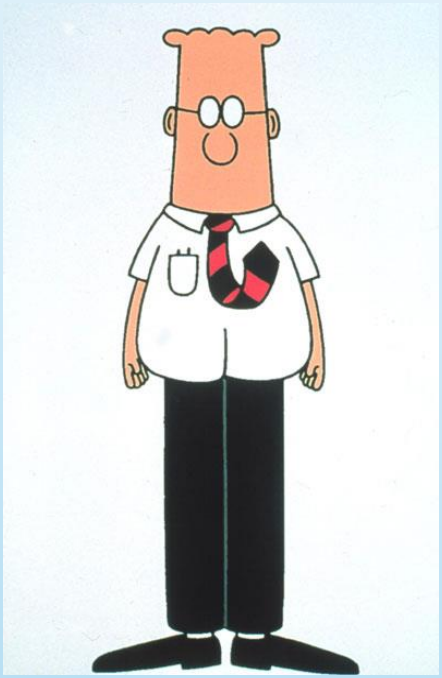
Name a movie with an Architect in the starring role

- Matt Dillon in “You, Me and Dupree”
- Tom Hanks in “Sleepless in Seattle”
- Charles Bronson in “Death Wish”
- Michelle Pfeiffer in “One Fine Day”
- Tom Selleck in “Three Men and a Baby”
- Henry Fonda in “12 Angry Men”
- Zach Braff in “The Last Kiss”
- Virginia Madsen in “Firewall”
- Matthew Broderick in “The Cable Guy”
- Joseph Gordon-Levitt in “500 Days of Summer”
- Matthew Perry in “Three to Tango”

Name a movie with an Engineer in the starring role



Typical Engineer



- Focused
- Slow and methodical
- Better math skills than English skills
- Keen understanding of HIS trade
- Introverted

Project Manager

- Highly organized
- Reacts quickly
- Exceptional communicator
- Understands ALL trades fairly well
- Charismatic

PROPOSALS

Proposals

- Defines what scope will be done for what fee under what conditions.
  - Based on current understanding
  - Things change

SCOPE

Scope

- The Engineer's scope is generally limited to 5 feet outside the building footprint
- Excludes work in a public right of way
- Civil
  - Natural Gas?
  - Power? Telephone?

Scope

- Schematic Design – system types
- Design Development – space planning
- Construction Documents
- Plan Check
- Construction Administration

Scope

- Meetings
- Web meetings
- Conference calls
- Plan check
- Site visits
- Construction meetings

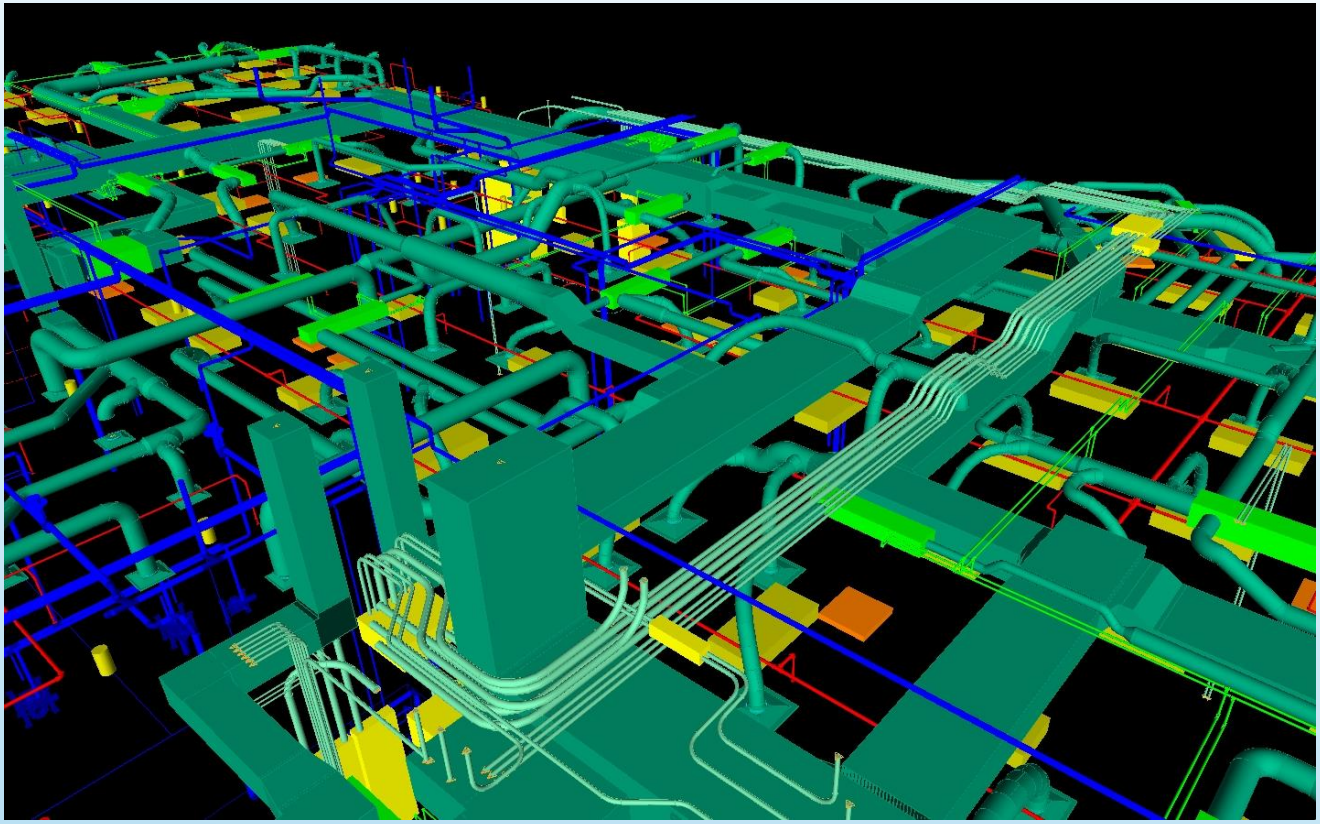
Scope

- Demolition Drawings
- Bid Alternates
- Phasing of Construction Documents
- Phasing of Construction Administration
- LEED and Green Building Services
- 3rd Party Rebates and Incentives

Scope

- Value Engineering
- Designing to a Budget
  - Progress cost estimates during design
  - Who decides what changes are made?
  - When can changes be made?
    - DD, 70%CD, 90%CD, during construction?

Revit



Revit

- Construction Documents
  - 3-dimensional drawings
  - Coordinated model
- Shop Drawing
- BIM
  - Building Information Management

EXCLUSIONS

Exclusions

- Life safety / code consultant services
- Design of temporary utilities
- Extensive site surveys or verification of the accuracy of as-built drawings
- Acoustic Engineering
- Structural Engineering and supports

Exclusions

- Do not work outside of your area of expertise
  - Irrigation design
  - Design of pools and fountains
  - Fireplace design
  - Architectural lighting design
- Payment of plan check fees and permits
- Adherence to others' CAD standards

Exclusions

- Multiple prime contractors
- Preparation of As-Built Drawings
- Preparation of O&M manuals
- Training
- Systems start-up
- Commissioning

CONDITIONS

Conditions

- Required
  - As-Built Drawings
  - Civil Drawings
  - Architectural Backgrounds
  - Food Service Drawings
  - Equipment specified by others

Conditions

- Possibly limited
  - Fire Sprinklers
  - Fire Alarm
  - Controls
  - Low Voltage

Schedule

- Reasonable efforts in performing the services with due diligence
- Consistent with the schedule
- Performance must be governed by sound professional practices.

Schedule

- If the work will take 8 weeks, the schedule should include 24 weeks
  - Coordination
  - Late information
  - Other projects
    - Implied not discussed

FEES

Pricing methods

- Fixed Fee (Lump Sum)
- Hourly
- Percentage of Construction Cost

- Difficulties arise when the architect and engineer are on different terms

Fixed Fee

- Requires a well defined scope
- Hardest to manage
- Can be the highest profit or the lowest
- Determined by:
  - Previous similar project
  - Estimating hours (effort)
  - Estimating construction cost (liability)

Fixed Fee

- Previous Projects
- Per square foot
  - Less than $0.50/sf to more than $5/sf
  - Varies by project type
  - Varies by architect
  - Varies by client

Hourly

- Good for indeterminate scopes
- Billing Rates
  - Varies by firm size and location
- Not to Exceed
  - Without prior authorization

Hourly

Task	Draftsman	Designer	Engineer	Sr. Eng.	Principal	TOTAL
Site Survey			6			
Utility Coord.	2	4	4			
Meetings				30	16	
Design	319	244	114	66	62	
Plan Check	7		12		2	
RFIs,Submitals	32		64	32		
Site Visits				32		
Total	360	248	200	160	80	1048
Rate	$100/hr	$125/hr	$150/hr	$175/hr	$225/hr	$136.45
Fee	$36000	$31000	$30000	$28000	$18000	**$143000**

Percentage of Construction Cost

- R.S. Means Construction Cost Data
  - Commercial
    - Architect 10% (of hard construction costs)
    - Engineer 6% (of MEP construction cost)
  - Health Care
    - Architect 11%
    - Engineer 8%

Percentage of Construction Cost

- R.S. Means Construction Cost Data
  - Multi-Family
    - Architect 6%
    - Engineer 4.5%
- Repetitive work
- Liability
  - Prototypes

Percentage of Construction Cost

- Construction Cost
  - Under $60/sf to over $400/sf
  - Varies by finishes
  - Varies by location
  - Varies by unions
- MEP as a percentage of the whole
  - Varies by system type
  - Varies by finishes, location, unions …

Percentage of Construction Cost

sf	55,000				
des fee	10.0%	architect			
des fee	6.0%	MEP Engineer			
	%		$/sf	Const. Cost	**Design Fee**
Project		$	150.00	$8,250,000	$825,000
M	12.0%	$	18.00	$990,000	$59,400
P	6.0%	$	9.00	$495,000	$29,700
E	14.0%	$	21.00	$1,155,000	$69,300
MEP	32.0%				**$158,400**

CONTRACTS

Disclaimer

- *I recommend consulting a lawyer*
- *I am not a lawyer*
- *I can not give legal advice*
- *The following is based on my limited experience as a business owner*

Contracts

- Proposal
- Verbal Contract
- Unsigned Contract
- Negotiated Contract
- Signed Contract

Legal Terms

- All
- Any
- Sole
- Days
- Shall
- Defend

Legal Terms

- Act or omission
- Claims, losses, costs, damages, demands, causes of action and liabilities
- Related, out of or in connection with
- Gross negligence, negligence or willful misconduct
- Officers, directors, employees, sub-consultants, shareholders, trustees, agents, successors, assigns …

Dispute Resolution

- Jurisdiction
- Mediation
- Non-Binding Arbitration
- Binding Arbitration
- Litigation
- Bench Trial
- Jury Trial

Indemnify

- Indemnify: (v) to protect; to shield; to stand between
  - Indemnity: (n) protection; the act of indemnifying
- “Contractual Liability”
  - Not covered by most Errors and Omissions policies

Indemnify

- Typical use – protection from liability outside of one's control
  - Contractor shall indemnify Owner against injuries in the workplace
  - Owner shall indemnify Architect against errors resulting from the sole negligence of the outside consultant (eg: furniture systems)

Indemnify

- Atypical use – shifting liability to others, especially towards the smallest contract
  - Architect shall indemnify Owner against all claims related to the project excepting owner's sole negligence
  - Consultant shall indemnify Owner and Architect against all claims excepting the proportional negligence of each

Hold Harmless

- Legal term for “Will not sue”
- Typical use – to keep those without liability from being sued
  - Contractor will Hold Harmless the owner for claims related to workplace injuries

Limitation of Liability

- Typical use – to balance risk versus reward
  - Consultants liability shall not exceed $100,000.
  - Consultants liability shall not exceed the total fees paid to Consultant

Time is of the Essence

- The parties to the agreement must perform by the time to which the parties have agreed
- Legal term for “any delay whatsoever with or without cause is going to cost a lot of money”

Pay When Paid

- Pay If Paid is unenforceable in California and many other states
  - Difficult to enforce without access to the Architect's or Client's accounting records
  - Limits the Consultants lien rights
- Workaround: payment is due when received, after legal action has been taken or other "reasonable time"

The essential key,

COMMUNICATION

Communication

- Projects fail due to a breakdown in communication
- Communication must be clear, concise and timely
- Communicate through contractual channels
- OPR: Owner's Project Requirements
- BOD: Basis of Design

Owner's Project Requirements

- OPR: A document stating, BEFORE DESIGN, the code requirements and owner wants and expectations for the building's purpose and use as it applies to the project
  - Client/Owner Requirements
  - Sustainability and Environmental Impact
  - Energy Efficiency desires
  - Indoor Environmental Quality Requirements
  - Project program, including facility functions and hours of operation, and need for after-hours operation.
  - Equipment and systems desires
  - Client/Owner and O&M desires

Basis of Design

- BOD: A document stating how the engineer will meet the OPR
  - Systems types
  - Design parameters
    - Ground water temperature
    - Water pressure
    - Gas pressure
    - Rainfall rate
  - Control

MANAGING AN INBOX

Inbox

- Email has become the preferred method of communication.
- Thousands of emails are exchanged on every project
- Engineers must keep records for 10 years
  - Lawyers don’t read plans

Inbox

- Project managers can expect to get 5 to 50 emails a day on each project
- The inbox is not an effective to-do list
  - Flag email for follow up
  - Use Calendars to track dates
  - Use Tasks to track action items

Inbox

- Goals,
  - Respond to email in 24 hours
  - Answer email in 2-5 days
  - Do not participate in “chat room” style email
    - Waste of time and a poor record
    - Pick up the phone after 3 emails
    - Follow up in writing

EMAIL

Three Sentence Email

- Good News, Bad News, Question
  - Always begin an email on a positive note
  - State the reason for your email
  - Finish by identifying the responsible party

Poor Email

John,

There is no way I can meet your deadline. You have not given me enough time. I'll try to get this to you later this week.

Poor Email

- Starts with bad news
- Uses “I” not “we”
- Complaining
- No commitment
- Did not pass responsibility

Really Bad Email

John,

I don’t know where to begin. I’ve been waiting weeks and weeks for you to send me information and up until today I didn’t get anything from you and today the information that you send doesn’t have the rest of the stuff in it and when I opened it at someone elses terminal because mine has been crashing for the last few weeks (long story ☹) it came up with a bunch of lines in it. What are those lines? Should we just delete them? I’m not sure what to do because we have to do our calculations still and I could’ve done it last week, but this week I have another project that goes out on Thursday so I can’t even look at this until Monday …

Good Email

John,

We received your backgrounds today and can turn this around fast. We will send our plans on Tuesday April 10th by 5:00. Call me if you have any questions.

Peter Kraut

(555) 555-5555

Good Email

- Positive attitude
- Identifies a team
- Presumptive in meeting objectives
- Deflects next action to client

MEETINGS

Meetings

- Meetings are a major source of information and responsibility
- An agenda is necessary
- Listen to seemingly unrelated topics
  - Possible MEP requirements
  - Broader understanding of design
  - Understanding of construction sequence

Who’s in charge?

The Person Taking the Minutes

Meeting Minutes

- Minutes taken by Architect:

  “The Engineer will deliver plans on Friday.”

- Minutes taken by Engineer:

  “The Engineer will deliver plans three days after receipt of final drawings from Architect”

Meeting Minutes

- Minutes taken by Architect:

  “The Engineer will indicate drain locations”

- Minutes taken by Engineer:

  “The Engineer will show drains at each structural low point as indicated by Architect”

Meeting Minutes

- The foregoing constitutes our understanding of the items discussed and conclusions reached. All attendees are requested to review these items and advise in writing of any errors or omissions. If no corrections are made within ten days, these minutes shall be considered an accurate account of the meeting indicated above

MANAGING SCOPE AND RISK

Managing Scope

A Project Manager is someone who is really good at saying…

NO

Managing Scope

- When scope exceeds your proposal:
  - If you do work that is beyond your scope, identify it first to avoid being responsible for subsequent scope
  - Send a request for additional fee within 5 days and *before* beginning work
  - If you do the work without additional fee (for promoting future business) identify it before you begin

Managing Scope

- A request for additional services must include:
  - A description of the scope
  - Fee
  - Schedule impacts
  - Exclusions, Conditions …
  - “All work will be performed in accordance with the original contract”
  - A place for acceptance

STANDARD CORRESPONDENCE

Design Schedule

In our proposal, we anticipated the following issues:

- Schematic Design (identifying system types)
- Design Development (identifying spatial requirements)
- 75% Construction Documents (for coordination)
- 90% Construction Documents (for plan check)
- 100% Construction Documents (for bid)

Please send the project design schedule so that we can plan our efforts. It is important that we keep up with the project, but it is equally important that we do not get too far ahead creating the added cost of re-design. Please include the issuance of final floor plans, reflected ceiling plans, roof plans, site utilities, landscape, food service equipment, MEP and other consultant scopes in your schedule.

Backgrounds

In an effort to ensure that we present our work well and coordinate it with yours, please send final backgrounds 2 weeks prior to the delivery date. These should include floor plans, reflected ceiling plans, roof plans, site plans and sections. This should allow sufficient time to clean up and insert the backgrounds, print, review and make minor adjustments to our work. We would appreciate it if you could identify any significant changes to your drawings that we should pay specific attention to.

Late Changes

At this time, our design has reached the Design Development level. We recognize that the design process includes coordination with other trades and that Architectural Backgrounds must therefore evolve. Late changes, however, require a significant additional effort on our part that was not included in our original scope. Please understand that if we receive direction or changes in backgrounds or scope that require redesign after the 50% Construction Document level, we will need an additional fee to address them. If there is anything that we can do to assist in the decision making process now, please let us know.

Record Sets

Identified in our proposal, we require a printed construction set at each milestone. In addition to saving the client our printing costs by using your bulk rates, this set allows us to coordinate our work with others. It is important that this milestone set include your work and the work of other trades, along with ours. Please send a half size set of 50% Construction Documents for our use and record.

Construction Prior to Permit

We will put forth reasonable professional efforts to comply with applicable laws, codes and regulations but the plan check and permitting process is an essential phase of this project. It is our understanding that a decision has been made to bid and / or begin construction on this project prior to the completion of the plan check and permitting process. Please understand that this creates a potential for change orders for which we cannot be held liable.

Delivery

It is our understanding that we will be sending plans and specifications for construction later this week. To ensure a smooth delivery, please clarify the following:

- What issue date would you like in the title block?
- What delta, date and description, if any, would you like in the revision block?
- What clouds and deltas should remain on the plans?
- Will we be delivering electronically or on paper?
- If on paper, what size?
- If on paper, how many sets?
- Where are we sending them?
- What date and time are they due?

Submittals

In our proposal, we included the review of submittals. To ensure an efficient and accurate review, the HVAC, plumbing and electrical submittals must each be submitted as a complete package. Allow 10 days for initial review of each submittal. Allow 5 days for review of each resubmittal. Please send the submittal schedule for our review.

Most of our work utilizes a Basis-of-Design Product Specification in which a specific manufacturer's product is named. Products other than those specified are considered substitutions. Except for conditions outside of the Contractor’s control, when substitutions are made, the Contractor shall become responsible for any associated redesign, coordination with other trades, approvals of the authorities having jurisdiction, performance, schedule impacts and cost impacts.

Submittals

- Include disclaimer with all submittals:

  This review is only for general conformance with the design concept and the information given in the Construction Documents. Corrections or comments made on the shop drawings during this review do not relieve the contractor from compliance with the requirements of the plans and specifications. Review of a specific item shall not include review of an assembly of which the item is a component. The contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of the Work with that of all other trades and performing all Work in a safe and satisfactory manner.

Substitutions

- Include disclaimer with all Substitutions:

  By submitting these substitutions, the contractor represents and warrants that he has personally investigated the proposed substitution product and determined that it is equal to or superior in all respects to that specified on the construction documents and certifies that it includes all related costs under this contract including but not limited to any mechanical, plumbing, electrical, architectural and structural requirements for this project.

Shop Drawings

In our proposal, we included the review of Shop Drawings. Our construction documents indicate the scope of the work and establish a standard of care. Shop Drawings are required to coordinate the layout with other trades to provide a complete and operational system within the space available. Allow 10 days for initial review of each Shop Drawing. Allow 5 days for review of each resubmittal. Please send the Shop Drawing schedule for our review.

If the Contractor proceeds without approved Shop Drawings, he assumes all risk associated with the removal and replacement of the work including cost and schedule impacts

RFIs

It is our policy to respond to Requests for Information (RFIs) in 5 working days in conformance with the standard of care in the industry. Should there be an occasional urgent RFI, please let us know. The repeated occurrence of urgent RFIs is an indication that the Contractor is not addressing coordination in a timely fashion.

RFIs must include a reference to the plan or specification in question and a complete description of the conflict or ambiguity. They must also include sketches, photographs, manufacturer's information and/or code sections. A suggested solution with cost and time impacts is also required.

Requests for Information

- Respond within 5 days
  - Before the weekly OAC meeting
  - perception
- Do not accept responsibility for coordination
- Do not allow submittals, substitutions or design changes through RFIs
- Reject the first RFI on every project
  - Quote the specifications

Requests for Information

- Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - Project name, Project number, Date, Name of Contractor, Name of Architect, RFI number, RFI subject, Contractor's signature
  - Specification Section number, title and related paragraphs, Drawing number and detail references, Field dimensions and conditions
  - Contractor's suggested resolution
  - Impacts the Contract Time or the Contract Sum
  - Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, dimensions, thicknesses and structural grid references

Requests for Information

- The following Contractor-generated RFIs will be returned without action:
  - Requests for approval of submittals.
  - Requests for approval of substitutions.
  - Requests for approval of Contractor's means and methods.
  - Requests for coordination information already indicated in the Contract Documents.
  - Requests for adjustments in the Contract Time or the Contract Sum.
  - Requests for interpretation of Architect's actions on submittals.
  - Incomplete RFIs or inaccurately prepared RFIs.

As-Builts (early reminder)

It is the contractor's responsibility to maintain As-Built Drawings. It is important to note that this effort must be made throughout the course of the project and that MEP As-Built Drawings, in particular, cannot be accurately created after slabs are poured, walls are closed and ceilings are in place. For this reason, a set of Shop Drawings / Construction Documents should be kept at the job-site, clearly marked "As-Built" and continually updated as work is installed. This set should be made available for your viewing and ours on each visit to the job site, not for review, but simply to ensure that the As-Built drawing effort is in development.

Construction Schedule

In our proposal, we anticipated four (4) site visits. In order to observe the most work while still allowing time for possible corrections, we suggest the following visits:

- rough underground – 2 weeks before the slab is poured
- rough walls – 2 weeks before the second side of drywall is installed
- rough ceilings – 2 weeks before tile is dropped
- finish – 2 weeks before Substantial Completion

We will need two weeks' notice to schedule site visits. Please send the project construction schedule so that we can plan our efforts.

Field Observation Reports

- Include disclaimer with all Field Observation Reports:

  These observations indicate the general progress and quality of the installation on the date indicated above. They do not constitute a complete, exhaustive or detailed inspection of the work. Engineer does not guarantee the performance of, and shall have no responsibility for the acts or omissions of the Contractor, Subcontractor, supplier or any other entity furnishing materials or performing work on the Project.

Change Order Reviews

- Contractor-Initiated Proposals
- Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change.
- Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  - Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made.
  - Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - Include costs of labor and supervision directly attributable to the change.
  - Include an updated Contractor's construction schedule that indicates the effect of the change.

Close Out Documents

In our proposal, we included the review of close out documents. Allow 10 days for initial review of each close out document package. Allow 5 days for review of each resubmittal. The close out documents should include the following:

- As-built drawings
- HVAC test and balance report
- Domestic hot water return balance report
- Short circuit analysis
- Arc flash study
- Response to all field observation and Punch List items
- Operation and Maintenance Manuals
- Documentation of equipment start up
- Maintenance service agreements
- Warranties and workmanship bonds

QUESTIONS