Department of General Services
Design & Construction Management

CONSTRUCTION PROCEDURES
AND
QUALITY ASSURANCE MANUAL

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PURPOSE

PURPOSE

The purpose of this document is to provide the Metropolitan Government of Nashville Design & Construction Management Group, , on contract Architects, design professionals, Contractors as well as various agencies within the Metropolitan Government of Nashville with the design and construction review requirements frequently overlooked or for those items requiring special attention for the quality of the various phases of the design and construction process. This quality assurance plan shall assist in providing documentation of the various phases progression and comments as well as finally become accurate record documents reflecting all approved changes and modifications to the original facilities design for the Metropolitan Government of Nashville.

OVERVIEW OF OWNER'S REP/PROJECT MANAGEMENT ROLE

Capital construction projects are comprised of the following phases:

I. Feasibility (Programming and Space Planning)
II. Design
    A. Conceptual
    B. Schematic
    B. Design Development
    C. Construction Documents
III. Bidding
IV. Award
V. Construction
VI. Occupancy
VII. Warranty

There are eleven (11) basic capital project implementation steps, which are outlined below:

1. Formulate A Project Program
    a. Master Plan Process (To be "spear-headed" by DCM. DCM to solicit assistance from additional Metro Agencies as required)
        i. Mission + Specific Agency Goals = Facility Needs
    b. Agency Input To The Program Definition
        i. Constraining the desires of the users to fit the budget
        ii. Creating a consensus amongst the users and Design and Construction Management project team
2. Create A Project Management Team *(See Typical Project Organization)*
    a. Needs Vary By Phase (Programming, Design, Construction)
3. Set Realistic Project Goals
    a. Time For Completion (Design, Reviews, Permits, Weather)
    b. Budget (Design, Construction, Voice/Data, F&E, etc.)
        i. Maximum impact on cost made during programming, then design, and least of all during construction
    c. Quality (Durability, Impact On Time and Budget)
4. Budget Impact On The Project
    a. Budget/Funding
    b. Issues related to choice of designer & timing of construction

5. Select A Designer
    a. Design or Design-Build
    b. Define Project Lead for Design Team
    c. Fee and Reimbursable Costs
    d. Define Mechanical, Electrical and Plumbing Designers
    e. Define How the Designer Will Administer Field Construction Work
    f. Evaluate Prior Project References
        i. Timely, Cost Control, Quality, Cooperation, Paperwork Processing
    g. Define Level of Comfort Dealing With The Designer
6. Your Design Criteria
    a. Minimize maintenance and spare parts
        i. Locks, fire alarm, energy controls, elevators, MEP fixtures and equipment
7. Different Stages Design Process
    a. Conceptual
    b. Schematic
    c. Design Development
    d. Construction Documents
8. Select The General Contractor & Form of Contracting
    a. Types of contracts (lump sum, design build, g-max, CM at Risk, Multi-prime)
    b. Bidder List
        i. Pre-Qualified or Open List
    c. Negotiate Sole Source
    d. Value Engineering Before Award
9. Building Permits
    a. Zoning Approval
    b. Utility Impact
        i. Water, sewer, storm water (governmental approval)
        Ii. Electricity, gas, telephone (availability and fees)
    c. Plan Review by ADA
    d. Plan Review By Additional Metro Agencies
        i. City, county, state depending of type of project
    e. Fees and Application
10. Control Time, Cost and Quality During Construction
    a. Time schedules
        i. CPM for work
        ii. Submittals for material & testing
            1. List of what is to be submitted and status of both GC and AE actions pending
            2. Identify long lead times
        iii. Progress Meetings (resolve issues quickly and document decisions)

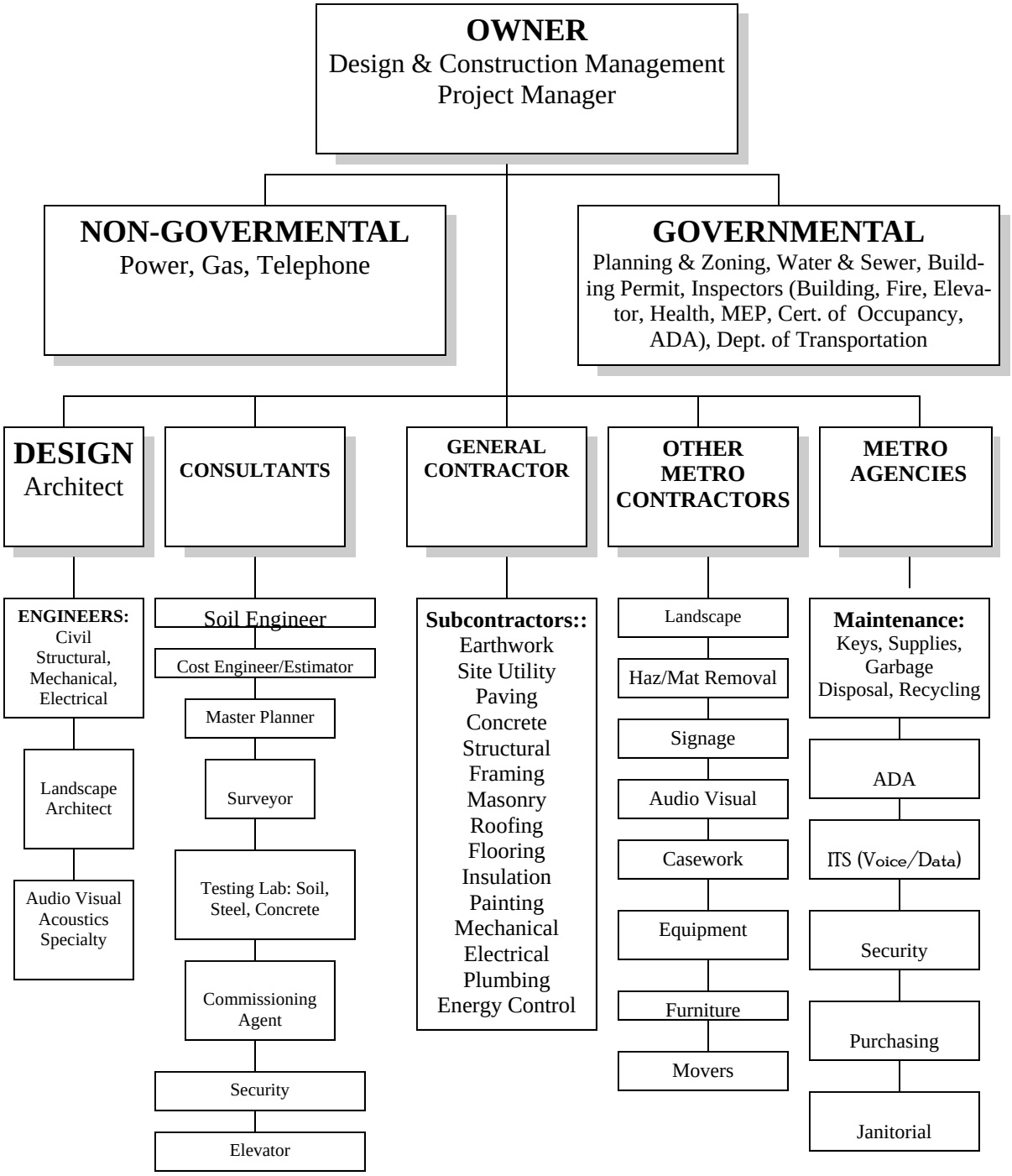
b. Cost
i. Change Order Logs (Pending Estimates and Final Values)
ii. Total Budget Tracking (Voice/Data, F&E, PP…)

c. Quality
i. Testing Labs
ii. AE Inspections
iii. GC Quality Controls
iv. Other agencies inspections (county building dept.)

d. Coordination
i. On Campus Activities
ii. Maintenance (Underground Utilities, Keys)
iii. Voice/Data

11. How To Obtain Final Occupancy
a. Certificate of Occupancy Inspections
b. Punch List Process with General Contractor
c. Warrantee contacts and O&M training for Maintenance.

TYPICAL PROJECT ORGANIZATION

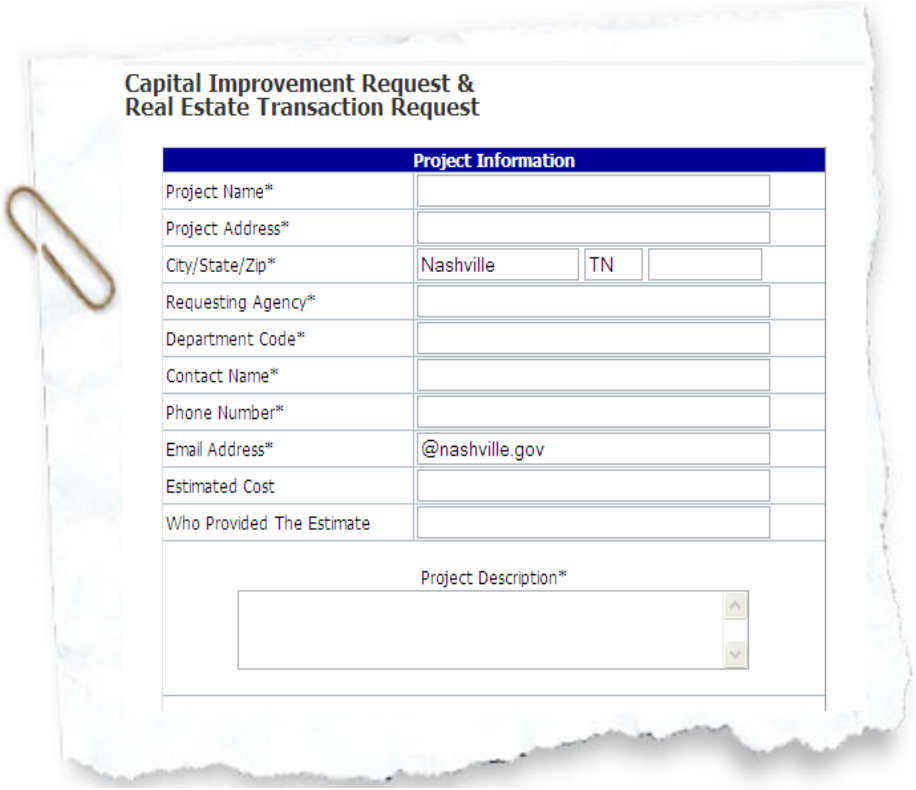


REQUESTING A PROJECT

Requesting A Project

The first step in requesting a project is to formally initiate the project's documentation by completing the Capital Improvement Request (CIR) form via internet by accessing the following link: http://www.nashville.gov/gsa/design_construction/CIR_form.asp

The below document represents a small excerpt of the full page CIR form. Reference the webpage for the full contents of this form. Direct requests for projects from Metro agencies whether received via e-mail, phone or in person should always be guided to complete the on-line CIR Form.



Capital Improvement Request &
Real Estate Transaction Request

Project Information			
Project Name*			
Project Address*			
City/State/Zip*	Nashville	TN	
Requesting Agency*			
Department Code*			
Contact Name*			
Phone Number*			
Email Address*	@nashville.gov		
Estimated Cost			
Who Provided The Estimate			

Project Description*

Participation

A Capital Improvement Request (CIR) or Work Request is received from an Agency requesting design or construction services. Routing for this request is received by the Business Support Services Group.

1. The Capital Improvement Request (CIR) or Work Request is reviewed to en sure the necessary information for the implementation of the project that has been provided (contact name, agency, funding, business unit (BU) numbers, purpose of the project, etc.). REFERENCE ATTACHMENT A

2. The CIR or Work Request is entered into the CIR Log Sheet and the project database located on the M: drive by the Business Support Services Group.
3. The CIR or Work Request is assigned to the appropriate Project Manager based on the type of Agency requested services by the Business Support Services Group.
4. A returned e-mail will be sent to the Customer contact, Project Manager and BOSS Director. At this time the assigned Project Manager will need to make contact with the Agency within 48 hours and review with the Agency the Scope of Work utilizing the Project Authorization Form. REFERENCE ATTACHMENT B. *Also reference CAPITAL IMPROVEMENT PROJECT ACCEPTANCE.*
5. All essential project comments and milestones are the responsibility of the Assigned Project Manager to be entered in the Project Database located on the M: Drive (M:/BOSS/BOSS Projects/BOSS PROJECTS DATABASE) by close of business day every Friday. A Project Database Record with field instruction are included in the attachments sections. REFERENCE ATTACHMENT C.
6. Project Manager will initiate all services/goods via Requisition and Purchase Order process.
7. Upon Substantial Completion of the project the Project Manger shall submit to the Business Support Services Group all appropriate materials including building plans, warranty information, operation manuals, space analysis, etc. REFERENCE ATTACHMENT D.

CAPITAL IMPROVEMENT PROJECT ACCEPTANCE

Once a Capital Improvement Request for a project is accepted, and the funding is proven to be clearly available and funding source(s) identified, the Project Manager(s) shall review the Capital Improvement Request for its contents. An initial meeting thereafter shall be set-up with the agency who submitted and/or originated the CIR form. The purpose of this meeting shall be the following:

1. Gain a clear understanding of the scope of work as defined by the agency.
2. Gain a clear understanding of the agencies' expectations for the proposed project as well as needs.
3. Gain a clear understanding of the agencies' programming
4. Perform a space and/or site walk through.
5. Collect any as-builts, record drawings, specifications and general project documents that the agency may have in their possession.
6. Define other Metro agencies that may need to be involved in this project.
7. Re-iteration of the Contents of the Project Authorization Form (Reference Attachment B) that a fee will be charged to either the project or agency for construction management services. The agency requesting the project should have a clear understanding that DCM's fee's are project based. A lump sum fee estimate should be included in all estimates being submitted by the agency via CIR.

PROJECT ROUNDTABLE MEETING

Project Roundtable Meeting

After the a draft scope of work is generated and supporting documents are compiled, an initial project roundtable meeting should be scheduled. The Project Manager should use the following questions in order to determine which Metro agencies should be involved in this meeting.

1. Is this a registered or historically relevant building? If so, a member of the Historical Commission should be invited.
2. Will there be any site work that will create a disturbance to significant and/or large trees? If so, Metro's Arborist should be invited.
3. Is this site/property adjoined to another Metro agency property and project activities could possibly disturb their property or programming? If so, this Metro agency should be invited.
4. Does this project involve any roadway or sidewalk modifications or construction? If so, Metro Public Works needs to be invited.
5. Does this project involve any site sanitary sewer or water infrastructure modifications or construction? If so Metro Water Services should be invited?
6. Does this project involve any site electrical? If so, NES should be invited?

The following agencies should always be invited:

1. Metro Agency requesting the project.
2. Information Technology Services
3. ADA Compliance Division
4. Department of Codes and Safety

MANAGING CAPITAL CONSTRUCTION

GENERAL OBEJECTIVES

These ten (10) objectives should be included in your management plan for your capital project:

1. Establish a facility needs assessment based on master planning mission related requirements.
2. Create preliminary budgets, scope of work, schematic layouts and site plans based on customer needs, applicable codes and principles of design.
3. Identify funding sources and create strategy for requesting funds.
4. Apply leadership skills to manage diverse teams comprised of customers, designers, contractors and Metro agencies.
5. Review project plans and specifications for accuracy and administrative Requirements for the customer.
6. Create change order estimates, value engineering estimates and negotiate costs with contractors.
7. Maintain project information including submittals, changes and close-out records.
8. Review project schedules, monitor progress and take corrective action to meet due dates.
9. Utilize the resources of the WEB to enhance productivity in project management operations.
10. Coordinate project completion, commissioning of facilities and post occupancy Inspections.

MANAGING CAPITAL CONSTRUCTION

1. MASTER PLANNING
    a. Perform a facilities needs assessment by evaluating assets, deficits, sites and renovations
    b. Identify sources of funding for various projects
2. PROJECT PLANNING
    a. Conduct customer interviews to determine scope of work and make a space program data sheet
    b. Create space relationship diagrams
    c. Calculate net and gross square footage for various projects
3. PROGRAM BUDGET ESTIMATES
    a. Use MEANS to create approximate estimates for various facilities
    b. Adjust cost estimates for site location and inflation
    c. Perform cost comparison analysis to determine the most cost effective facility construction/renovation options
4. SCOPE OF WORK AND SPATIAL LAYOUTS
    a. Write a narrative project scope summary
    b. Make a Project Budget Summary sheet
    c. Identify the modular elements in the program requirements, which will dictate the configuration of the building floor plan and then develop appropriate net square foot dimensions for these modules
    d. Create room layout diagrams for three levels of planning (Master Plan, Schematic Relationships and Room Layouts)
5. PROJECT COST ESTIMATES
    a. Adjust budget estimates to local cost rates and inflation
    b. Write business letter to client describing facility project planning and methodology
6. BUILDING CODES
    a. Identify applicable codes and ordinances
    b. Utilize appropriate facility codes to calculate:
        i. Occupancy Classification
        ii. Type of Construction
        iii. Building Size and Height Limits
        iv. Egress Needs (Exit, Travel Distance, Hallways)
        vi. Plumbing Fixture Needs
7. DESIGN PROCESS
    a. Describe the four phases of design in terms of plans, specifications, estimates and management concerns
    b. Write a statement of work for a design contract
    c. Create a planning level project schedule for design and construction based on standard curves
    d. Establish a design fee estimate
    e. Define reimbursable design costs

8. DESIGNER SELECTION & FEES
    a. Define the AE selection process
    b. Perform a designer selection rating system
    c. Define method(s) for establishing a price for design work
    d. Define the contract limits of designer liability for design
    e. Analyze designer fee proposal and create negotiation strategy
    f. Document results of fee negotiations
    g. Create detailed time schedule from planning through final work completion
9. PLANS AND SPECIFICATIONS
    a. Specifications and plans reflect CSI format
    b. Perform constructability review of project plans
    c. Create submittal log for construction phase
10. CONTRACT AWARD PROCESS
    a. Perform construction bid analysis
11. PRECONSTRUCTION
    a. Create a Pre-Construction Meeting Agenda *(Reference Meeting Agenda Standard Forms)*
    b. Verify insurance and bonding coverage requirements
    c. Generate quality control check list for construction projects
12. CONTRACT ADMINISTRATION
    a. Define critical path *(DCM Project Manager, General Contractor Function)*
    b. Select appropriate scheduling technique for construction work (*DCM Project Manager, General Contractor Function)*
    c. Organize project information into a logical filing system
    d. Create and maintain a change order log
    e. Conduct a project close-out
13. CHANGE ORDERS
    a. Identify General Conditions related to change orders
    b. Analyze a change order proposal for validity and pricing
14. WARRANTY
    a. Establish systems start-up training schedule for Maintenance Department
    b. Verify accuracy of operation manuals and as-built drawings

<u>RESPONSIBILITIES</u>

The Design & Construction Project Manager is responsible for the following tasks:

1. Keep Project On Schedule
2. Maintain Status of Change Orders (i.e. funding, estimates, time)
    * Emphasis placed on contractor and designer to act promptly
    * Obtain funds in a timely manner
3. Negotiate Change Orders and Write Recommendation Letters
    * Document rationale behind changes (i.e. price and schedule extension)
4. Document Contact Actions Such as Directions to Contractors or Clarifications For Designers

5. Review The Following Submittals
   * Plans and Specifications
   * Monthly Payment Applications
   * Progress Schedules
   * Schedule of Values
   * Shop Drawings and Samples
   * Safety and Quality Control Plans
6. Coordinate Activities of Customer, Contractors, Designers via:
   * Pre-Construction Conference
   * Daily Contacts With Field Supervisors
   * Project Status Meetings (Changes Pending, Submittals, RFI, Action Pending Schedule Status)
   * Project Completion and Turnover (Punch List Completion, Ensure Compliance With Contract Requirements for Training, Warrantee, Record Drawings, Etc.)
7. Routinely Inspect Jobs for Safety and Quality *(Reference Field Observation Report in Standard Forms Section)*
   * Look for potential accidents affecting off-site personnel
   * Look for compliance with change order work
8. Notify Proper Personnel of Situations Involving:
   * Accidents
   * Utility outages
   * Construction quality deficiencies
   * Potential change order involving time or money
   * Situation involving reprimand or censure
   * Any controversial matters (crime, arguments)

ARCHITECTURAL SCOPE OF SERVICES

In initiating the generation of the architectural scope of services, the following should be answered:

1. Process to select an architect?
2. Define what design services are needed?
3. What will be the total design cost?
4. What is the anticipated duration to complete the design and bid the work?

In approaching the selection designer selection, please note, the process is not based on Competitive bidding due to the following: at this stage, in most cases, the scope of work is not defined well enough by the owner to get competitive bids from other designers; the best-qualified designer is needed, not the cheapest; the designer needs adequately perform as the owner's representative without cost related distractions. Most importantly, as it pertains to Federal (and many state) projects Public Law 92-582 (Brooks Act) exempts design work from competitive bid procedures for the reasons stated above.

The Design and Construction Project Manager shall utilize Metro's Purchasing Department to facilitate the bid solicitation process. Purchasing designer selection process shall consist of the following:

1. Advertise
2. Slate (create a list of potential designers, usually 3)
3. Select (evaluate the candidates, based on interviews, and logically choose one)
4. Negotiate (after choosing the best qualified firm, negotiate the fee)

A written design contract statement of work will allow Metro to proceed with the design phase quicker, because you will have a clearer vision of your design service needs before meeting with the potential architects. (SEE DESIGN CONTRACT STATEMENT OF WORK.)

Once you have identified your service needs, the next step is to actually choose an architect. Many factors will be used to make this decision, so the fairest method is to create a rating factor analysis. These evaluation factors, and the weight assigned are agreed to by the selection panel in advance of any meeting with the designers.

Designer Rating Table for Designer
Example

Rating Factor	Weight Assigned	Score (1-5)	Weighted Score
1. Firm's prior experience this type of work	30		
2. References	10		
3. Do they listen to your needs	10		
4. Do you "like" them	25		
5. Qualifications of those will actually perform the design	25		
	100		Total Score:

**** Please note, the assigned Purchasing Agent shall define the assessment rating scales/table*

After the designer's have been rated accordingly, the next step in the evaluation process will be to evaluate the fees. Historically, the design fee negotiation preparation is 90% of the negotiation. Understandably there will be some cost factors that will not be able to be quantified with ease, however the following are clear quantifiable items:

1. The number of progress meeting site visits, and their reimbursable costs.
2. The unit cost for printing plans and specs, but not the final quantity.
3. The need for models, renderings, etc.
4. The hourly billable costs for designer time

The Project Manager can make educated estimates of design time needed, based on the proposed scope:

1. How many drawings are needed to define the major elements of the work:
   a. Architectural
   b. Structural
   c. Mechanical, Plumbing, Electrical
2. How many hours are needed to make each drawing?
3. How many meetings are expected with the owner?

Architect/Designers use many methods of determining the design fee for a project which are the following:

1. Time based methods:
   a. Hourly billing for each designer (includes salaries, benefits and OHP.)
      i. Calculate hourly cost rates (SEE DESIGNER BILLABLE RATES).
      ii. Estimate time to perform tasks in statement of work (SEE TYPICAL ARCHITECTURAL SERVICES).
      iii. Sample calculation (SEE SAMPLE FEE NEGOTIATION ANALYSIS).
   b. Professional fee plus expenses, which includes salaries, overhead and a lump sum profit. (8 to 12% of construction plus reimbursable)
   c. Multiple of direct designer expenses (direct salaries are multiplied by a factor covering benefits and OPH).

2. Value of work based methods:
    a. Estimated construction cost multiplied by a percentage.
    b. Stipulated lump sum. (what the market will allow)
    c. Multiply consultant's bills by a percentage representing designers OHP expenses.
    d. Square footage times a price factor ($/sf).
    e. Units. (number of units times a price factor ($/unit).
    f. Royalties (designer shares in owner's profit/income from the project).

Pricing methods are all fundamentally related to the amount of time the designer must spend to complete the project.

There are numerous estimating guides that contain data on the probable duration of both the design and construction phases based on the following factors:

1. Degree of difficulty of the project
2. Administrative process used by Owner (Metro)
3. Weather conditions

A representative sample of time and cost is shown below:

	SCHEMATIC DESIGN TIME (weeks)	
Construction Value (Millions $)	Simple Project	Complex Project
Under 1	2	3
5	3	4
10	4	5

	DD to FINAL DESIGN TIME (weeks)	
Construction Value (millions $)	Simple Project	Complex Project
Under 1	16	20
5	32	36
10	48	60

	CONSTRUCTION TIME (weeks)	
Construction Value (millions $)	Simple Project	Complex Project
Under 1	20	32
5	48	60
10	60	74
25	76	96
40	84	104

It can be anticipated the Architect's design will contain errors and omissions that will not be discovered until construction is in process. money during construction. Hence, in an effort to forecast these anticipated errors and omissions, it is reasonable to expect 1 to 3% of the construction cost will be for change orders.

Design Contract Statement Of Work

1. Outline format for Statement of Work for Design.
    - a. Scope of Work
        - i. Design service desired
            1. Planning, conceptual design, complete design
        - ii. Type of work to build
            1. New construction, renovation, addition
        - iii. Size of project
            1. SF, number of occupants (staff and customers), number of work stations (offices, special rooms)
        - iv. Location of project
            1. Address of site, company name.
        - v. Construction Budgets
            1. Funds available
            2. Redesign requirements to meet budgets
        - vi. Additional design services
            1. Site survey
            2. Soil borings
            3. Telephone/data system design
            4. Furnishing & equipment design
    - b. Time Schedule Submission Requirements
        - i. AE contract award date
        - ii. Design submittals dates
            1. Schematic
            2. Design Development
            3. Construction Documents
        - iii. Solicitation of bid date
        - iv. Construction contract award date
        - v. Start of construction date
        - vi. Occupancy date
    - c. Method of Contracting for Construction
        - i. Competitive Bid
            1. open bid list
            2. limited, pre-qualified bidders
            3. small business only
        - ii. Pre-selected contractor
            1. negotiate fixed price
            2. cost plus fixed fee
        - iii. Construction by Owner

d. Specifications and Drawings
    i. Specifications
        1. CSI (Construction Specification Institute) format
        2. Generic, no brand names allowed in spec.
        3. Proprietary items allowed
        4. At least three equal products
        5. Performance
        6. Referenced commercial standards
    ii. Drawings
        1. Size of plans (full or half)
        2. Quantity needed with each design submission for review
        3. Quantity for bidders
e. Additional project services
    i. Local permit applications
        1. Planning/Zoning Board (water & sewer connection)
        2. Code Officials review meeting
        3. Erosion permits
        4. Highway crossing permits
        5. Notification of additional power demand
    ii. Construction services
        1. Review and approval of contractor shop drawings, samples, catalog cuts.
        2. Keep minutes of progress meetings
        3. Site visits
        4. Inspections
            a. Periodic, Punch List, Final.
        5. Change order technical support and cost review
        6. Review of value engineering proposals
f. Cost estimates
    i. Life cycle estimates
    ii. Design estimates
        1. Schematic
        2. Design development
        3. Construction documents
g. Payment schedule
    i. Lump sums (with percent complete progress payments)
        1. Schematic
        2. Design development
        3. Construction documents
        4. Contract administration
    ii. Other services
        1. Hourly rates for staff and principals

Typical Architectural Services

Your Architect can provide a multitude of services from pre-design through final contract administration. The following list is useful during your negotiation of the fee, since it allows you to see where the costs are and how many hours of effort are expected for each.

PROJECT #:				
PROJECT NAME:				
			ESTIMATED	
Phase / Task	Staff (Professional non- Professional)	Billable Rate $/hr	Total hours	Total cost
PRE-DESIGN				
P1- administration				0
P2- programming				0
P3- master planning				0
P4- exist. facilities survey				0
P5- prelim. cost estimate				0
P6- site selection				0
P7- promotion				0
P8- presentation				0
P9- other				0
Subtotal			0	0
SCHEMATIC DESIGN				
S1- administration				0
S2- design				0
S3- drafting				0
S4- field survey				0
S5- cost estimate				0
S6-presentations				0
S7-other				0
Subtotal			0	0

DESIGN DEVELOPMENT				
D1- administration				0
D2- design				0
D3- drafting				0
D4- field survey				0
D5- cost estimate				0
D6- outline specifications				0
D7- consultant coord.				0
D8- presentation				0
D9- other				0
Subtotal			0	0
CONSTRUCTION DOCS.				
C1- administration				0
C2- change in scope				0
C3- working drawings/				0
drafting				0
C4- working drawings/				0
design				0
C5- cost estimate				0
C6- specifications				0
C7- consultant coord.				0
C8- quality control				0
C9- other				0
Subtotal			0	0
phase / task	staff	rate	hours	cost

BIDDING / NEGOTIATION				
B1- prebid administration				0
B2- post bid administration				0
B6- addenda				0
B9- other				0
Subtotal			0	0

CONSTRUCTION ADMIN.				
A1- administration				0
A2- shop drawing review				0
A3- record drawings				0
A4- observation				0
A5- change orders				0
A6- close-out				0
A7- coordination				0

A8- other				0
Subtotal			0	0
ADDITIONAL SERVICES				
X1- administration				0
X2- renderings / models				0
X3- drafting				0
X4- exist. building survey				0
X5- extended admin.				0
X6- other				0
Subtotal			0	0
TOTALS			0	0
SUMMARY				
Total Fee:				$-
Engineering Consultants:				$-
Total Design FEE:				$-

FACILITY PROGRAM MATRIX

Since the planning process establishes the basic customer desires for the new facility, which are used to define the facility needs, it is essential that all aspects of the project be evaluated. Developing planning data involves the collective action of the user groups, Design & Construction Management, and possibly a planning consultant.

ELEMENTS	GOALS / NEEDS	FACTS/ CRITERIA	SOLUTIONS/ OPTIONS
1. **HUMAN**: a. Function (what is purpose of space) b. Social (how do work groups interact) c. Physical (client age, children/ elderly, ADA) d. Physiological heat sensitive elderly, light glare) e. Psychological (colors, create feelings of calm/energy??)			
2. **ENVIRONMENTAL:** a. Site (views, topography) b. Climate (temperature, sun angle) c. Context (off site traffic patterns, other building shadows) d. Resources (available water, air, fuel, building materials) e. Waste (trash, sewer)			
3. **CULTURAL:** a. Historical (historic districts, native designs) b. Institutional (purpose of space: prison, hospital) c. Political (zoning, planning boards) d. Legal (building/fire codes)			
4. **TECHNICAL**: a. Materials (client wants specific material used: brick/ adobe) b. Systems (Mech/Electric systems, ceiling styles, light types) c. Process (time available, fast track, modular)			

NOTE: Every ELEMENT is not applicable to each project. Select the relevant ones or modify titles to suit specific project descriptions.

ELEMENTS	GOALS / NEEDS	FACTS/ CRITERIA	SOLUTIONS/ OPTIONS
5. **FLEXIBILITY:** a. Growth (need for future expansion?) b. Change (flexible for changes in use) c. Permanence (long life or short)			
6. **ECONOMIC:** a. Finance (feasibility? commercial market assessment) b. Construction (establish realistic budget) c. Operations (staffing cost impact) d. Maintenance (replacement cycle for… roof, HVAC) e. Energy (cost of energy)			
7. **AESTHETIC:** a. Form (what it looks like.. color, shape) b. Space (open plan, or cubicles) c. Meaning (image to community.. power, friendly..)			
8. **SAFETY:** a. Structural (stable won't fall down, special equipment needed) b. Fire (special needs) c. Chemical (on or off site pollution) d. Personal (working space around equipment) a. Criminal (lighting, prisoner control)			
9. **OTHER:**			

SPACE PERFORMANCE DATA SHEET

After the broad programming goals are developed, specific requirements for each space need to be documented so the designer can incorporate these needs into the design. The Space Performance Data Sheet is also used by the Owner Representatives when making their design reviews to confirm that there aren't any critical requirements that have been inadvertently excluded. The following is an example:

NAME OF ROOM:	Teletorium
FUNCTION:	Large meeting room with teleconferencing capability
NET AREA (SF) (Note criteria e.g. 10 SF /person)	3000 sf
OCCUPANCY: (Number of people e.g. staff and visitors)	300 in fixed seats
EQUIPMENT (Special equipment e.g. Sound system, oxygen pipes)	Large screen TV, Overhead data projector, Microphone at each seat
CRITICAL FACTORS: (Special needs e.g. Acoustic levels, access or views to other spaces)	Light levels high enough for TV camera images of audience
FINISHES: (cleanable, durable) Wall Ceiling Floor	High quality surfaces, corporate looking, carpets
SPATIAL RELATIONSHIP: (Describe adjacency needs (bubble diagram or matrix) Usually separate attachment)	Next to the lobby, breakout study rooms, and catering kitchen
OTHER:	

PROJECT BUDGET ESTIMATES

Project approximate budget estimates are based on the total square footage to be constructed with cost factor adjustments for geographic location, complexity of the design (height, environmental systems, etc.), and the required quality of the finishes. These unit costs are available from a variety of estimating services such as R.S. Means. The following table demonstrates how the estimated construction costs are marked up to include total project costs such as design, equipment, and site development.

Cost Estimate Elements (typical values shown)	Formula	Approximate Estimate $
A. Facility Cost (gross square footage)	$/SF x gross SF	
B. Site Development (utilities, roads) 5 – 25% of A	10% of A	
C. Fixed Equipment (built in not movable) 5 – 25% of A	8% of A	
D. Total Construction	A+B+C	
E. Design Fees (5 – 15% of D)	10% of D	
F. Construction Contingency (3-10% of D)	3% of D	
G. Movable Equipment (5 – 25% of D)	10% of D	
H. Land Acquisition (use appraisal)		
I. Total Budget	D+E+F+G+H	

As the design progresses the estimate will become more accurate, but it will always just be the designer's best guess.

Project Estimate Unit Costs
Example

Costcode	Description	Quantity	Unit	MATERIALS$/ Unit	Labor Hrs/Unit	LABOR $/ Unit	OTHER $/ Unit	TOTAL $/Unit
01	**GENERAL**							
01020	**PROFESSIONAL**							
010201000	Building permit		Ea	0.00	0.000	0.00	125.00	0.00
010201100	Engineer		Hr	0.00	1.000	83.00	0.00	0.00
010201200	Architect		Hr	0.00	1.000	83.00	0.00	0.00
010201400	Draftsman		Hr	0.00	1.000	32.00	0.00	0.00
010203160	Supervision		Hr	0.00	1.000	45.50	0.00	0.00
013301300	Surveyor		Hr	0.00	1.000	69.50	0.00	0.00
01410	**TESTING**							
014101100	Aggregate test		Ea	0.00	0.000	0.00	80.00	0.00
014101120	Compression test, cylinder		Ea	0.00	0.000	0.00	50.00	0.00
01500	**TEMPORARY FACILITIES**							
015003000	Temporary repairs		Ea	28.55	3.600	163.80	0.00	0.00
015003100	Temporary CL fencing, 5' H		Lf	9.60	0.250	11.38	0.00	0.00
015003200	Temporary lighting		Lot	48.75	2.100	106.58	195.00	0.00
015003300	Temporary power		Lot	85.50	2.750	139.56	425.00	0.00
015003410	Power pole, 100 Amp		Mon	0.00	0.000	0.00	90.00	0.00
015003430	Power pole, 200 Amp		Mon	0.00	0.000	0.00	100.00	0.00
015003450	Electricity per 1000 Sf		Mon	34.50	0.000	0.00	0.00	0.00
015003460	Temporary office trailer, 24' long		Mon	0.00	0.000	0.00	225.00	0.00
015003500	Temporary plumbing		Lot	190.00	9.000	456.75	400.00	0.00
015004100	Temporary roof		Lot	410.00	10.000	455.00	280.00	0.00
015004200	Temporary board up		Lot	375.00	8.000	300.00	0.00	0.00
015004210	Board-up cover, min		Lot	48.000	2.500	93.75	0.00	0.00
015004220	Board-up cover, one sheet ply-wood		Ea	20.000	1.100	41.25	0.00	0.00
015004230	Board-up cover, two sheets plywood		Ea	30.000	1.750	65.63	0.00	0.00
015004300	Temporary construction		Lot	365.00	16.000	600.00	225.00	0.00
015004400	Portable toilet		Mon	0.00	0.000	0.00	120.00	0.00
015004420	Temporary water, 1000 Gallons		Lot	78.00	0.000	0.00	0.00	0.00

FACILITY BUILDING CODES

In addition to the design parameters you have established for your new facility, there is another mandatory source of building criteria, which must be incorporated into the design. Every state has adopted a similar, but different, set of minimum design requirements, which are intended to protect the public from unsafe or unhealthy facilities. These "code" requirements may force you to include additional exit hallways, or eliminate dead end passages, or include a fire sprinkler system in the building. Every facet of the design is governed by these codes from fire ratings of material to the number of toilets for men and women.

Early in the design process, it is strongly recommended that you and the design team discuss the overall design concept with the code officials to elicit their concerns. This is not an "approval" of the design, but it will establish a baseline for the formal building permit review.

Most states use building codes based on one of following Model Codes:

1. SBC – Southern Building Code (south mainly)
2. International Building Code
3. National Conference of States on Building Codes and Standards – BOCA (northeast mainly)
4. Combinations of the above codes

Building codes cover the following general topics:

1. Occupancy (assembly, classroom, housing, etc.)
2. Special Use Occupancy (chemical storage, fuel depot)
3. Types of Construction (combustible, noncombustible)
4. Fire resistance of materials and construction
5. MEP (number of fixtures, air flow, insulation thickness)
6. Fire protection systems (alarms, sprinklers)
7. Means of egress (stair size, length of hallways)
8. Accessibility (ADA)

After you have complied with the appropriate state codes, you will discover that they have incorporated by reference a whole host of other codes, which also govern your project. Some of these are:

1. Plumbing (BOCA, SPC, UPC)
2. Mechanical (BOCA, NMC, UMC)
3. National Electric Code (NEC)
4. Life Safety Code (NFPA 101)
5. One and Two Family Dwelling Code (OTFDC)
6. Code of Federal Regulation (CFR) in lieu of local codes on Federal Projects.
7. Americans with Disabilities Act (ADA) Not a code. It's a LAW.
8. Fair Housing Act (FHA) residential version of ADA.

Lastly, you will have to comply with various national standards, which are also included by reference in the codes. Some of these are:

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
4. Underwriters Laboratory (UL)
5. National Fire Protection Association (NFPA)

Sample Code Review Procedure

A. OCCUPANCY AND SIZING

1. Occupancy Classification
    a. Pick the appropriate use from the Building Occupancy Table (A-Assembly,…S- Storage)
        i. Assembly will be the most restrictive/expensive
            1. Protecting large numbers of people
    b. If mixed use then the most restrictive use governs
2. Covenants
    a. Check property deed or subdivision rules for restrictive covenants
        i. Set back from property line
        ii. Attached/detached structures
        iii. Style of building
        iv. Minimum size of building
3. Municipal Zoning Ordinance
    a. Check Zoning Regulations
        i. Allowable uses of property (Residential, Business..)
        ii. Set backs from property line.
        iii. Max height (fire truck limits??)
        iv. Minimum size of building
        v. Off street parking required
4. Minimum Occupancy Load
    a. Enter building code table for your facility use
    b. Either Net or Gross SF used to determine occupant load
5. Means of Egress
    a. Use the Minimum Occupancy Load to size the following:
        i. Minimum number of exits
        ii. Maximum travel distance to exits
        iii. Minimum hall width
        iv. Minimum stair width
        v. Minimum door opening width
        vi. Maximum dead end hallway
    b. See building code table
    c. Minimum number of exits (SBC1004.2.2)
        i. Occupancy 1-500 = 2 exits
        ii. Occupancy 501-1000 = 3

iii. Occupancy over 1000 = 4

d. Distance separation between exits (SBC 1004.1.2)

i. At least one half the length of the maximum diagonal dimension of the building or area being served by the exits.

ii. Example

Room 90 x 90 = 127' diagonal

½ of 127' = 64' separation of the exits

6. Bathrooms

a. NOTE: the Minimum Occupancy for bathrooms is NOT THE SAME AS EGRESS OCCUPANCY. (407.1.3 SBC)

i. Deduct corridors, toilet rooms, stairways, vertical shafts, equipment rooms, custodial closets.

ii. Then divide the remaining square footage for the Occupancy.

b. Select the male/female ratio from plumbing code

c. Enter plumbing code table to determine the number of fixtures:

i. Water closets

ii. Urinals

iii. Lavatories

iv. Showers

d. Size the bathrooms to meet the fixture counts AND the American With Disabilities Act (ADA) dimensions.

i. Larger stalls for wheel chairs (5' radius)

ii. Calculate the minimum number of ADA fixtures (toilet, sink)

iii. At least one for each sex will be required

TYPE OF CONSTRUCTION AND FIRE RATINGS

1. Type of Construction
   a. Enter building code table for your building Occupancy.
   b. Pick TYPE of Construction desired that matches the size and height of the desired facility.
      i. TYPE VI (un-sprinkled) will be the cheapest so start there.
   c. Obtain the following allowable sizes from the Table:
      i. Max number of stories
      ii. Multi-story area
      iii. Single story area
2. Fire Ratings
   a. In order to achieve the higher Types of Construction (I, II, sprinkled, etc.) classification the cost will change due to:
      i. Fire rated hallways
      ii. Automatic closures on all doors in halls
      iii. Sprinkler systems
      iv. HVAC ductwork fire dampers at rated walls
      v. Alarm and detection systems
      vi Areas of refuge per floor
   b. Choose the Type carefully since it has a significant cost and detail of construction impact

OTHER CODES TO CHECK

1. Building (structure loads storm, earthquake)
2. Electric (circuit sizes, location of outlets)
3. Mechanical (fresh air, energy conservation)
4. Plumbing (fixtures and piping)
5. Gas
6. Fire (alarms, detection)
7. Energy (efficiency of equipment)
8. Accessibility (slope of walks, signage, width of doors, seating)

CERTIFICATION OF BUILDING CODE RESEARCH

1. Every project submitted for building permits must have a cover sheet summarizing the code compliance of the design.

DESIGN PHASE CHECKLIST

Construction design is an interactive process where money and desires are converted into safe, functional facilities through the application of engineering principles and architectural ideals.

The four phases of design are: Conceptual, Schematic, Design Development, and Construction Documents. Each phase builds on the decisions from the previous phase, and the level of design detail increases at each successive level. The following check list is based on the W.D. Middleton's work in Facilities Management: A Manual for Plant Administration Part IV, Facilities Planning, Design, Construction, and Administration. The purpose of this checklist is to highlight the information being provided by the designer with review action notes for the owner to consider.

1. CONCEPTUAL PHASE

2. SCHEMATIC PHASE
   A. Designer's Deliverable:
      I. Plans & Elevations- Rough drawings to scale, no MEP systems, verify utility system availability
      II. Outline specifications- No details, rough indicators of basic materials (exterior/interior)
      III. Cost estimate- gross square foot rates, percentage cost factors for MEP systems
      IV. Renderings and models- useful for fund raising, final design could be different due to cost or design issues (big smoke stacks on the roof?)
   B. Project Management Issues:
      I. Scope creep- beware of designer or customer changes which increase cost
      II. Schedule slippage- too many changes, program scope revisions, or tardy review of plans by the customer
      III. Design review and approval- verify that the design meets the program objectives (overall needs, and room by room)
      IV. Quality assurance- reinforce requirement for designer to follow owner's design guidelines. Make designer document any variances from the standards
      V. Code compliance- check basics of fire exits, maximum building heights, and ADA access
      VI. Design contingency- since MEP systems are not defined, nor is the building design very specific at this stage then retain 10% of the construction estimate to cover changes during design
      VII. Cost and budget estimates- check against feasibility estimates for increases.

VIII. User committees- this is the last chance to make significant changes and to verify the attainment of basic program needs.

3. DESIGN DEVELOPMENT PHASE (DD)

A. Designer Deliverable:

I. Plans- final dimensions and layouts to scale. MEP plans 70% complete (show piping, duct chases, and equipment layouts).

II. Specifications- all sections are included, but MEP is still partial.

III. Cost estimate- based on quantities of materials, may be done by independent cost estimator.

B. Project Management issues:

I. Design review- focus on the items that have changed since Schematics, primarily MEP and finishes.

II. Technical review- are the owner specification guidelines being followed?

III. Scope creep- items previously disapproved reappearing?

IV. Cost and budget- look for value engineering opportunities, especially in MEP.

4. CONSTRUCTION DOCUMENTS PHASE (CD)

A. Designer deliverable:

I. Plans- all done, MEP details have been added.

II. Specifications- all done, MEP details have been added.

III. Cost estimate- based on latest MEP design, no design contingency remains.

IV. Bid forms- includes alternatives.

V. General Conditions- includes all of the legal wording.

VI. Supplemental Conditions- contains your special requirements (parking, work hours, utility costs, site fencing, signage, etc.).

B. Project Management issues:

I. Design review- there are many MEP items you have not seen in prior submissions. Focus on any changes from DD.

II. Scope creep- look for excessive bid alternatives.

III. Schedule slippage- allow reasonable time to bid even if the design is late. Rushing bidders can push up the bid prices.

IV. Constructability review- double check existing conditions shown on the plans (utilities, roads, etc.).

V. Supplemental conditions- make sure that your standards have been followed.

VI. Bid form- look for conflicting bid alternates. Make sure that unit prices are included for any anticipated extra work (rock removal, soil removal). Verify time and place for bid submission.

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CONSTRUCTABILITY REVIEW

By the time that the design has reached the bid document stage there are few opportunities to make
improvements or changes without causing added design cost and delay the project. It is not too late to correct errors, which would cause defective bidding or result in costly change orders to the work.
Addendums can be issued during the bidding phase, but they do complicate the process of getting bids, since the bidders must read through several documents in addition to the original bid set. For the reasons mentioned above, Metro agencies and the end user should be cautioned that any modifications or changes will need to be picked up their individual agencies' expense.

The following guidelines are provided to help you perform this review in a timely, but accurate manner:

1. Visualize the project first
    - A. Read Summary of Work.
    - B. See site plan and drawing index.
    - C. Look at floor plans and architectural elevations.
        - i. What are the principal materials of construction for:
            1. Floor
            2. Wall
            3. Roof
        - Ii. Where are the exterior items:
            1. Parking lot/roads
            2. HVAC units
            3. Transformer
    - D. Scan Division 1 for:
        - i. Time for completion
        - ii. Owner provided items (utilities, material)
        - iii. Salvage material
        - iv. Safety
        - v. Quality control plans
        - vi. Schedules required
        - vii. Progress meetings
2. Detailed study of plans: (make notes on plans in color as you go, if more than one person reviewing then use different colors for each person.)
    - A. Find utility connections to existing:
        - i. Water, sewer, electricity, storm water, telephone, gas (cut off valves for all? Or outages later)
    - B. Locate limits of construction
        - i. Close existing parking or roads?
        - ii. Close walkways?
        - iii. Fence required (what type? Screen fabric?)

C. Scan other drawings to see:

i. Footing depth and soil conditions (water table depth, deep footings?)

ii. Location of mechanical room inside

iii. Location of building services outside (water, sewer, gas)

iv. Location of exterior equipment (HVAC chillers, transformers)

v. Any special equipment

1. Elevator

2. Generator

3. Scan specifications:

A. Look for unusual sections

i. Generators

ii. Special equipment

iii. Alarm systems

B. Look at bid items and alternatives

i. Do they make sense if awarded (complete scope of work)

CONSTRUCTION DOCUMENT PRECEDENCE

The document that is signed by the Owner and Contractor is called the Contract Agreement. It can have many formats depending on the type of contract (design-build, lump sum construction, construction management, etc.). Typically the architect creates the contract utilizing American Institute of Architects (AIA) standard forms, but this is not the only source of contract formats. The Association of General Contractors (AGC) and the Construction Management Association of America (CMAA) also produce standard formats. They are all generally the same, but the difference is in the details. The "legal" fine print needs careful review, because the responsibilities and duties of the contract parties are subtly shifted, depending on the perspective of the agency that created the documents.

The Contract Agreement generally includes the following information:

1. Names and addresses of the owner and contractor.
2. Brief narrative describing the work.
3. Date of commencement and completion.
4. Contract amount (unit prices if any).
5. Progress payments including retention.
6. Final payment procedures (all work satisfactory).
7. Miscellaneous (interest on late payments)
8. Termination
9. Enumeration of contract documents (list every drawing and specification, and addenda)
10. Signatures of the owner and contractor.

A construction contract is made up of more documents than just the technical specifications and drawings. The bidding documents include items A through F below, while the final contract is made up of items B through G (*see Table 1 Contract Documents*).

Now that you have assembled all of these documents, in instances where different sections of the contract contradict other sections, step one is to determine the correct technical solution to the irregularity, then decide if it is a change order or not. Usually the material typed specifically for your project will govern over preprinted standard clauses. This means that more time should be spent reviewing the nonstandard clauses.

Table 1
Contract Documents

A. Bidding Requirements	
1. Invitation to bid	
2. Instruction to bidders	
3. Bid forms	
4. Bid bonds (protects the owner if the low bidder withdraws and the second low is selected at a higher cost)	
B. Contract Forms	
1. Final agreement for signature	
2. Performance Bond protects the owner if contractor fails to perform the work)	
3. Payment Bond (guarantees the subs payment)	
4. Certificates of insurance (Workman's Compensa~ tion, Builder's Risk, Liability)	
C. Contract Conditions	
1. General Conditions (owners use various versions. AIA, Federal, AGC, etc.)	
2. Supplementary General Conditions	
D. Specifications	
Division 1 Administrative Divisions 2~16 Technical	
E. Drawings	
F. Addendums (changes issued before bidding)	
G. Contract modifications (changes issued after award)	

It is generally accepted that the precedence of the contract documents is as follows:

Table 2
Precedence of Contract Documents

Change orders issued after award.	
The Agreement (signed form with administrative clauses, such as time for completion, total price, and also references the specs and drawings to include them in the contract.)	
Addenda (those with a later date have precedence over earlier versions).	
Supplementary Conditions (included in the Specification package, they vary for each project)	
General Conditions (preprinted fine print clauses that don't vary for each project)	
Division 1 of the Specifications (Administrative)	
Divisions 2-16 of the Specifications (project specifications precede referenced standard specifications)	
8. Drawings:	
Detailed project drawings	
General project drawings	
Standard (reference) drawings	
Shop drawings from contractor	

BID EVALUATION

Bids were received by Purchasing should be stamped with a time and date of receipt. Assuming that when the bids were opened at the specified time, no bidders or other members of the public were invited to attend. Your Architect proceeds with filling out a bid tabulation sheet, which includes the designer's estimated cost (SEE BID TABULATION). After bids are opened, they must be evaluated to insure that the contract is awarded to the low, responsive, and responsible bidder. The Supplemental GeneralConditions in the Invitation for Bids usually define the process to be followed including rejection of all bids. The bid evaluation process includes the following steps.

1. Price evaluation.
    A. Who has the lowest price?
        i. Is it too low to be realistic?
        ii. Will they cut corners or ask for excessive change orders?
    B. Are there unit prices included which may be excessive?
    C. Is the math correct?
        i. Bid alternatives added to equal the grand total?
        ii. Unit prices for work times the estimated quantity?
2. Responsive evaluation
    A. Forms completed properly?
        i. Signed bid, bonds, addenda acknowledged?
    B. Bid on time?
    C. No exceptions or qualification to the specified work.
        i. Clarifications and suggested deductions are not fatal issues.
        ii. Work exclusions are not acceptable.
3. Responsible evaluation
    A. Can this contractor perform the work?
        i. Pre-qualification process

Utilizing a Bid Tabulation form , determine the low, responsive, and responsible contractor given the following (see *Bid Summary Example and Bid Tabulation Form*):

Bid Summary Example

Architect/Owner data:

Estimate $640,000, Addenda #1 & #2 were technical changes
Addendum #3 changed bid time to 30 Nov @ 3pm
Alternative #1(brass door knobs) $3000
Bid bond required
Original bid date 28 Nov 2001 @ 3pm.

Giantt Contractors.

Bid $781,000
Addendum 1,2,3 acknowledged
No notes on bid
Bid bond attached
Received 2PM 28 Nov 2001

Alternative #1 $5000.Smalle Contractors.

Bid $510,000
Addenda 1 & 2 acknowledged
Alternative #1 $2000
Bid bond; received 3pm 30 Nov 2001.

Okay Contractors.

Bid $698,000
Three Addenda acknowledged
Alternative #1 $3,000
Bid bond
Received 2:59pm 30 Nov 2000

Slowe Contractors.

Bid $695,000
Three addenda acknowledged
Alt #1 $2500
Received 3 PM 30 Nov 2000
Bid bond

Bid Tabulation Example

Bidder	Addenda	Base Bid	Alternate 1	Alternate 2	Total Bid with Alts	Unit price 1	Unit price 2	Unit Price 3	Notes on bid?
AE Est dated									
Bidder 1									
Bidder 2									
Bidder 3									
Bidder 4									
Bids opened by:									

VALUE ENGINEERING

In instances where a bid is beyond the forecasted budget, there are two approaches:

1. Redesign and rebid the project. Your designer has a contract with you to design a facility within a reasonable variation from the budget estimate.
2. Negotiate with the low bidder and reduce costs by value engineering.

If the agreed upon approach is value engineering, the contractor is invited to a meeting with you and the architect to discuss his ideas for cost reduction. If two contractors have reasonably competitive bids, then ask each one to meet separately with you. This will provide some competitive pressure on the contractors, since they know there is still a chance someone else will get the job if their final price is too high.

Cost savings ideas are not "unfeasible" at this stage, but the integrity of the design intent should be maintained by telling the contractor not to pursue unacceptable reductions. Lists of possible reductions are created and prioritized for their dollar value and relative impact on the design (SEE SAMPLE VALUE ENGINEERING LIST). The contractor submits and the architect validates cost savings. This phase resembles a change order negotiation, where you are trying to discover how the cost reductions are calculated (labor, material, and equipment costs). The contractor is going to explain that the labor costs won't vary significantly no matter how much you delete. (Note: The opposite position is presented when you have additive change order.)

Material substitutions usually generate the most cost savings, especially, if you can get the contractor to get competitive bids. Focus on those items, which will be the least visible when the work is done, that way you can maintain the "look" of the facility. All of these pricing activities are going to take place under severe time constraints in order to meet your proposed conceptual schedule.

Track Value Engineering Ideas
Example

ITEM #	VALUE ENGINEERING IDEAS	SOURCE	VALUE	ACCEPTED ??	NOTE
1	Eliminate the import of 6" of top soil fill on the field inside the track. 2094 CY	OWNER	$41,788	$41,788	Previously deleted by Addenda #2, JHA had included by mistake.
2	Eliminate the poured-in-place concrete ring on the outer perimeter of the track. 58 CY	GC	$30,488	NO	
3	Delete Sprigging infield and 90 day Maintenance Period	OWNER	$20,000	$20,000	by others later
4	Eliminate the "As-Built" certifications for ABC, Asphalt Paving, ,BUT NOT Synthetic Surfacing, AND Line Marking.	GC	$11,000	$7,000	
5	Eliminate the Site Construction Fence.	OWNER	$5,600	$5,600	
6	Change vinyl fence fabric to galvanize	GC	$3,600	NO	
7	Change channel drains to ACCO 4010 with #420 galvanize grate	GC	$3,000	$3,000	? Ken verify
8	Utilize WASHED WHITE sand in lieu of Bunker Sand.	GC	$2,500	$2,000	
9	Delete 44 Y fittings for future field drains (6")	GC	$2,000	$2,000	?? VALUE
10	Change field drain material from ADS-N12 to Hancor Co.	GC	$2,000	$2,000	?JHA to verify
11	Change fence black bottom pipe to 6ga tension wire	GC	$1,600	$1,600	
12	Eliminate the Prime Coat under Asphalt Paving. (This procedure has been eliminated on most projects due to potential environmental problems.)	GC	$1,500	$1,500	?? CALL S&ME
13	Utilize Quarry Screenings in lieu of Decomposed Granite.	GC	$1,400	$1,400	?? GET SAMPLE
14	Eliminate the Herbicide Treatment under Asphalt Paving.	GC	$1,000	$1,000	
	TOTAL		$129,976	$91,388	see note

PROJECT FILE STRUCTURE

Prompt and accurate retrieval of contract documents is essential to successful project management. Project files start with the planning documents, and are closed out when the final inspections and turnover is complete. Large organizations that have separated planning from construction will have two sets of documents, which makes the Project Manager's job more difficult, when researching a problem involving planning and intent of design.

The construction contract file must contain a complete set of documents including the Agreement, Addenda, and Changes. Filing is done by type of document and their sequence of occurrence. Preconstruction would be first and Warrantees last. (SEE CONTRACT FILES.)

In addition to construction costs, there will be purchases for furniture, data/telephone equipment, moving, design fees, physical plant support, engineering, and abatement.

Contract Files

Planning Phase:

* Customer's initial scope of work
* Preliminary Planning Data
    * Facility size
    * Approximate budgets
    * Master Plan site options
* Planning layouts for rooms
* Preliminary funding options
* Approved planning scope of work and budget

Design Phase:

* AE Contract +Addendum to AE contract
* Design Stages
    * Schematic Design
        * Submissions/Review comments
    * Design Development
        * Submissions/Review Comments
    * Construction Documents
        * Submissions/Review Comments
    * Additional AE services
        * Furnishings Plan
        * Other services

* Engineering Contracts
    * Surveys
    * Engineer's Construction Field Reports
    * Construction Test
        * Soil
        * Concrete
        * Other (steel, fire proofing, roofing, precast, etc.)
* Permits
    * Erosion Control
    * Road Crossing
    * Sewer/water service
    * Check Requests for permits

<u>Construction Phase:</u>

* Construction Contract
    * Addendum
    * Invitation for Bids
    * Bids and evaluation form
        * Bonds, insurance, Workman's Comp.
    * Value Engineering
        * Submitted VE ideas
        * Approved VE Ideas
* Formally Issued Change Orders in numeric order
* Pre-Construction Meeting
    * Insurance Certificates
    * List of Subcontractors
* GC Progress Payments & Lien Release
* Requests For Information (RFI)
    * RFI Summary Log
* Changes
    * Proposal Requests
    * Change Order Log
    * Pending Change Orders (PCO'S)
    * Change Directives pending formal change order
* General Contractor Daily Reports
* Progress Meetings (Bi-Weekly Minutes)
* General Correspondence from
    * AE
    * GC
    * Other
* Project Schedules / Monthly Progress Reports

<u>Close Out</u>:

* Punch list inspections
* Administrative close out documents
        * Manuals, warrantees, as built drawings,
        * Certificate of Occupancy

* Project Blue Prints
    * On a stick file in the project office
* Submittals (Shop Drawings, Technical Data per Specification Division 1 – 16)
    * 1- Administrative (General requirements/special conditions)
        * Photographs
        * O&MN manuals
        * Warrantees and bonds
    * 2- Site work (paving, grass, termites)
    * 3-Concrete
    * 4-Masonry
    * 5-Metals (structural, stairs, railings)
    * 6-Wood & plastics
    * 7-Thermal and moisture protection (roofing, insulation)
    * 8-Doors and windows
    * 9-Finishes (flooring, carpet, paint, gypsum wallboard)
    * 10-Specialities (toilet accessories, flag poles, lockers..)
    * 11-Equipment (projection screens, food service)
    * 12-Furnishings (lab case work, theatre seats)
    * 13-Special construction (metal buildings)
    * 14-Conveying systems (elevators)
    * 15a-Mechanical HVAC
    * 15b-Plumbing
    * 16-Electrical (fire alarm, lights, wiring)

In order to keep accurate track of project costs it is essential that your accounting system be able to monitor multiple lines of budget and cost data. You may have additional budget managers involved with the project each responsible for a different aspect of the work, such as computers, audio visual, furnishings, and telephones. Each of these managers needs a specific budget and the means to track costs. The following categories are provided for your accounting cost codes:

PRE-CONSTRUCTION AGENDA

The Pre-Construction Conference is the last administrative check point before work commences. The Project Manager meets with the following people to verify that the project is ready to start in an orderly manner:

1. General Contractor
2. Architect
3. Principal subcontractors (Mechanical, Electrical, Plumbing) - (*Where Applicable*)
4. Design Contract Administrator (Structural, MEP)
5. Customer Representative
6. Project Field Inspector (*Where Applicable, for example ADA*)
7. Other (security, etc.)

The agenda for this meeting includes information in the following general categories:

1. General Administrative
   A. Contact names
   B. Phone numbers, fax number, etc.
2. Contractual
   A. Signed documents
   B. Bonds
   C. Insurance
      i. Workman's Compensation, liability by contractor
      ii. Builder's Risk by owner
3. Contract procedures
   A. Progress meeting dates (biweekly, monthly)
   B. Shop drawing submission paper flow (number of copies, etc.)
4. Payment processing
   A. Monthly due date
   B. Processing sequence (designer to owner)
   C. Schedule of Values (billable items of work)
5. Change orders processing
   A. NO verbal changes.
   B. Only the owner's Project Manager can authorize changes
6. Quality control
   A. Contact person for testing lab
   B. Scheduling procedure for field tests (GC call lab direct)
7. Close out procedures
   A. Training
   B. Spare parts and operations manuals

8. Other
   A. Security
   B. Telephone services
   C. Utility services
   D. Emergency response process (accidents, crimes, etc.)

Division 1 of the specifications and the Supplementary General Conditions, which were written specifically for your project, contain most of the information needed to create the Pre-Construction Agenda. (SEE SAMPLE PRECONSTRUCTION AGENDA.)

The resultant of this meeting is permission for the contractor to proceed with the site work. If you have not verified proper execution of the contract documents including the insurance certificates and bonds, **then do not proceed**.

Sample
Preconstruction Agenda

Fill in the contract data before the meeting, and the specification requirements as well.
Reference Meeting Agenda in Standard Forms section for formatting.

1. Project Title and Location:
2. Contract Documents
   i. Contract signed
      1. Addenda included
      2. Value Engineering included
   ii. Bonds
      1. Performance
      2. Payment
   iii. Insurance Certificate
   iv. Building Permit
3. Contract Dates:
   i. Contract Award date:
   ii. Contract Completion date:
   ii. On site start date:
4. Project Organization:
   i. Owner
      1. Construction Manager:
      2. Customer Representative:
   ii. Design Contract Administrator:
      1. Design Contract Administrator
      2. Structural Engineer
      3. MEP Engineers
   iii. Prime Contractor Representative:
      1. Project Manager
      2. Superintendent
5. Specification SECTION 01010 Summary (owner work)
   i. Owner to install telephone/data and kitchen equipment.
   ii. Security limited access and minimum light 5 ft candle.
   iii. Coordinate with owner as required and make coordinated shop drawings if required.

6. SECTION 01025 Payment, Modifications, Completion (billing process, change process)
    i. Use AIA format.
    ii. Due on the 25th
    iii. Schedule of Values (Itemize the work for progress payment billing verification. Normally follows the 16 Divisions in the specification).
7. SECTION 01030 Alternatives, Allowances, Unit Prices (if any)
    i. List allowances.
8. SECTION 012000 Progress (schedules, meetings)
    i. CPM schedule.
    ii. Progress meeting agenda, schedule, format.
9. SECTION 01300 Submittals (how many copies)
    i. Submit ___ copies to AE.
        1. Send a copy direct to Owner
    ii. Three copies will be retained (AE, Engineers, Owner).
10. SECTION 01400 Quality Control (by who)
    i. Testing lab contact person
    ii. Process for scheduling tests.
11. SECTION 01500 Temporary Facilities (provided by)
    i. Trailers, parking.

12. SECTION 01600 Product Requirements (substitutes)

    i. Process for requesting substitutes.

13. SECTION 01700 Construction Procedures (training)
    i. Training for maintenance personnel.

14. SECTION 01800 Project Records (drawings)
    i. Maintain accurate notes of changes or field conditions.

15. General Items:
    i. Owner concerns (personnel behavior, access, etc.)
    ii. Safety program by contractor

NOTE: Copies of forms to be used are usually distributed at the meeting. (Transmittals, Request For Information, Change Request, Change Log, and Submittal Log).

CRITICAL PATH SCHEDULE TYPICAL ACTIVITIES

There are many techniques for scheduling a project such as CPM, PERT, or Gantt Chart. Reference literature and on line web sites abound with products and systems. Depending on the complexity of the project, the schedule requirements vary greatly. Simple garage additions may be done without any formal schedule, other than the one in the mind of the builder, while multi-million dollar, multi-phase, multi-prime contractor projects might have several very complex critical path schedules with full time schedulers to monitor progress.

Critical path schedules are the most prevalent technique used. The contractor creates a precedence of work activities and generates a network of activities (what comes first, and what follows in a logical progression of work). Then he/she assigns estimated time durations to each one, and feeds the data into a schedule program. Every activity is given a calculated set of start and finish dates (early sequence and late sequence). The activities that have the same dates for both the early and late sequence are "critical" since any slippage in them will cause the whole schedule to slip. All other activities are "non-critical" and can slip ("float") based on the difference between the early and late start dates. (SEE SAMPLE CPM CALCULATION.)

For building projects the same logic applies for one or ten stories:

1. Clear site
2. Foundations
3. Structure (walls, floors)
4. Roof
5. Interior walls
6. Mechanical, Electrical, Plumbing (site, rough in, fixtures, operate)
7. Installed equipment, casework
8. Finishes (paint, flooring, ceiling)
9. Clean-up, punch-out, turnover.

In addition to the construction work activities, there are many other potentially critical items such as long lead material submittals and delivery; formal inspections by government agencies (including the Certificate of Occupancy- SEE TOPIC 28), and design schedules. (SEE TYPICAL PROJECT SCHEDULE).

Schedulers look for the hidden factors, which will drive the schedule such as:

1. Long lead material (special glass windows from Canada)
2. Weather sensitive work (large excavations in December)
3. Trade sequencing in tight areas (Mechanical room roof cannot finish until large HVAC ducts are installed)
4. Repetitive work opportunities which will increase efficiency (multi floor, or multi buildings the same layout)

Monitoring progress can be done by simply marking the individual activity's progress and noting if you are meeting the time line. Non-critical activities can slip and become critical so all paths must be monitored.

Schedules are updated for each progress meeting where the General Contractor must make a detailed review of the progress to date. Options for regaining lost time are discussed, but the ultimate decision on means and methods rests with the GC.

Sample CPM Calculations

The following table shows the logical relationships for six activities. The "start dates" are based on a cumulative addition of the durations along the logic path. When two paths join (B & D meet at E) the highest cumulative duration is used. The back pass calculation is made following the logic path, but this time the smaller cumulative duration governs. When the early and late dates are identical the activity is on the critical path. The mathematical difference between late start and early start is the "float" time, which indicates how many days the activity can be delayed without effecting the total project duration.

Activity	Predecessor	Duration	Early Start	Late Start	Float
Start					
A	-	1	0	0	
B	A	2	1	2	1
C	A	2	1	1	
D	C	1	3	3	
E	B,D	1	4	4	
F	E	1	5	5	
Finish					

The critical path is A-C-D-E-F, and activity B has one day of float.

BUILDING PROJECT TYPICAL ACTIVITIES

The following activities are commonly used for a building project. If you enter these activities into a CPM schedule program then you can assign durations and develop a timeline for the project, which includes design, construction, inspections, and milestones.

ID	TASK	PREDECESSOR
1	DESIGN:	
2	Program Definition	
3	Schematic Design	2
4	Design Development	3
5	Construction Documents	4
6	Bid	5
7	Bid Evaluation	6
8	Award	7
9	Preconstruction Meeting	8
10		
11	SITE WORK:	
12	MOBILIZE	9
13	CLEARING SITE	12
14	SITE EARTHWORK	13
15	TEMPORARY SITE UTILITIES	14
16	FINAL SITE UTILITIES	15
17	PARKING GRAVEL BASE	16
18	SITE LIGHTING	17
19	CURB & GUTTER	17
20	PARKING PAVEMENT	19
21	PARKING STRIPE	20
22	SIDEWALKS	19
23	LANDSCAPE	22
24		

25	BUILDING:	
26	SLAB-	
27	FOUNDATION EXCAVATE & FORM	13
28	FOUNDATION POUR	27
29	POUR SLAB	28
30	SHELL-	
31	EXTERIOR. WALL FRAME	29
32	EXT . DOOR/ WINDOW	31
33	EXT. WALL COVERING	32
34	EXT. WALL INSUALTION	33
35	ROOF SHEATH	31
36	ROOFING	35
37	INTERIOR-	
38	INT WALL FRAME	35
39	INT DOOR FRAMES	38
40	INT. WALL DRYWALL	39
41	INT. PRIME COAT PAINT	40
42	CEILING GRID	41
43	CEILING TILES	42
44	DOORS HUNG / HARDWARE	41
45	FINISH PAINT	41
46	FINSIH FLOOR (VCT/CARPET)	45
47	FINAL CLEAN UP	46
48		
49	MEP:	
50	UNDER SLAB UTILITIES	28
51	ROUGH IN ELECTRIC	38
52	ROUGH IN PLUMBING	38
53	ROUGH IN HVAC	38
54	ABOVE CEILING MEP	38,51,52,53
55	CONTROL WIRING HVAC	54
56	TELE/DATA CABLES ABOVE CEILING	38
57	HVAC DROPS IN CEILING	42
58	LIGHT FIXTURES IN CEILING	42
59	TRIM OUT TELE/DATA OUTLETS	45
60	TRIM OUT ELECTRIC	45
61	SET PLUMBING FIXTURES	45
62	TEST & BALANCE HVAC	43

63	TELE/DATA OPERATIONAL	59
64	FIRE ALARM SYSTEM OPERATIONAL	60
65	MEP SYSTEMS OPERATIONAL	60,61,62,64
66		
67	INSPECTIONS:	
68	FOUNDATION	27
69	SITE MEP	16
70	UNDER SLAB MEP	50
71	FRAMING	40
72	ROUGH IN MEP	54
73	INSULATION	40
74	ABOVE CEILING MEP	54
75	ABOVE CEILING FIRE STOP	43
76	FINAL ELECTRIC	60
77	FINAL PLUMBING	61
78	FINAL HVAC	63
79	FINAL STRUCTURAL/ ADA	43,44
80	ELEVATOR INSPECTION	64
81	FIRE INSPECTION SYSTEMS	80,64
82	CERTIFICATE OF OCCUPANCY	76,77,78,80
83	COLD STORAGE INSPECTION	65
84	HEALTH INSPECTION FOR FOOD	82,83
85		
86	MILESTONES:	
87	SLAB POURED	29
88	DRY IN BUILDING SHELL	36
89	PERMANENT POWER ON	76
90	CEILING TILE DONE	43
91	HVAC SYSTEMS OPERATIONAL	65
92	FLOORING DONE	46
93	AE PUNCH LIST ALL WORK	46
94	PUNCH OUT ALL WORK	93
95	FURNITURE & EQUIPMENT INSTALLED	82
96	TURNOVER TO CUSTOMER	95,59,82,84

PROGRESS MEETING MINUTES

Depending on the size and nature of the project the meetings might be weekly, but most likely they are biweekly or monthly. The frequency of these meetings is ultimately determined by the Project
Manager.

The stated purpose of the meeting is to monitor progress and to identify corrective actions needed to maintain the schedule. Technical problems should be processed via Requests For Information (RFI), which the contractor submits directly to the designer. It should be strongly discouraged for an individual to raise a technical problem for the first time during a progress meeting, due to the fact that there is no time to analyze the issues and determine a solution.

It is useful for the designer to bring technical experts/design team to the meeting to discuss options and to observe the site conditions. Technical meetings should take place before the progress meeting, and the results presented for approval to the owner's representative.

Minutes of the progress meeting are taken by either the contractor or the designer. They become part of the official record for the contract and are useful in resolving disputes later. Decisions are made and directions are issued at these meetings. A formal agenda is needed which includes the following topics:

1. Document list of attendees (sign up sheet)
2. Schedule review
   - A. Verify satisfactory progress on the critical path activities.
   - B. Verify the milestone status
   - C. Verify coordination with other contractor and owner activities
3. Summarize work progress
   - A. Since the last meeting
   - B. Projected for the next two weeks (or until the next meeting)
4. Review the status of submittals
   - A. What is to be submitted
   - B. When will the design review be done
5. Request For Information
   - A. Status of previous requests
   - B. Identify new requests and their status
6. Old Business (Review action items from previous meetings)
   - A. Each item is briefly summarized and is identified with the following information:
     - i. Unique identification number
     - ii. Date item was first discussed
     - iii. Action party (GC, AE, owner.)
     - iv. Date action due
   - B. Additional notes are added like a diary with new dates until the item is closed

7. New Business
    A. Notes taken in the same manner as Old Business
    B. Contractor is asked to submit any new items prior to the meeting.
8. Changes
    A. Based on the meeting discussion determine if any new changes have been created.
    B. Add new changes to the Change Order Log
    C. Review the status of pending changes
        i. Pricing submission by contractor
        ii. Designer review and recommendation to owner
        iii. Assignment of formal change order numbers to approved changes.

When the minutes are distributed, they also include a copy of the RFI Log, Submittal Log, Change Order Log, and a summary project schedule (time scaled CPM bar chart). This document is sent to the attendees and other interested parties . An accurate set of minutes will be an essential tool to monitor the progress of everyone, including the owner representative.

In order to prove that the contractor is complying with the technical requirements of the contract, the specifications require many items to be submitted for approval. These submittals might be field test results, manufacturer certifications, detailed shop drawings for fabrication of steel, physical samples of materials, etc.

The construction manager must be aware of:

1. What is supposed to be submitted?
2. How long is the lead-time for approval? (Some require designer to check detailed calculations).
3. How long does it take to deliver the item? (Some items are not off the shelf).
4. What is the impact on the schedule of work? (Critical path can change if materials don't
arrive on time).

On a larger project a few examples of long lead time items are:

1. Special equipment (large HVAC units, elevators, generators, motorized shelving)
2. Fabricated materials (structural steel, HVAC duct, switch gear)
3. Special order items (marble from Italy, bronze bells from Holland, unique carpet patterns, pipe organs made in Canada, triple pane-three coat window glass)
4. Owner opinions needed (furniture fabrics)
5. Items requiring factory codes (door locks)
6. Lastly anything else that does not come in when it should and creates a delay on the critical path of the work.

SUBMITTAL LOGS

During the Preconstruction Conference, the contractor is directed to create a submittal log and to list the items he was planning to submit for approval. This list is used as a guide to identify any critical submittals that have been overlooked by the contractor and to provide an indication of the designer's workload. The critical path schedule also includes activities for the delivery of long lead or complex items.

The submittal log should include the following information: (SEE SUBMITAL LOG)

1. Specification section
2. Description of item to submit
3. Name of subcontractor
4. Scheduled Dates for:
    - A. Submittal
    - B. Time allowed for review
    - C. Date approval due to meet schedule
5. Actual dates for:
    - A. Submittal
    - B. Review time
    - C. Re-submittal date
    - D. Final approval
6. Remarks

When the progress meetings are held with the contractor and architect, it is important for them to review the status of items to be submitted, and the status of pending approvals. The architect has a list of items received, which may not match the contractor's list of submitted items.

The project manager needs to keep pressure on both parties to submit and process this paperwork quickly and accurately.

Submittal Log

			Scheduled Date			Actual Date				Notes
Section	Vendor/Subcontractor	Description of Work	Submittal Date	Review Time	Final Release	Submittal Date	Review Time	Resubmit Date	Final Release	Notes
3300	Sharp Carter Corp.	Concrete-Floor patch								
5120	Piedmont Metals	Structural Steel	12/28/2001	3 wks.	01/18/02					None required
5500	Decorative Metal& Welding	Metal Fabrications	1/15/2002	2 wks.	01/29/02	02/06/02				Handrail bracket
6400	Locust Grove	Architectural Woodwork	1/15/2002	4 wks.	02/12/02					Cabinets
8110	SH Basnight & Sons	Steel Frames	11/20/2001	2 wks.	12/04/01	12/07/01			12/21/01	Approved as noted
8200	SH Basnight & Sons	Flush Wood Doors	12/4/2001	2 wks.	12/18/01	12/07/01			12/21/01	Approved as noted
8400	Southern Plate & Window Glass	Aluminum Framing System	12/28/2001	2 wks.	01/11/02	02/12/02				
8520	Southern Plate & Window Glass	Aluminum Windows	11/6/2001	10 days	11/16/01	12/04/01			12/12/01	Approved as noted– **Glass sample needed
8700	SH Basnight & Sons	Door Hardware	12/4/2001	6 wks.	01/15/02	12/07/01			12/21/01	Approved as noted
8800	Southern Plate & Window Glass	Glazing	12/28/2001	6 wks.	02/08/02					
8810	Southern Plate & Window Glass	Fire Rated Glass/Framing System	12/28/2001	6 wks.	02/08/02					

			Scheduled Date			Actual Date				Notes
Section	Vendor/Subcontractor	Description of Work	Submittal Date	Review Time	Final Release	Submittal Date	Review Time	Resubmit Date	Final Release	Notes
9100	Central Carolina Interiors	Metal Studs	12/4/2001	6 wks.	01/15/02	12/04/01			12/12/01	
9210	Central Carolina Interiors	Gypsum Plaster	12/4/2001	6 wks.	01/15/02	12/04/01			12/12/01	
9250	Central Carolina Interiors	Gypsum Drywall	12/4/2001	6 wks.	01/15/02	12/04/01			12/12/01	
9300	Commercial Tile	Porcelain Tile*	1/15/2002	2 wks.	01/29/02	02/04/02				
	Commercial Tile	Grout				02/05/02	resubmit			rejected 2/12/02
9510	Central Carolina Interiors	Acoustical Ceilings	12/4/2001	6 wks.	01/15/02	12/04/01			12/12/01	
9650	Sharp Carter Corp.	VCT/Base*	12/4/2001	6 wks.	01/15/02	01/31/02			02/12/02	
9680	Sharp Carter Corp.	Broadloom Carpet*	12/4/2001	6 wks.	01/15/02	01/31/02			02/12/02	
9690	Sharp Carter Corp.	Carpet Tile*	12/4/2001	6 wks.	01/15/02	01/31/02			2/12/2002	
	Sharp Carter Corp.	Fritz Tile				1/31/2002			2/12/2002	
9900	S & L Painting*	Painting	12/4/2001	6 wks.	01/15/02	1/14/2002			1/25/2002	Satin Finish
10100	Polyvision	Markerboards	11/19/2001	2 wks.		11/19/2001			1/17/2002	
12511	Clayton's Interiors	Horizontal Blinds	1/15/2002	4 wks.	02/12/02	1/7/2002			1/14/2002	
15010	Plumbing Fixtures	Professional Plumbing	12/28/2001	4 wks.	01/25/02	1/11/2002			2/12/2002	
15501	HVAC-Air Handlers	Superior Mechanical		3 wks.		12/21/2001			1/11/2002	
	Rotary Water Chillers	Superior Mechanical		3 wks.		12/21/2001			1/11/2002	
	Vane axial fans	Superior Mechanical		3 wks.		12/21/2001			1/11/2002	

			Scheduled Date			Actual Date				Notes
Section	Vendor/Subcontractor	Description of Work	Submittal Date	Review Time	Final Release	Submittal Date	Review Time	Resubmit Date	Final Release	Notes
	Heating coils AHV-1	**Superior Mechanical**		**3 wks.**		**12/21/2001**			**1/11/2002**	
	Chemical water treatment	**Superior Mechanical**		**3 wks.**		**1/11/2002**			**2/11/2002**	
	Insulation	**Superior Mechanical**		**3 wks.**		**11/28/2001**			**12/19/2001**	
	Qualifications	**Superior Mechanical**		**3 wks.**		**1/17/2002**			**1/29/2002**	
	Flex Duct	**Superior Mechanical**		**3 wks.**		**1/16/2002**			**1/29/2002**	
	Duct sealer	**Superior Mechanical**		**3 wks.**		**1/16/2002**			**1/29/2002**	
	TDF Duct system	**Superior Mechanical**		**3 wks.**		**1/16/2002**			**1/29/2002**	
	Compression tanks	**Superior Mechanical**		**3 wks.**		**11/28/2001**			**12/3/2001**	
	VAV terminal units	**Superior Mechanical**		**3 wks.**		**11/28/2001**			**12/3/2001**	
	Fire dampers	**Superior Mechanical**		**3 wks.**		**11/28/2001**			**12/3/2001**	
	Pumps	**Superior Mechanical**		**3 wks.**		**11/28/2001**			**12/3/2001**	
	Heat exchanger/valves	**Superior Mechanical**		**3 wks.**		**11/28/2001**			**12/3/2001**	
	Air distribution	**Superior Mechanical**		**3 wks.**		**11/28/2001**			**12/3/2001**	
	Chiller	**Superior Mechanical**		**3 wks.**		**12/21/2001**			**1/11/2002**	
	Controls	**Superior**		**3 wks.**		**1/30/2002**			**2/11/2002**	

			Scheduled Date			Actual Date				Notes
Section	Vendor/Subcontractor	Description of Work	Submittal Date	Review Time	Final Release	Submittal Date	Review Time	Resubmit Date	Final Release	Notes
		Mechanical								
	Fan coils #11, 12, 13	**Superior Mechanical**		**3 wks.**						
16000	**Fire Alarm**	**King Electric**		**4 wks.**		**1/29/2002**	**resubmit**		**resubmit**	**rejected 2/12/02**
	Electrical Gear	**King Electric**	**11/20/2001**	**4 wks.**	**12/18/01**	**12/18/2001**			**1/11/2002**	
	Lighting	**King Electric**		**4 wks.**	**to King on**	**1/10/2002**	**resubmit**	**E1, G, K, L rejected**		
	Lighting	**King Electric**		**4 wks.**			**resubmit**	**1/31/2002**	aan 2/12/02	**approved as noted**

REQUEST FOR INFORMATION LOG

During the course of construction the contractor will need clarification and direction to implement the design. The field superintendent is the most likely source of these questions, since he is on the front line of issues, which will delay the work if not resolved quickly.

Typically the dimensions shown on the plans will not work, or :

1. The elevations shown on the structural are not the same as the architectural
2. The electrical plans show a drop ceiling, but the architectural show a plaster ceiling
3. The mechanical specifications require the electrical contractor to provide equipment that is not specified in the electrical section
4. Site elevations are different on the civil and landscape plans

The contractor is informed during the Preconstruction Conference that the architect must issue all clarifications and directions. A simple one-page form is used, where the contractor uses the top half to describe the problem and recommend a possible solution, while the architect utilizes the lower half to answer the question. These Requests For Information are listed on a RFI log with the following data fields:

1. RFI number
2. Date initiated
3. Description of problem (describe, what and where)
4. Date answer needed by to keep the work on schedule (ASAP usually)
5. Date architect replied
6. Remarks (brief summary of the answer and note if a change is needed)

Copies of the RFI must be sent to the owner's representative because they will probably result in a change order, or could delay the project if timely action is not taken by the design team. The RFI log is reviewed at each progress meeting to ensure that all parties are aware of unresolved issues. (SEE RFI LOG.)

Request for Information Log

RFI #	Date Submitted	Date Response Needed	Issue Descrip-tion	Date AE Response	Remarks (Change)
1					
2					
3					
4					
5					
6					

SOURCES OF CHANGE ORDER

Change orders (contract modifications or Notice of Corrections) are generated from numerous sources. The following list is an indication of the diversity of contract modifications:

1. Differing Site Conditions- material or exiting conditions are not as shown on the plans.
2. Design Deficiencies- errors or omissions in the plans & specs. Designer's limit of liability is to meet the professional standards of the design industry, which means that there will be deficiencies.
3. Changed Requirements- customer changes her mind and creates revisions in the work.
4. Improvements- value engineering ideas are developed by the contractor, designer, or owner to enhance the work.
5. Criteria- Revisions to design codes which must be included in the work. (normally the code in effect at time of bidding is not corrected if a new code is subsequently issued). If life safety or other significant issues are modified by a new code, then the design team should evaluate the impact on the operational and safety aspect of the project before issuing an change.
6. Constructive- unknowing action or inaction by the Project Manager causes the contractor to perform additional or different work. (Lost critical submittals for approval and material delivery impacted).
7. Ripple- changes to one segment of the work creates additional cost in areas not directly involved in the change. (Added work delayed whole project into bad weather season).
8. Delay or Acceleration- contractor is paid for owner interference with the project schedule.

Of all the changes listed above, are referred to as a "Constructive Change" Changes can be initiated by the contractor or the owner/designer. Usually the contractor initiates modification requests for changed conditions, design errors, constructive work, delay and time extensions, while the owner usually issues change requests for design changes, changed requirements and changed conditions.

When the contractor and owner cannot reach agreement on the validity or value of a proposed change order, then the next step is for the contractor to formally proceed with a claim for equitable adjustment. . Before taking this expensive route, it is essential to verify that you have not improperly rejected the change request.

If your position can pass the following compendium of rules of evidence then you probably should
proceed with denial of the change request, but if you can't "pass the test" then a negotiation needs to be met:

Note: These rules are based on the work of W.F. Pettit, Nash & Cibinic, and Kostos.)

1. Rule 1- The interpretation of the a contract term must be reasonable or logical.
2. Rule 2- Manifest intent. The intention of the drafter is to be construed by a review of the words, phrases, symbols, or legends he used as the drafter, and is bound by the meaning he induces in the other party to understand and act upon.
3. Rule 3- Whole agreement. The Court must look to the four corners of the contract to ascertain the meaning to establish a "harmonious whole."
4. Rule 4- Normal meaning of words. Words, symbols, and marks will be given their common and normal meaning.
5. Rule 5- Principle apparent purpose. This rule is applied when the specification required a complete installation or system installed by the contractor, but through an oversight, the designer neglected to specify a necessary detail, which must be added to enable the system to operate successfully.
6. Rule 6- Order of precedence. Contract documents are interpreted in a specified order of precedence as stated in the Supplemental General Conditions. (details over generality, specifications over plans)
7. Rule 7- Construed against drafter. If after applying all of the previous rules the contract issue is still not clear (ambiguous) the provision will be construed against the party that drafted it (you).
8. Rule 8- Duty to seek clarification. If a party knows of a glaring error on the part of the drafter, he cannot take advantage of the error by his silence. If he fails to inquire, the provision will be construed against him.

A good rule of thumb is the following, if an individuals question if it is okay to change something **ALWAYS** ask what did the plans require. Do not make any verbal changes, because there will be no way of determining what you intended when the work is changed incorrectly.

The following documents serve as official records:

1. Daily reports by contractor and your inspector,
2. Photos,
3, Correspondence,
4. Schedules,
5. Submittals, samples
6. Test reports.

The following table is a summary of the various sources of changes and the resulting impact on the contract.

Source of Change	=	**Impacts on Contract**
Acts of God: -Weather -Differing Site Condition	Ripples	
Owner: -New requirements -Late delivery of equipment -Slow decisions -Stop work -Constructive changes	Ripples	**Time:** -Delay -Acceleration -Liquidated damages -Termination for default
Designer: -Defective design -Over inspection	Ripples	
General Contractor: -Defective work -Slow subcontractors -Under staffing	Ripples	**Cost:** -More labor -More OH -More idle equipment -More material -Inflation -Legal fees
Other: -Strikes -Code inspectors -Accidents	Ripples	
		Quality: -Rework -Substitutes -Less quality
Note: Expect cost to be 3% on new work and 10% on renovations		

CHANGE ORDER LOG

Keeping accurate track of all changes (pending and executed) is one of the primary tasks for the Project Manger. After negotiation, the changes will be collected and processed as a formal change to the contract, which the designer issues. Some changes may not result in a net change in the contract price, but they need to be documented, since they affect the work. Other changes are inconsequential and are process as field changes at no cost or time increase. These changes are documented in the contractor's Daily Report, or by designer issued notes.

The Project Manager needs a tool to use with both the contractor and designer to keep them focused on the pending changes. A simple excel format status log is used at every progress meeting to achieve this focus. The following data needs to be included in the change order log:

1. Unique identification number for each change.
2. Date item was initiated
3. Reference for the change (Designer letter, Request for Information, etc.)
4. Description of the change (leave plenty of space to describe what and where).
5. Target cost (SWAG).
6. Amount submitted by contractor and date.
7. Amount recommended by designer and date.
8. Amount approved by owner and date.
9. Contract Change Order number assigned
10. Remarks (status)

In order to obtain the total pending and approved changes add up the following three columns: Target + Amount Submitted + Amount Approved. (SEE CHANGE LOG.)

No changes are authorized without the permission of the owner. The designer may recommend, but you are the only one who can spend the owner's money by issuing a change order.

Field changes are normally authorized for work, which is minor and does not cost very much. The owner, designer, or contractor may initiate the need for a field change, but the owner is the only person who can approve the directive. The following multi-copy form is useful in making the written record of field changes.

Proposal #	Date entered	Reference Document	Description	Target SWAG $	Pending Amount Submitted $	Date Submitted to AE	Date Approved by AE	Amount Approved $	Change Order #	Remarks
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
			Total Target $	xxx						
			Total Pending $		yyy					
			Total Approved $					zzz		
			Total all Changes (target+ pending+approved)							
			Note: After the change has been submitted, clear the "Target" column and place the estimated cost at the end of the Description field. This will allow easy summation of the total without double counting. Likewise when a change has been approved delete it from the Pending column.							

CHANGE ORDER REQUESTS/ESTIMATES

Change order estimates or Change Order Requests are prepared before requesting a proposal to ensure that adequate funds are available prior to asking the contractor to spend time creating a proposal. This keeps un-fundable changes from clogging up the paper system, and wasting everyone's time. They are also made in advance of receiving the proposal so there is an independent perspective on the cost.

Change order estimates are difficult to price, since they typically involve small quantities of work, which don't allow large-scale efficiency of production. Estimating guides such as R.S. Means have specialized databases to address this issue, but don't cover every possible change situation.

Estimates should be based on:

An accurate material take off (SF, CY, LF, etc.)
Current labor rates by trade ($/hr per man or crew)
Current equipment rates (rental or owned $/hr, $/ day, etc.)
Estimated time to compete the work by subcontractor.
Impact on the critical path.

In addition to the book rates for construction work, adjustments should be made to allow for hidden costs of the changed work. The following listing is an indication of some of these price considerations:

LABOR:

Learning Curve. When personnel are added to perform additional work a period of familiarization must be considered until these workers are oriented to the job, plans, tool locations, work procedures, etc. If multiple crews are required to perform certain task, then the learning curve is correspondingly multiplied.

Dilution of Supervision. A new field activity associated with integrating the change work into the base contract requires a diversion of the supervisor's attention from the base work. While the supervisor is analyzing the change, organizing the assignment of workers, procuring additional material, and finding equipment and tools, productivity of the other workmen is adversely affected.

Fatigue. Overtime is often required to complete the additional work within the specified contract period. Overtime disrupts the rhythm of the work, and lowers work output per hour, because efficiency decreases with fatigue.

Reassignment of Manpower. Reassignment of workers is generally required when unexpected changes occur. Productivity decreases because there is not enough time to plan an orderly transition in the work flow.

Morale and Attitude. Skilled workers have pride in their work and the timely completion of the project. Changes interrupt the schedule, require changes in crew sizes and crew assignments, and also may require work to proceed without detailed plans. If overtime is being selectively used, then there will be a resentment by those who are not getting overtime. All of these factors contribute to a poor morale, which will result in lower productivity and also lower the quality of work.

Delay. The job progress is held up and workmen may be scheduled to move on to another project, or they are not available to for assignment to this project.

MATERIAL:

1. Small quantities increase the unit cost.
2. Restocking fees for material not used.
3. Cost of additional submittals for new material.
4. Cost of clerical work to purchase new material.
5. Increased waste factor when material is bought in standard lengths.
6. Delay time waiting for new material.

EQUIPMENT:

1. Mobilizing and demobilizing equipment on site.
2. Full day rental for partial day use.
3. Additional equipment needed because base contract equipment already fully committed.

OTHER:

1. Escalation. If work is delayed, then added costs are incurred for off site storage, equipment rental, and price increases.
2. Site Access. Delayed work or new work, makes the site more congested which reduces efficiency and increases cost.
3. Beneficial Occupancy. Delayed work can result in the owner moving into areas where the contractor has more work to do. Security, access, cleanup, noise limits, and working hour limits all contribute to increased cost.
4. Management costs. The cost of estimating, negotiating, and processing the change.
5. Plans and layouts. The cost of additional working drawings and field layout.

Once the direct costs have been identified, then the indirect costs must be added to establish the total estimate. Indirect costs include:

1. Superintendents, Clerks
2. Payroll taxes
3. Payroll fringe benefits
4. Travel and subsistence
5. Job insurance
6. Small tools expense
7. Equipment rental
8. Job supplies (water, paper)

9. Telephone on site
10. Site trucks
11. Taxes
12. Construction and Performance Bonds
13. Permits
14. Temporary services (toilets)
15. Cleanup
16. Warrantee and call back
17. Delay penalty and liquidated damages
18. Office overhead

Typically the Owner will specify a format for change orders to provide uniformity of pricing data over all of the projects being administered. It also forces the contractor to provide more information, which will be useful to the PM during change order negotiations.

The proposal should have a summary page and backup data. Back up data includes the quantity take off plus direct labor and equipment costs. The summary page should show sub and prime mark ups. (SEE CHANGE ORDER SUMMARY PAGE.)

When a change is first identified, you should establish an order of magnitude estimate with the contractor, so all parties can prioritize.

Change Order Summary

ITEM	COST $
Subcontractor	
a. Material Cost	
b. Labor Cost	
c. Total Direct Cost	
1. Field OH cost __10___% of 'c'	
2. Home office OH _3__% of 'c+1'	
3. Profit _6_% of 'sum c thru 2'	
4. Bond _0.5__% of 'sum c thru 3'	
5. Total sub cost add 'c' thru '4'	
Prime contractor	
a. Prime direct costs	
b. Sub total costs '5'	
c. Total prime cost 'a+b'	
d. Prime Field OH _10__% of 'c'	
e. Home office OH_3_% of 'c+d'	
f. Profit _6_% of sum'c thru e'	
g. Bond _0.5_% of sum 'c thru f'	
h. Total change cost add 'c thru g'	

CONSTRUCTION CHANGE ORDER NEGOTIATION PROCEDURES

Negotiation of construction change orders is very similar to the AE design negotiations, since you try to isolate the cost items that are factual and establish pricing for them, and then you \proceed to explore the less factual issues. Your estimate of cost must be made before the proposal is received to you can compare the two independent versions of the cost for the change.

The following is a list of some items that are factual, and other that require a mutual understanding:

1. The quantities of material are generally factual since they are based on the plans or field measurements, but extraneous factors such as waste, shrinkage and swell can be variables to discuss.
2. The hourly labor rates are obtainable and can be audited, but care must be taken to ensure that no extra markups have been added which will be doubled during the final mark up of the costs (percentages for supervision included with direct labor).
3. The amount of time to complete the work is subject to interpretation of duration for demolition and rework prior to the new work commencing.

The following check list is useful for the PM to establish his/her strategy for a successful negotiation:

1. Define scope of the change
   - A. What work is added/deleted
   - B. Total cost of work (proposed/estimated)
   - C. Time needed for work per CPM
2. Review and reconcile proposal vs estimate
   - A. Group work by sub trade
   - B. Verify quantities
   - C. Verify pricing
3. Identify and analyze
   - A. Areas of significant cost difference
     - i. Material, or labor, or pricing
   - B. Areas of agreement
     - I. Double check to be sure there are no errors
4. Positions and goals
   - A. Define your:
     - I. Total cost and time maximums you are willing to settle for
     - II. Strategy for the negotiation agenda
       - A. Dispose of minor items first
       - B. Attack the major items first
     - III. Set the tone of the negotiation as professional and fact finding not accusations and emotion.
     - IV. Establish your role as one who is seeking an equitable adjustment

5. Record keeping

A. As negotiations progress note the agreed items and move on to the next issue. (Qty, hours, deletions/additions to the work).

B. Summarize the total cost/credit and time impact at the end of negotiations to verify the agreement.

C. Write a memo to your approving authority, which documents the results in a logical sequence.

I. What was changed in the proposal? (Qty, hrs…)

II. What was changed in the estimate? (Qty, hrs.)

A. Why did you agree to change your estimate?

QUALITY ASSURANCE INSPECTION REVIEW

There will be many different construction quality and compliance inspectors on your project. They will include inspectors from:

1. Design team
   A. Structural, Mechanical, Electrical, Plumbing
2. Independent Inspectors (hired by Metro)
3. Government Inspectors
   A. Building Code Officials (Mechanical, Electrical, Plumbing, Structure, Elevator, Health/Food, Fire Marshal, ADA.)
4. Manufacturer Representatives

An independent engineering testing company needs to be hired that has Professional Engineers (Quality Control Engineer) on their staff to verify that the crucial materials being used on your project meet the specifications set by the designer.

Your testing program is documented by the design team in the technical portion of the specifications (Divisions 2-16). The desired qualities of the construction materials are identified along with the
appropriate tests to be conducted. Typical tests involve: (SEE QUALITY CONTROL FIELD TESTING.)

1. Soils (type of soil and compaction)
2. Concrete (reinforcing steel placement and concrete strength after 7 and 28 days)
3. Steel (torsion on bolts)
4. Fireproofing (thickness)
5. HVAC system (balance air flow through the duct work)

The professional testing company is chosen using the same process as the design team. They are selected based on their technical and professional qualifications followed by a fee
negotiation with the most qualified firm. Normally the construction tests are itemized with a unit cost, then an estimated total cost is calculated based on the plans. Additional services are priced using an hourly cost scale for professionals and technicians.

An essential factor in making the selection of the testing company is their relative proximity to the work site, since timely inspections and reduced travel costs are crucial. Most likely, the firm you hired to make the original site soil investigation will be a strong candidate to perform the construction testing. They have the most familiarity with the site and the project, plus you have already selected them from the competition before.

Construction Quality Control

Field Testing

By Brad McLester P.E.

S & ME Inc.

The following information is general in nature and is intended to provide a broad overview of construction activities/materials that should be tested, evaluated, or observed by the independent engineering/testing firm. There may be other items that should be evaluated depending on surface and subsurface conditions on the job site, complexity of the structure, and intent of the Designers. Therefore, this information should only be used as a guide. It is assumed that an adequate subsurface exploration (geotechnical evaluation) has been performed during the design phase and that the conclusions and recommendations contained in that report are included in the design plans and specifications.

SITE PREPARATION:

1. A meeting should be held on site with the Grading Contractor and testing agency prior to grading to discuss any unusual conditions or potentially problem items which could exist, such as wet or plastic soils, rock, etc. These items should be described in the subsurface exploration (geotechnical) report for the project.
2. Verify that all topsoil, stumps, previous structures and utilities, etc., have been removed from the grading limits and are not buried in fills under parking areas, buildings or in fill embankment slope areas. Excess topsoil can potentially be spread out and blended with soil in a controlled manner and placed in nonstructural areas provided that the resulting blend can be moderately compacted.
3. Prior to filling, proof roll the exposed soil with a loaded pan or dump truck. Repair any areas that pump, wave, or deflect excessively.
4. Have a sample of the soil to be used as fill tested a week or more before grading begins. This should at least include moisture content and standard Proctor compaction testing in the lab.
5. In wet or unstable soil conditions, determine if special grading measures such as trench drains, stabilization with geotextile fabric and stone, undercut/soil replacement or other measures are needed.

FILL PLACEMENT

1. Have all fill tested for compaction. This applies to mass filling, fill behind retaining walls, and in embankment slope areas. For most projects, one test should be performed for every 2500 to 5000 square feet or one foot of fill depth. The testing frequency can be reduced on large projects where full time testing and monitoring is performed. The required percent compaction should be on the plans or in specs. If not, assume 95% of the standard Proctor maximum dry density of soil is required in all but the top 24 inches below slabs and pavements where 98% can be assumed. (Specs may vary.)

2. Have utility trench backfill tested at least every one to two vertical feet of fill depth. This is particularly necessary under buildings and pavements and for fill around large diameter storm drain lines, catch basins, etc.

3. Observe/monitor the fill under equipment to verify that it does not pump or wave to confirm the test results are reasonable.

4. Rock pieces and boulders can normally be incorporated in the lower parts of deeper fills provided that they are not stacked on top of each other and the surrounding soil is well compacted. Some construction debris such as concrete or asphalt can potentially be buried in deeper fills if it is well documented and soil is well compacted around it.

5. Bench new fill into existing slopes by notching into the slope in 12 to 24 inch vertical heights so that fill can be compacted horizontally and not on an incline.

6. Walk the face of fill slopes with a small dozer or loader to help compact the slope face and provide indentions in which grass seeds can grow. Divert rain-water runoff away from the top of
embankment slopes to reduce erosion potential.

7. Fill embankments should be constructed as flat as reasonably possible. They should be no steeper than 2:1(horizontal: vertical) unless a geotechnical engineer says otherwise. Even at 2:1, some silt and clay soils in this area will slough and require repair. Establish vegetation or mulch on slopes as soon as possible.

<u>EXCAVATION</u>

1. After cut areas are lowered to design grade level, proof roll the exposed soil to confirm that it is
uniformly stable to support the slab and/or pavement. This can be very important in deeper cuts that extend near the groundwater table.

2. If rock is encountered in either trench or mass grading, have it quantified by the testing lab to
confirm its measurements and verify that it is classified as “rock” in the specs.

3. If you must blast rock in developed areas or near structures, consider having the blast vibrations monitored with seismic equipment to document that the shock waves are not considered “damaging”. The perception by the public that the blast is damaging can be worse than reality.

4. Walk the face of cut slopes with a dozer or tracked loader similar to that suggested for fills.

FOUNDATION EVALUATIONS

1. A qualified soil technician or engineer should evaluate the soils in the bottom of all foundation excavations (in cut and in fill). The evaluation should include visual observation and probing the entire footing trench. Representative hand auger borings that include dynamic cone penetration testing (dcp) should be performed. The number and location of these tests should be determined on a site-by-site basis. At a minimum, one hand auger/dcp test should be performed in every other column footing excavation and in every 75 linear feet of wall footing. The hand auger test depth should be equal to the footing width in most cases. In uniform conditions or where a significant amount of compaction test data is available, the test depth and frequency could potentially be reduced.
2. Where footings cross utility lines, the lines can be sleeved or the footing stepped down to bear below the utility line. This is particularly important for column footings or heavily loaded wall footings because stresses will be applied to the utility lines by the footing loads. The structural engineer should be consulted if there are any questions regarding foundations bearing over or near utility lines.

CONCRETE TESTING

1. For most projects, water should <u>not</u> be added to concrete. The time of placement should be less than 90 minutes from batch time and the temperature of the mix should be greater than 50 degrees and less than 90 degrees. Note that less time will be available for concrete placement during hot weather and with higher strength mixes (high cement content). Special projects or conditions could require additional testing and control.

2. Slump the concrete on as many trucks as practical, but not less than one slump test per set of cylinders. Slump before and after plasticizer or add-mixtures are applied if possible. Other routine tests such as temperature, unit weight, and air content should be performed on each set of cylinders.

3. At a minimum, one set of 4 concrete cylinders should be cast for each days pour and for every 50 yards poured. The cylinders should be made after any plasticizer or other add-mixture is added. Cylinders should be made at the point of discharge if a pump truck is used, when possible. Do not move, vibrate or otherwise damage the cylinders!

4. An insulated curing box or large Igloo type cooler should be available to the testing lab to set fresh cylinders in overnight during very hot or cold weather. The cylinders should not be moved for about 20 +/- 4 hours. They should be transported to the testing lab for wet curing and compression strength testing. Standard compression testing includes a 7-day break and two 28-day breaks. The spare cylinder can be broken (normally at 56 days) if a low break is recorded at 28 days, otherwise it is discarded.

PAVEMENT TESTING

1. Thoroughly proof roll the soil sub grade and repair any problem areas prior to placing stone. This is imperative for the successful long life of the pavement.
2. Prior to placing stone for pavement areas, confirm that samples of the stone have been subjected to laboratory standard Proctor compaction and gradation testing to verify that the stone meets NCDOT specs. This is often the responsibility of the paving contractor but it ultimately falls under the job superintendent and project manager if there is a problem. This lab test data will be required during field compaction testing.
3. Crushed aggregate base course (CABC) stone should be tested for compaction prior to asphalt placement. A degree of compaction equal to 98 to 100% of the standard Proctor maximum dry density is typically required. The stone layer thickness should also be measured after compaction.
4. Evaluate the stone base by proof rolling with a loaded dump truck immediately prior to paving and repair any areas that have deteriorated due to construction traffic or weather.
5. The temperature, thickness and density of asphalt can be tested during paving to confirm that the spec requirements are met. The density can be measured with a nuclear gage on site or by a combination of field and laboratory testing during paving. A degree of compaction equal to 95% of the Marshall Mix design maximum density is typically required. (Note: use type I-1 or HDS surface mix for heavy duty drives and truck areas. Type I-2 is smoother and performs best in automobile parking areas)

STEEL INSPECTION

1. Have a random sampling of bolts torqued and welds visually inspected to confirm that the steel erector is performing satisfactorily. On special projects, the Structural engineer may require more extensive testing in both the plant and on the job site.

PROJECT SAFETY

As a Project Manager you are the Owner's representative looking out for their interests.

* Are you responsible for the safety of the contractor's workers?
* Should you be the inspector of safety on the job?
* What is your responsibility if you see something unsafe on site?

The General Contractor is responsible for his work and the action of his workers. You have Workman's Compensation Insurance required in the contract to protect your liability exposure, and you have builder's risk and third party insurance for damages to the work site or other parties.

Your primary concern is to minimize the impact of construction activities on your campus.

* Construction vehicles hitting your staff/visitors.
* Construction debris falling or blowing off the site and hitting others.
* Construction materials dropping from cranes and hitting others.
* Fires, explosions (blasting), or flooding (burst pipes or run off water).

The contractor's risk management inspector (usually from their insurance carrier or an in house employee in larger construction firms) will make periodic site safety inspections. The state OSHA inspector makes random inspections and will levee fines on the contractor depending on the severity of the infractions noted. Typical fines are thousands of dollars for seemingly minor infractions:

* Improper grounding of extension cords (ground pin missing = electrocution).
* Not wearing hard hats. (visitors count too! = things fall on site.)
* Working on roof without safety harness. = people fall.
* Rolling a scaffolding by grabbing the ceiling grid and riding the scaffold. = fall again.
* Ladders not tied off at the top. = more falling.
* Ditch being dug without shoring.= dirt falls on people.

There are many sources of safety inspection materials from other agencies such as your insurance company, or your local OSHA office's web site. (SEE SAFETY INSPECTION CHECKLIST.) The following table summarizes the frequency of occurrence of the typical accidents.

CATEGORY	# of OCCURRENCES IN CHECK LIST
Fall off = you might fall off something or trip over something and then fall.	Most frequent
Crushed = temporary supports or piles of material collapse and you are crushed to death.	Second most frequent
Struck by = something might fall on you, or run over you.	Third most frequent
EE = electrocution	Fourth most frequent
F = burned to death	
Eye = you can't see again	
Ear = you can't hear anymore	
Paper = your paper work is not good enough to prove your safety procedures and you pay a lot of money in fines as a result.	

Safety Inspection Checklist

	Meets Standards Yes No	Resp.Party		Meets Standards Yes No	Resp. Party
Recording, Posting & General Requirements			Ladders		
Good Housekeeping			Sound & properly secured		
Safety Meeting Minutes			Correct height		
OSHA Forms 100,100,102			Non-skid shoes		
OSHA Posters & Citations			Floors, Wall Openings & Stairways		
Emergency Phone Numbers					
Crane Signals			Barricades & handrails		
OSHA Signals on-hand			Floor openings, covered or handrails		
First Aid Kit and Card					
Drinking water and toilets			Stairways, handrails		
Lighting information			Cranes, Hoists & Elevators		
HAZCOM posted					
HAZCOM Material Safety Data Sheet			Posting requirements		
Personal Protective Equipment			Hand signals posted & used		
			Inspections, daily & annual		
			Conditions of wire ropes, clips ,etc.		
Hard Hats			U bolts fastened properly		
Eye and Face Protection			Guards and barricades		
Hearing Protection & Respirators			Power lines (distance)		
Fire Protection & Prevention			Hoist cable barrier		
			Safety hooks		
Fire Extinguishers			Motor Vehicle & Equipment		
Flammable & Combustible liquids			Brakes, lights (head, tail)		
Portable heaters (safe, ventilated)			Back-up alarm		
Material Handling, Storage & Disposal			Seat belts and roll bars		
			Excavation, Trenching & Shoring		
Work areas safe & clean			Angle of repose		
Materials properly stored			Supporting system (bracing)		
Waste disposed of properly			Material storage		
Hand and Power Tools			Adjoining structures		
			Access ladders		

General condition of all tools					
Electrical tools properly grounded			Concrete		
Guards on drills, grinders, saws			Equipment & materials		
Mushroomed heads on chisels			Reinforcing steel, storage & placement		
Wood handles, secured, split, etc.					
Air tools			Shoring requirements, drawings & Plans		
Welding and Cutting			Storage of forms & shoring		
			Clean-up		
Compressed gas cylinders, Secured & capped			Steel Erection		
Hoses, torches, gauges in Good condition			Permanent & temporary flooring		
			Safety nets, railing & belts		
Arc welding, leads & grounds			**Other (Specify**		
Eye protection					
Electrical					
Main Power lines (location)					
Extension cords, grounded					
Temporary lights & power					
Junction boxes, covered					

PROJECT TURNOVER

One of the most challenging tasks for a Project Manager is to successfully close out a construction project. Success is defined as a timely completion of ALL work, with specified quality, and no significant warrantee call back work.

Many systems are no longer visible at the near the end of the work (Mechanical, Electrical, Plumbing (MEP) systems above ceiling and in walls, structural elements, etc.). These items should be inspected as the work progresses. Now that the end is near you can inspect the remaining work, which is mainly finishes. Your customer will be very interested in these items as well.

Punch list inspections are made by the Subcontractors, then General Contractor (GC), then AE, and finally by your customer. Typically the inspections start after the painting is done, and all of the finishes are present (flooring, ceiling, plumbing fixtures, doors, etc.). The best format is to make an Excel spread sheet identifying: (SEE PUNCH LIST)

1. General Location (area, room#, etc.),
2. Specific location of deficiency (west wall over door, etc.),
3. Description of deficiency (missing door knob),
4. Inspector (who found the deficiency? AE or Engineer? If questions arise you'll know who to ask for more details),
5. Responsible party (filled in by GC to indicate which Sub is responsible).
6. Status (complete, cancelled...).

By using a spread sheet you can list the deficiencies by room, by floor, by trade, etc. You can also email the lists with updates on status for the Project team to review. The GC will assign the tasks to the appropriate subcontractors for action. Timely processing is crucial, so agree on the format for the report beforehand, and make the AE send it within 24 hours so the trades can proceed.

In addition to physically verifying that all of the work is complete, you must also have a checklist to insure that all of the administrative items are done as well. The administrative clauses and each technical section of the specification contain particular submissions.

For example:

1. Division 1 requires: As Built drawings, Manuals, and Certificates for Warrantee.
Division 2-16 require: Spare parts, extra material for maintenance (paint, carpet), training for operators of equipment, etc.

See the Construction Contract Completion Checklist for a typical list of these items. Your project will have these plus other unique requirements that your team developed. (SEE CHECKLIST)

The final payment to the GC is dependent on successful completion of both the physical and administrative work. Once you have made the final payment and released the retention funds (5 to 10% of the progress payment held to insure successful completion of the contract) then it will be very, very difficult to get the GC's attention on items of low dollar value. By the time the final inspections are made, most of the subcontractors and manpower resources have left your job, and moved on to the next project. It is crucial that the inspections are not made too late or too early in order to take advantage of on site resources. Two outcomes:

Too early = list too long, many items not even done yet.
Too late = no one left to do the work.

The last 5% of the work will take you more than 30% of your total efforts on the project depending on the GC's capability and your AE's professionalism. Projects don't just smoothly transition from construction to operational facility without the careful attention to detail by you to ensure it is done right: (SEE TURNOVER LETTER)

Keys to the right customer
Manuals and training for operators
Systems functioning in an orderly sequence
Move in plan includes telephones, room keys, and delivery of the furnishings.
And more and more….

For major projects with complicated systems (hospitals, processing plants, etc.) the turn over process is more formalized. Outside consultants not part of the design team are hired to oversee every element of the ultimate successful turnover. They review designs for compliance and maintainability, monitor field work and develop testing protocols for making systems operational (oxygen piping in hospital, gasoline purge line in processing plant, etc.) and then observe the tests by the subs.

Planning for the final turnover will require close attention to detail.

Construction Contract Completion Check List

ITEM	DATE DONE
Contractor Issues:	
1. Certificate of Occupancy	
2. Warrantee Certificates	
3. Operation and Maintenance Manuals	
4. Training for Maintenance Personnel	
5. Spare parts and attic stock turned over to owner	
6. As Built drawings sent to Architect	
7. List of warrantee agents	
8. Keys returned	
9. All claims and change orders settled	
10. Test and balance reports for HVAC sent to Architect	
11. All punch list work complete	
12. Submit final pay request with release of liens	
Architect Issues:	
1. Record drawings prepared from As Builts.	
2. All change orders and claims settled	
3. Approval of test and balance reports	
Owner Project Manager Issues:	
1. Notify Maintenance Department and Security of acceptance of facility	
2. Provide copies of Maintenance Manuals	
3. Provide copies of Warrantee and Agents	
4. Forward spare parts, keys, and as builts	
5. Verify all changes and claims are settled	
6. Process final payment	

MEETING /DOCUMENTATION PREPARATION

Meeting Preparation

Meeting invitations should be transmitted via e-mail via Microsoft Outlook. It is advisable that the Project Manager provide at least a five (5) day advanced notice for a meeting request. The following standard documents should always be used in preparing a meeting:

1. Meeting Agenda *(see Attachments section)*
2. Meeting Sign-In Sheet *(see Attachments section)*
3. Meeting Notes Template *(see Attachments section)*
4. Meeting Minutes *(see Attachments section)*

Document Preparation

Depending on the complexity of the project, the contract documents preparation should be approached through the following phases:

Phase I—Conceptual Design Drawings and Documents
Phase II—Schematic Design Drawings and Documents
Phase III—Design Development Drawings and Documents
Phase IV—100% Construction Drawings and Documents

Each project should be set-up by the Project Manager on SharePoint (see Attachments section). All agencies and/or affiliated companies should formally note any comments and modifications on SharePoint. Phase III, Design Development Drawings and Documents, will be the final opportunity to present any new changes/modifications. Phase IV, 100% Construction Drawings and Documents should be used as the final check-set phase.

QUALITY CHECKLIST

CONCEPTUAL DESIGN DRAWINGS

ARCHITECT OR ENGINEER OF RECORD

Company Name	Principal in Charge	Date
Company Name	Project Architect	Date
Company Name	Mechanical Engineer	Date
Company Name	Electrical Engineer	Date
Company Name	Civil/Structural Engineer	Date

METROPOLITAN GOVERNMENT OF NASHVILLE

Project Manager	Date
ITS Manager	Date
Storm Water	Date
Public Works	Date
ADA	Date

CONCEPTUAL DESIGN DRAWINGS QUALITY CHECKLIST

QUALITY ITEM		Yes	No
1)	Does design conform to existing master plan?	☐	☐
2)	Does site plan show utilities and circulation?	☐	☐
3)	Does site plan show topographic features?	☐	☐
4)	Are small-scale line drawings of plans and sections adequate to define horizontal and vertical relationships?	☐	☐
5)	Do plans show existing and proposed facilities in their relative arrangement?	☐	☐
6)	Do plans accommodate the disabled?	☐	☐
7)	Is there a general description of architectural, engineering, structural and mechanical systems to be used?	☐	☐
8)	Is there a listing of minimum codes to be used?	☐	☐
9)	Do square footage areas correlate to the program requirements?	☐	☐
10)	Does cost model correlate to established budgets?	☐	☐

QUALITY CHECKLIST
Conceptual Design Drawings

OTHER QUALITY ITEMS		Yes	No
1)		☐	☐
2)		☐	☐
3)		☐	☐
4)		☐	☐
5)		☐	☐
6)		☐	☐
7)		☐	☐
8)		☐	☐
9)		☐	☐
10)		☐	☐

EXPLANATION OF "NO" RESPONSES

1) _____
2) _____
3) _____
4) _____
5) _____
6) _____
7) _____
8) _____
9) _____
10) _____

_____ Signature _____ Date

*Add additional sheets as required.

SCHEMATIC DESIGN DRAWINGS

ARCHITECT OR ENGINEER OF RECORD

Company Name	Principal in Charge	Date
Company Name	Project Architect	Date
Company Name	Mechanical Engineer	Date
Company Name	Electrical Engineer	Date
Company Name	Civil/Structural Engineer	Date

METROPOLITAN GOVERNMENT OF NASHVILLE

Project Manager	Date
ITS Manager	Date
Storm Water	Date
Public Works	Date
ADA	Date

SCHEMATIC DESIGN DRAWINGS QUALITY CHECKLIST

QUALITY ITEM	Yes	No
1) Have applicable codes, standards and rules been cited?	☐	☐
2) Is there a differentiation between new construction and existing items?	☐	☐
3) Are the "outline specifications" included?		
4) Architectural:		
a) Is life safety plan information provided?	☐	☐
b) Is occupancy classification indicated?	☐	☐
c) Are separations (fire and smoke) shown?	☐	☐
d) Are sprinkler requirements explained?	☐	☐
e) Is construction type stated?	☐	☐
f) Are typical exterior wall and roof sections shown?	☐	☐
g) Are the numbers of floors described?	☐	☐
h) Is the square footage per floor shown in accordance to the program?	☐	☐
i) Does cost correlate to established budgets?	☐	☐
1. Have the estimates of construction costs by the Architect/Engineer and Construction Manager or Owner's Cost Consultant been reconciled?	☐	☐
j) Are overall plan dimensions indicated?	☐	☐
5) Civil/Structural:		
a) Are the design parameters given?	☐	☐
b) Is a topographical survey provided?	☐	☐
c) Is a narrative of drainage concept provided?	☐	☐
d) Is statement on flood considerations provided?	☐	☐
e) Is a statement of availability of utility services provided?	☐	☐
f) Is the building system narrative provided?	☐	☐
g) Are the proposed roads and parking described?	☐	☐
h) Is a soil and geotechnical report provided?	☐	☐
i) Are overall plan dimensions indicated?	☐	☐
6) Mechanical:		
a) Are the design parameters given?	☐	☐
b) Is the source of utility services shown?	☐	☐

SCHEMATIC DESIGN DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
c) Is the design of any specialty systems provided (i.e., laboratory gases)?	☐	☐
d) Are the energy requirements included?	☐	☐
e) Are the energy management/temperature controls and/or building automation systems described?	☐	☐
f) Are indoor environmental requirements described?	☐	☐
7) Electrical:		
a) Are the design parameters provided?	☐	☐
b) Is the source and voltage of electrical service provided?	☐	☐
c) Is the fire alarm system described?	☐	☐
d) Is the security system described?	☐	☐
e) Is the communication system described?	☐	☐
f) Is the lighting system described?	☐	☐
g) Is the computing data networking system described?	☐	☐

OTHER QUALITY ITEMS		Yes	No
1)		☐	☐
2)		☐	☐
3)		☐	☐
4)		☐	☐
5)		☐	☐
6)		☐	☐
7)		☐	☐
8)		☐	☐
9)		☐	☐
10)		☐	☐

EXPLANATION OF "NO" RESPONSES
1)
2)
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10)

Signature _____ Date _____

*Add additional sheets as required.

DESIGN DEVELOPMENT DRAWINGS

ARCHITECT OR ENGINEER OF RECORD

Company Name	Principal in Charge	Date
Company Name	Project Architect	Date
Company Name	Mechanical Engineer	Date
Company Name	Electrical Engineer	Date
Company Name	Civil/Structural Engineer	Date

METROPOLITAN GOVERNMENT OF NASHVILLE

Project Manager	Date
ITS Manager	Date
Storm Water	Date
Public Works	Date
ADA	Date

DESIGN DEVELOPMENT DRAWINGS QUALITY CHECKLIST

QUALITY ITEM	Yes	No
1) Does the design development submission represent the philosophy of design?	☐	☐
2) Are the "final draft" specifications included?	☐	☐
3) Do the drawings show overall floor plans, outside elevations, location and orientation on the site?	☐	☐
4) Are the system schematics shown for the facility?		
a) HVAC	☐	☐
b) Plumbing	☐	☐
c) Electrical Power Distribution	☐	☐
d) Fire Alarm	☐	☐
e) Security	☐	☐
f) Site Water	☐	☐
g) Site Storm Sewer	☐	☐
h) Site Sanitary Sewer	☐	☐
5) Does HVAC schematic diagram depict the following?		
a) Approved results of the life-cost analysis.	☐	☐
b) Approved results of the energy analysis.	☐	☐
6) Are schematic diagrams shown for campus type of utilities for the following:		
a) Chilled Water	☐	☐
b) Steam	☐	☐
c) Fire	☐	☐
d) Domestic Water Distribution	☐	☐
7) Do the "final draft" specifications describe the following:		
a) Scope of project.	☐	☐
b) Applicable codes.	☐	☐
c) Applicable rules.	☐	☐
d) Applicable standards.	☐	☐
e) Applicable regulations.	☐	☐
f) Each discipline with required design values shown.	☐	☐

DESIGN DEVELOPMENT DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
8) Are the project location, Architect and Engineering firms' addresses and telephone numbers shown?	☐	☐
9) Architectural:		
a) Are occupancy types and floor areas indicated?	☐	☐
b) Are square footage calculations shown for every space in accordance with program requirements?	☐	☐
c) Is a description of the shape and façade of the building provided?	☐	☐
d) Are all code-required features shown?	☐	☐
e) Is the fire protection system described?	☐	☐
f) Are the insulation "U" values shown?	☐	☐
g) Are the glazing type "U" values shown?	☐	☐
h) Are the exiting requirements stated?	☐	☐
1. Are the required numbers of exits clearly shown?	☐	☐
2. Are the capacity calculations clearly shown?	☐	☐
i) Are dimensions strings indicated on column grid?	☐	☐
j) Are interior handrail posts noted to be set in Portland cement grout?	☐	☐
k) Is sufficient access provided to all elevator machine components?	☐	☐
l) Is tempered glass indicated where required?	☐	☐
m) Is VCT indicated at OIT closets?	☐	☐
n) Are sightlines into bathrooms appropriate?	☐	☐
o) Do exterior elevations depict visible rooftop mechanical equipment?	☐	☐
p) Are exterior hollow metal frames treated with a bituminous coating on the back/throat side?	☐	☐
10) Civil/Structural:		
a) Is a site plan shown?	☐	☐
b) Is a grading plan, including contours and finish floor elevations provided?	☐	☐
c) Is a utility plan included?	☐	☐
d) Is a statement of loadings provided?	☐	☐
e) Are preliminary foundation plans shown?	☐	☐
f) Are preliminary floor and roof plans shown, including beam sizes & slab depths?	☐	☐

DESIGN DEVELOPMENT DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
g) Is a soil and geotechnical report relating to foundation design provided?	☐	☐
h) Are dimension strings indicated on column grid?	☐	☐
i) Are exterior handrail posts noted to be set in Portland cement grout?	☐	☐
11) Mechanical/Plumbing:		
a) Are HVAC and plumbing plans showing preliminary layout of equipment areas provided?	☐	☐
b) Are air handling units specified with "wing" type coils?	☐	☐
c) Is a description of HVAC controls included?	☐	☐
d) Is a description of energy management system included?	☐	☐
e) Is a description of the building automation system included?	☐	☐
f) Are the critical interfaces with life safety systems such as fire/smoke dampers, firestopping and fire control interlocks described?	☐	☐
g) Are special plans and criteria for mechanical/plumbing systems shown (i.e., kitchen hoods, paint storage ventilation, fuel systems, and compressed gas systems)?	☐	☐
h) Are fire protection plans shown?	☐	☐
i) Were the NFPA requirements for construction phase submittal reviewed?	☐	☐
j) Do the drawings reflect the approved scheme resulting from the energy and life cycle cost analysis?	☐	☐
k) Is adequate access provided to mechanical equipment located in attic spaces via ladders, catwalks, etc.?	☐	☐
12) Electrical:		
a) Is the lighting layout provided?	☐	☐
b) Are the calculations to show foot-candle intensities in each room provided?	☐	☐
c) Are exterior lighting levels/photometrics indicated?	☐	☐
d) Do lighting illumination levels comply with the requirements of the Energy Analysis?	☐	☐
e) Are the preliminary electrical equipment locations shown?	☐	☐
f) Are the phase and voltage electrical characteristics shown?	☐	☐
g) Is the type of wiring system indicated?	☐	☐

DESIGN DEVELOPMENT DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
h) Are the preliminary communications and data plans shown?	☐	☐
i) Are the preliminary fire alarm plans shown?	☐	☐
j) Are the preliminary security plans with card readers shown, including electrical power requirements?	☐	☐
k) Is a narrative on proposed power distribution system provided?	☐	☐
l) Is the emergency generator fuel fill vent and whistle indicated?	☐	☐
m) Is electrical closet construction of fire rated assembly?	☐	☐
n) Do OIT closets indicate surface mounted 3/4" fire retardant plywood on all wall surfaces, painted?	☐	☐
13) Cost:		
a) Does cost correlate to established budgets?	☐	☐
b) Have the estimated costs of construction between the Architect/Engineer and the Construction Manager or Owner's Cost Consultant been reconciled?	☐	☐

OTHER QUALITY ITEMS		Yes	No
1)		☐	☐
2)		☐	☐
3)		☐	☐
4)		☐	☐
5)		☐	☐
6)		☐	☐
7)		☐	☐
8)		☐	☐
9)		☐	☐
10)		☐	☐

EXPLANATION OF "NO" RESPONSES
1)
2)
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10)

Signature _____ Date _____

*Add additional sheets as required.

100% CONSTRUCTION DRAWINGS

ARCHITECT OR ENGINEER OF RECORD

Company Name	Principal in Charge	Date
Company Name	Project Architect	Date
Company Name	Mechanical Engineer	Date
Company Name	Electrical Engineer	Date
Company Name	Civil/Structural Engineer	Date

METROPOLITAN GOVERNMENT OF NASHVILLE

Project Manager	Date
ITS Manager	Date
Storm Water	Date
Public Works	Date
ADA	Date

100% CONSTRUCTION DRAWINGS QUALITY CHECKLIST

QUALITY ITEM	Yes	No
1) Are the following shown?		
a) All necessary information previously described.	☐	☐
b) All necessary details.	☐	☐
c) All sections.	☐	☐
d) All schedules.	☐	☐
e) All system diagrams.	☐	☐
f) All construction types.	☐	☐
g) All wall ratings - fire and "U" values.	☐	☐
h) All listed firestop systems.	☐	☐
2) Do the documents clearly depict the following?		
a) All design and construction requirements.	☐	☐
b) Adequate information to permit accurate Contractor take-off and pricing.	☐	☐
c) The finalization of the previously submitted and approved design phases.	☐	☐
d) The agreed upon responses of earlier design review quality comments.	☐	☐
e) All items provided by Owner installed by Contractor, in matrix format.	☐	☐
f) All items installed by Owner, in matrix format.	☐	☐
g) Project name, project number and project location.	☐	☐
h) Compass orientation the same on all plan view sheets.	☐	☐
i) All easements, right-of-way, and interfaces with public, city or county utilities.	☐	☐
j) All proposed alternates shown clearly and accurately, and consistent between the specifications and drawings.	☐	☐
k) All previously approved energy and life-cycle cost analyses, schemes and architectural features.	☐	☐
l) All necessary building code approvals.	☐	☐
m) Drawing sheet signed and sealed by Architect or Engineer?	☐	☐
n) Do square footage areas correlate to program requirements?	☐	☐
o) Does cost correlate to established budgets?	☐	☐
p) Have the estimated costs of construction between the Architect/Engineer and the Construction Manager or Owner's Cost Consultant been reconciled?	☐	☐
3) Architectural:		
a) Are wall details shown that ensure the minimum "U" value is met?	☐	☐
b) Are roof details shown that ensure the minimum "U" value is met?	☐	☐

100% CONSTRUCTION DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
c) Floor plans:		
1. Are all dimensions and all spaces identified?	☐	☐
2. Are all walls dimensioned from column lines?	☐	☐
3. Are rated partitions identified?	☐	☐
4. Are ADA disability features identified?	☐	☐
5. Is the location of all drinking fountains, fire extinguishers, hoses, etc. shown?	☐	☐
6. Is all built-in equipment identified?	☐	☐
7. Is the orientation (north arrow) shown on all plans?	☐	☐
8. Is the scale shown for all drawings?	☐	☐
9. Are all access panels shown and coordinated in locations for access to mechanical, electrical and plumbing equipment?	☐	☐
d) Elevations:		
1. Are all exterior and interior elevations of the building shown?	☐	☐
2. Are all materials labeled?	☐	☐
3. Are all vertical dimensions shown?	☐	☐
4. Is the roof slope identified?	☐	☐
5. Do exterior elevations depict visible rooftop mechanical equipment?	☐	☐
6. Are exterior hollow metal frames treated with a bituminous coating on the back/throat side?	☐	☐
e) Reflected Ceiling Plans:		
1. Is the plan fully coordinated by CAD overlay with mechanical, electrical, data, and sprinkler system drawings, including access panels?	☐	☐
2. Are all ceiling materials identified?	☐	☐
3. Is the design intent of ceiling grid clearly shown?	☐	☐
f) Scale of Plans:		
1. Are all plans shown at 1/8" = 1'-0" scale, except for enlarged plan view for equipment rooms, stairs, etc.?	☐	☐
g) Section and Details. Identify:		
1. All exterior wall sections minimum 3/4" = 1'-0".	☐	☐
2. All interior wall sections minimum 3/4" = 1'-0".	☐	☐
3. All roof edges, expansion joints, penetrations shown with isometric drawing of scupper or any non-standard situations.	☐	☐

100% CONSTRUCTION DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
4. All head, jamb and sill details shown for all doors and windows, complete with dimensions.	☐	☐
5. All expansion joints shown, complete with dimensions.	☐	☐
6. Are stairs, stringers, landings completely detailed with floor and base finishes?	☐	☐
h) Schedules and Legends. Identify:		
1. Finishes. a) 4" rubber base b) Ceramic tile thickness uniform on walls. c) VCT floor in OIT closets. d) Use of acrylic enamel paints (no oil based paints).	☐	☐
2. Doors and windows.	☐	☐
3. Toilet accessories.	☐	☐
4. All abbreviations.	☐	☐
i) Miscellaneous:		
1. Show mounting heights for all ADA items; toilet room accessories, ramp slopes, stair design, seating capacity.	☐	☐
2. State on the drawings the code and year that applies to the project.	☐	☐
3. Show all design loads on drawings.	☐	☐
4. Are interior handrail posts noted to be set in Portland cement grout?	☐	☐
5. Is sufficient access provided to all elevator machine components?	☐	☐
6. Is tempered glass indicated where required?	☐	☐
7. Is VCT indicated at OIT closets?	☐	☐
8. Is privacy maintained with regard to sightlines into bathrooms?	☐	☐
4) Civil/Structural:		
a) Show anchor bolt embedments and projections.	☐	☐
b) Provide footing elevations.	☐	☐
c) Identify connections and services.	☐	☐
d) Indicate top elevation of all catchbasins and manholes.	☐	☐
e) Match contours with top elevations of catchbasins and manholes.	☐	☐
f) Is the type of pipe specified?	☐	☐
g) Are the datum elevations correlated with the USGS elevations?	☐	☐

100% CONSTRUCTION DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
h) Are the finish floor elevations shown?	☐	☐
i) Is the finish floor elevation above 100-year flood?	☐	☐
j) Are pavement sections shown?	☐	☐
k) Are control joints shown in all slabs?	☐	☐
l) Are proper control joints shown in all masonry walls?	☐	☐
m) Are all structural elements properly and accurately dimensioned from column grid lines?	☐	☐
n) Are exterior handrail posts noted to be set in Portland cement grout?	☐	☐
o) Are there any special structural details that require a sequence of erection narrative?	☐	☐
p) Are all design loads including dead, live, snow and wind loads shown and accounted for?	☐	☐
q) Has a roof snow/drift load analysis been performed?	☐	☐
r) Is sufficient access provided to all elevator machine components?	☐	☐
5) Mechanical/Plumbing:		
a) Are all fire/smoke dampers provided in all rated walls/ceilings?	☐	☐
b) Is a detail shown for sealing all wall and ceiling penetrations?	☐	☐
c) Is the water heater relief piping and discharge point shown?	☐	☐
d) Is all ductwork designed in compliance with ASHRAE and SMACNA?	☐	☐
1. Are ductwork pressure testing/leakage restrictions indicated?	☐	☐
e) Are all systems in compliance with University Standards?	☐	☐
f) Are "wing" type coils specified on air handling equipment?	☐	☐
g) Are all plumbing systems in compliance with applicable codes?	☐	☐
h) Is the following equipment provided in all attics?		
1. Access opening, platforms, and walkways, where applicable.	☐	☐
2. Lighting.	☐	☐
3. Auxiliary pans/drains for air conditioning equipment.	☐	☐
4. GFI convenience outlets.	☐	☐
i) Do all kitchen hoods conform to mechanical and fire codes?	☐	☐
1. Do all chemical fume hoods conform to mechanical and fire codes?	☐	☐
j) Are all air conditioning condensate lines with discharge shown?	☐	☐

100% CONSTRUCTION DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
1. Does the discharge conform to code?	☐	☐
k) Are all required backflow prevention devices shown?	☐	☐
l) Does the fire sprinkler system show:		
1. Details of water source?	☐	☐
2. Type of sprinkler system?	☐	☐
3. Plan of sprinkler system?	☐	☐
4. Are risers shown?	☐	☐
5. Are connections to existing systems shown?	☐	☐
6. Are all valves and controls shown?	☐	☐
7. Notation requiring fire protection contractor to provide the sprinkler head model number on the design submittal shop drawings?	☐	☐
m) Is the temperature control system provided?	☐	☐
n) Is the energy management system provided?	☐	☐
o) Is the building automation system provided?	☐	☐
p) Are temperature control energy management and building automation systems' schematics shown on the drawings?	☐	☐
q) Are the sequences of the HVAC systems' of operation provided, complete with a point list?	☐	☐
r) Are the ceiling diffuser and sprinkler head locations coordinated with the architectural reflected ceiling plans?	☐	☐
s) Was a CAD overlay made of the mechanical work to ensure no conflicts with other work, equipment or structures?	☐	☐
t) Is adequate access provided to mechanical equipment located in attic spaces via ladders, catwalks, etc.?	☐	☐
6) Electrical:		
a) Is an electrical site plan shown?	☐	☐
b) Was a CAD overlay made of the electrical work to ensure no conflicts with other work, equipment or structures?	☐	☐
c) Is lighting system in accordance with University energy guidelines?	☐	☐
d) Does all electrical work comply with the latest National Electrical Code?	☐	☐
e) Are all conductors copper?	☐	☐
f) Is the electrical legend complete?	☐	☐

100% CONSTRUCTION DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
g) Are all panelboard schedules provided?	☐	☐
1. Do they show voltage and phase?	☐	☐
2. Is the rating of the main disconnect shown?	☐	☐
3. Are all circuit numbers shown?	☐	☐
4. Are the number of poles shown?	☐	☐
5. Are all trip-amperes shown?	☐	☐
6. Are all volt-amperes shown?	☐	☐
7. Are all wire sizes shown?	☐	☐
8. Are all conduit sizes shown?	☐	☐
h) Is lighting fixture schedule shown?	☐	☐
1. Are all fluorescent lamps and ballasts of the energy-saving type?	☐	☐
2. Is an exterior lighting photometrics plan included?	☐	☐
i) Are riser diagrams shown for the following:		
1. Electrical service?	☐	☐
2. Fire alarm system?	☐	☐
3. Intercom system?	☐	☐
4. Telecommunications system?	☐	☐
5. Computer data system?	☐	☐
j) Is the following transformer data provided?		
1. Voltage?	☐	☐
2. Phase?	☐	☐
3. KVA rating?	☐	☐
k) Is the division of work between contractor, University of Notre Dame Utilities and AEP clearly shown?	☐	☐
l) Is the voltage and KVA rating of all generators shown?	☐	☐
m) Is the voltage and KVA rating of all transfer switches shown?	☐	☐
n) Is sufficient space shown as required by the National Electrical Code for the following?	☐	☐
1. Panelboard locations?	☐	☐

100% CONSTRUCTION DRAWINGS QUALITY CHECKLIST (continued)

QUALITY ITEM	Yes	No
2. Switchgear locations?	☐	☐
3. Transformer locations?	☐	☐
o) Are ensurances made that no water lines are above electrical panels or switchgear?	☐	☐
p) Are all locations of mechanical equipment and their circuits shown?	☐	☐
q) Are all circuits for kitchen equipment shown?	☐	☐
r) Are all rooms designated as shown on the architectural plans?	☐	☐
s) Is the lighting layout coordinated with the architectural reflected ceiling plan?	☐	☐
t) Is all grounding shown?	☐	☐
u) Is all the electrical equipment shown on the floor plans?	☐	☐
v) Are all circuits shown on the floor plans?	☐	☐
w) Are specifications provided for the following?		
1. All electrical equipment	☐	☐
2. The fire alarm system.	☐	☐
3. The intercom system.	☐	☐
4. The lightning protection.	☐	☐
5. The security system.	☐	☐
6. The telecommunications system.	☐	☐
7. The computer data system.	☐	☐
8. The firestopping details.	☐	☐
9. All grounding, including equipment grounding.	☐	☐
x) Are the schematic diagrams for door card swipe access systems shown?	☐	☐
y) Are the power requirements and sequence of control shown for elevator recall system?	☐	☐
z) Is the emergency generator fuel fill vent and whistle indicated?	☐	☐
aa) Are the preliminary security plans with card readers shown, including electrical power requirements?	☐	☐
bb) Are OIT/data outlets indicated at vending machines?	☐	☐
cc) Is electrical closet construction of fire rated assembly?	☐	☐
dd) Do OIT closets indicate surface mounted 3/4" fire retardant plywood, on all wall surfaces, painted?		

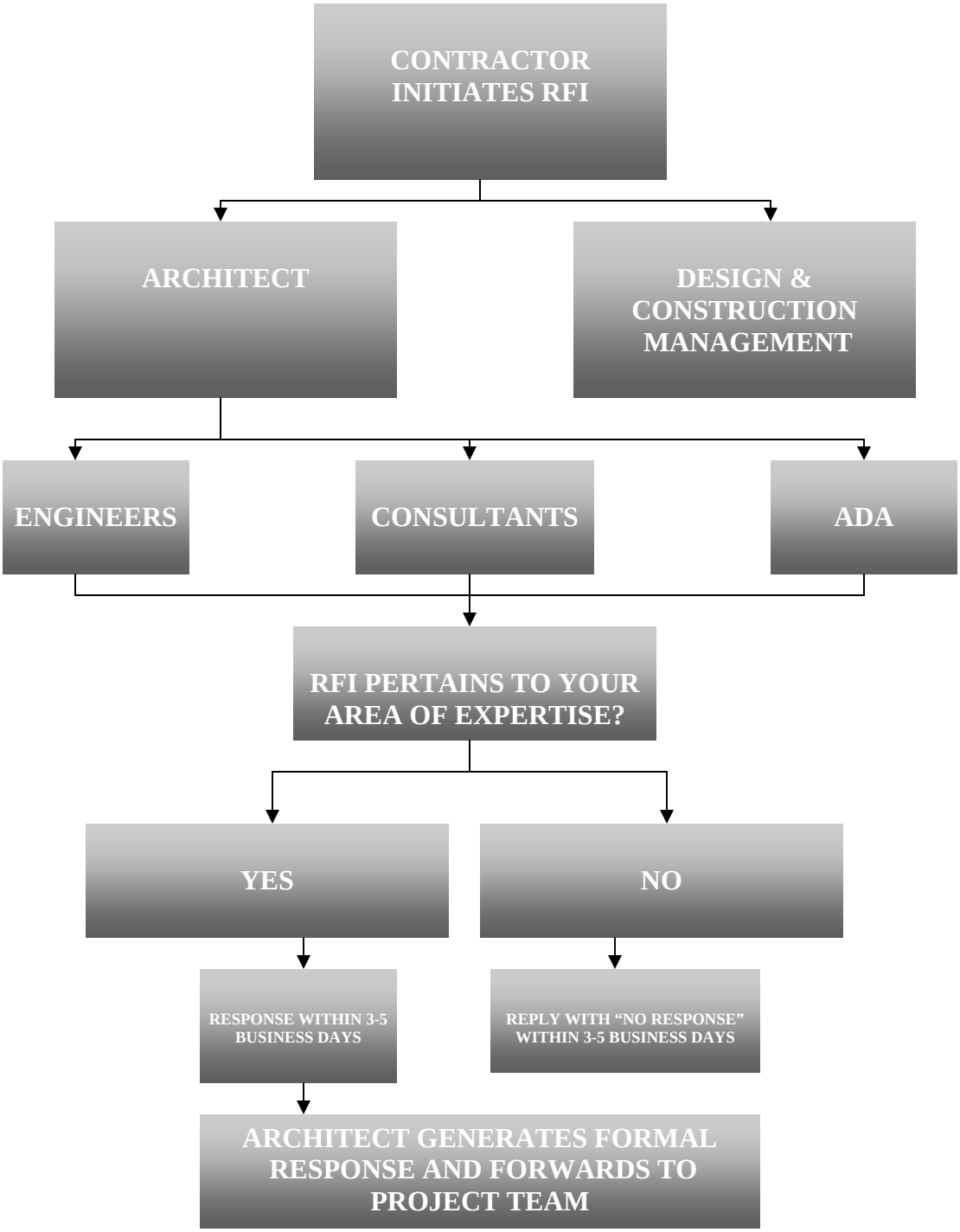
OTHER QUALITY ITEMS		Yes	No
1)		☐	☐
2)		☐	☐
3)		☐	☐
4)		☐	☐
5)		☐	☐
6)		☐	☐
7)		☐	☐
8)		☐	☐
9)		☐	☐
10)		☐	☐

EXPLANATION OF "NO" RESPONSES
1)
2)
3)
4)
5)
6)
7)
8)
9)
10)

Signature _____ Date _____

*Add additional sheets as required.

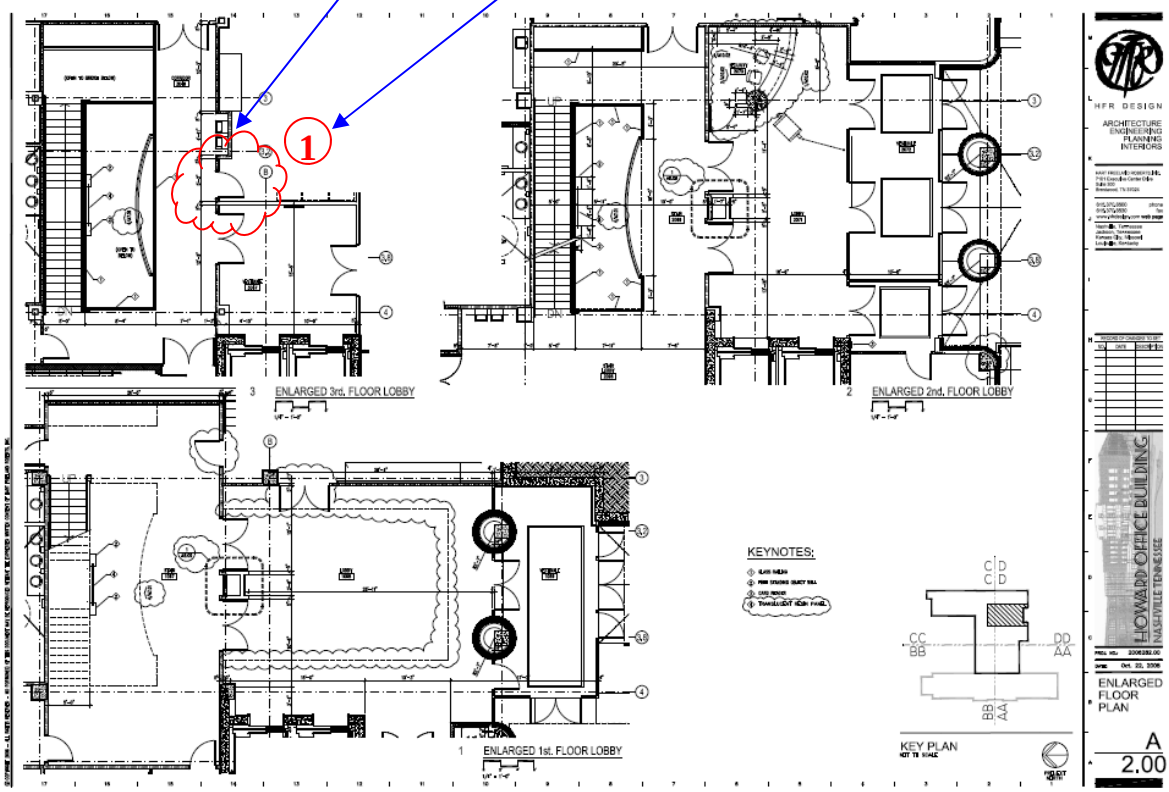
RFI REVIEW FLOW CHART

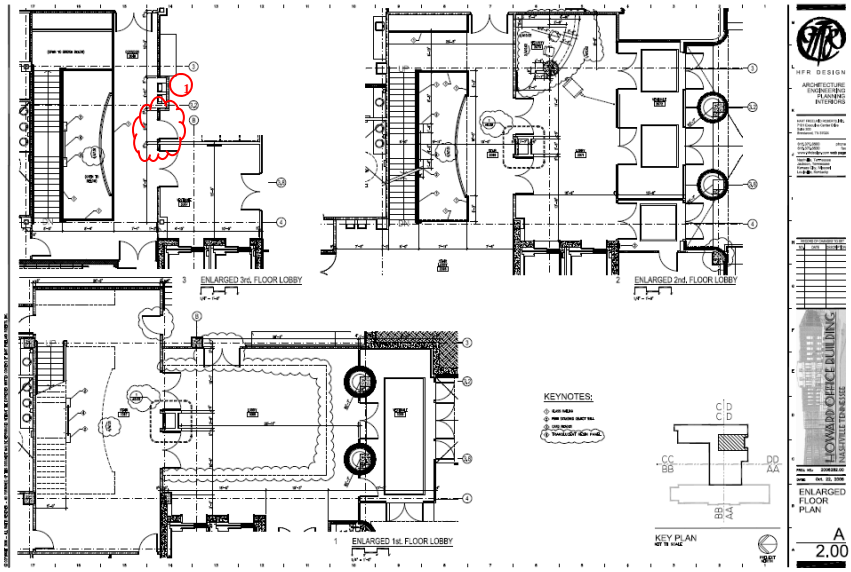


DESIGN REVIEW PROCESS

Cloud in RED area of reference

Number reference in chronological order .
Refer to title block for numerology which is in ascending order.





Date of Entry

Specify question/reference

Number reference in chronological order

NO.	DATE	DESCRIPTION
1	1.12.09	Verify door location - LG

Initial Entry

PROJ. NO.: 2006282.00

DATE: Oct. 22, 2008

ENLARGED FLOOR PLAN

A

2.00

ATTACHMENTS

ATTACHMENT A

From: website@nashville.gov [mailto:website@nashville.gov]
Sent: Wednesday, July 30, 2008 4:35 PM
To: Nicholson, Gregg (General Services); Lykins, Cyndi (General Services)
Cc: Barnett, Sarah (MNPD)
Subject: CIR Form Submission

A representative will contact you shortly with your assigned CIR number.
If you have questions, please contact Gregg Nicholson or Cyndi Lykins.

Thank you for submitting the following information.

Date Received:	7/30/2008
CIR #	pending

PROJECT INFORMATION

Project Name:	Police IT Cubicles
Project Address:	200 James Robertson Parkway
City:	Nashville
State:	TN
Zip:	37201
Requesting Agency:	Police IT - MNPD
Department Code:	Unknown
Contact:	Sarah Barnett
Phone:	615-862-7451
Estimated Cost:	
Estimate By:	
Project Description:	We are currently using cubicles for two workstations in the Police IT office (CJC, 3rd floor, Suite 312) and because of a limited amount of space available it is not the most ideal set-up. We know there is a better way, but we are not familiar enough with all the options we have using cubicles. We request that someone come out to help us arrange the cubicles in a more suitable way.
Project Justification:	The two employees need a proper work area that will give them adequate space for their required job duties.

Requested Completion Date: 08/01/2008

FUNDING INFORMATION

Amount:	
Source:	
Resolution Number:	
Revenue Account:	
Comments:	We made a request for this back in June '08. Lori Lazo came out with the Stell Group to assess the situation, but we never heard back from Stell or Ms. Lazo. We were not aware of the required form until now. We are extremely eager to see this request be attended to promptly. Thank you.

ATTACHMENT B

BOSS Design and Construction Projects

1417 Murfreesboro RD Nashville, TN 37217 (Ph 880-2644)

Project Authorization and Review Form

Project Name _____ Agreement Date _____

Agency _____ Project Revision # _____ Revision Date _____

Project Contact _____ Phone No. _____ email _____

Project Financials:

CIR # _____ Business Unit Number _____

** Project Budget ** _____ Actual Expenses _____

Project Timeline:

	Estimated	Actual
Design Start		
Design Complete		
Construction Start		
Substantial Completion		
Final Completion		

☐ Check box if there are any attachments to this form

_____ No. of attachments

Type of Project:

_____ New Construction
_____ Renovation / Addition
_____ Demolition
_____ Interiors Only
_____ Survey / Study / Assessment
_____ Other

Brief Description of Project:

Additional Project Notes / Comments / Reason for Revision:

*** * Design and Construction Management Fees are included in Project Budget.**

BOSS Project Manager _____ Date _____

Agency Representative _____ Date _____

BOSS Financial Manager _____ Date _____

Please indicate your overall satisfaction with our performance on this project on a scale of 1 to 5 (with 1 = least satisfied and 5 = most satisifed) 1 __ 2 __ 3__ 4__ 5__

Does this project meet your predetermined need described above? Yes _____ No _____

Agency Head (or Designee) _____ Date _____

adopted 7/30/08

ATTACHMENT C

BUILDING OPERATIONS SUPPORT SERVICES - PROJECT RECORD

Building: Criminal Justice Center
Department: Police
Project Number: 47
Project Name: CJC-to rearrange IT cubicles-47-073108
Project Status: Under Review

PROJECT INFORMATION

BOSS Project Manager: Lazo
Project Type: Renovation
Planned or Unplanned: Planned
Contracted or In-House: Contracted
Council District: 6 (Map)
Scope of Work: Existing cubicles need rearranging to make space more suitable work area.
CIR #: 02091004
Work Order:
Plans Barcode:

DATES

Date Opened: 7/31/2008
Anticipated Start Date: 8/5/2008
Anticipated End Date: 8/30/2008
Plans Review Date:
Plans Release Date:
Pre-Construction Meeting Date:
Substantial Completion Date:
Date of Final Closure:

NOTES

07/31/08 JWS - Entered Project Record.

COST

Estimated Project Cost: $600
Funding Source: Police Operational
Actual Project Cost: $0

CONTRACTOR

Name:
Company:
Phone:
Email:

DESIGN PROFESSIONAL

Name:
Company:
Phone:
Email:

Save This Project Record
Print This Project Record
Find a Project

ATTACHMENT C . . . Cont'd

The BOSS Projects database contains 33 data fields and two optional command buttons, plus the standard navigation buttons (left and right arrows at the bottom of the screen, as was designed in the Work Orders database and/or the ADA Compliance database).

Those field names that are in **bold type** are required when opening a new project. Those fields will be filled in by the Business Services Support Group, but maybe modified to suit the Design Construction Project Manager. The non-bold fields may or may not need to be filled in as the project progresses.
If you try to save a record while a required field is blank, it will give you an error message and will not let you save the record until you go back and fill it in.

If you try to enter something in a drop-down field that is not on the drop-down list, you will receive an error that says so. Just go back to the field and select from the list.

The Project Number field (with the **red border** in the upper right corner) will display a automatic System Generated Number. You will not have to do anything to it; in fact, you can't type in it or edit it. You'll use that number as part of the Project Name.

These instructions explain each field in the order you will go through them if you tab through the screen. Of course, you can also use your mouse to go from field to field. The red numbers by the field names on the sample form will not appear in the actual database; they're just there to make it easier for you to match the field's location with its description below.

1. **Building** – Use the drop-down list to put the name of the building in this field and also make a note of the abbreviation to the right of the building name. You'll use that abbreviation when you fill in the Project Name field.
2. **Department** – Use the drop-down list to select the department requesting the work.
3. **Project Number** – This field with automatically fill in with the number of the project. You will use it when you fill in the Project Name field. It is a "unique identifier" so will always be associated with that one project.
4. **Project Name** – If you hover over the field, you will receive a hint that reminds you that the project name is constructed of the building abbreviation, a very short description of the work, the project number, and the date the project was opened, with a dash between each element. So if you were doing a project to reroof the front part of the CJC Annex, the project name might be CJCNX-reroof front area-11-121307. Notice that there are no dashes or slashes in the date, and that it uses the two-digit year, not the four. This project naming system has been working well for ADA for many years, and I'm sure it will work well on BOSS projects too.
5. **Project Status** – Use the drop-down list to display the project's current status.
6. **BOSS Project Manager** – A simple drop-down list to choose from.
7. **Project Type** – Use the drop-down list to select the project type that comes closest to the one you're working on. An emergency will "trump" other project types.
8. **Planned or Unplanned** – A simple two-choice drop-down; self-explanatory.
9. **Contracted or In-House** – A simple two-choice drop-down; self-explanatory.
10. **Council District Number** – Self-explanatory; see note "11" below.
11. **Link to Council District Map** – This link takes you to a page on the Metro Council's website that displays a simple map with the council districts identified. If you can't tell from the map which district your project is in, please use the phone number on the Council website to call the council office.
12. **Scope of Work** – This should be a very brief description of what work is requested. Note that the field does not expand or scroll.
13. **Capital Improvement Request (CIR)** – Number assigned by Business Support Services Group.
14. **Work Order** – If this project was begun with a work order, the work order number will be input by the Business Support Services Group.

ATTACHMENT C . . . Cont'd

15. **Plans Barcode** – Many projects will not have these, but there may be projects that do involve our working with plans that will need to be stored by Metro Records when the project is completed. If so, the Business services Support Group will contact Jan for a set of barcodes that are required by Records, and add that barcode number into this field before closing the project.
16. **Date Opened** – Enter it in the order of month, date, year. Use hyphens or slashes as you choose; the database will convert to the format it needs as long as they're in the right order.
17. **Anticipated Start Date** - Enter it in the order of month, date, year. Use hyphens or slashes as you choose; the database will convert to the format it needs as long as they're in the right order.
18. **Anticipated End Date** - Enter it in the order of month, date, year. Use hyphens or slashes as you choose; the database will convert to the format it needs as long as they're in the right order.
19. Plans Review Date - Enter it in the order of month, date, year. Use hyphens or slashes as you choose; the database will convert to the format it needs as long as they're in the right order.
20. Plans Release Date - Enter it in the order of month, date, year. Use hyphens or slashes as you choose; the database will convert to the format it needs as long as they're in the right order.
21. Pre-Construction Meeting Date - Enter it in the order of month, date, year. Use hyphens or slashes as you choose; the database will convert to the format it needs as long as they're in the right order.
22. Date of Substantial Completion - Enter it in the order of month, date, year. Use hyphens or slashes as you choose; the database will convert to the format it needs as long as they're in the right order.
23. **Date Closed** (with the **red border** surrounding it) – Will be entered by the Business Support Services Staff. Be sure you do not fill in this field until the project is closed. If you do, it could get moved out of the database while you're still needing it to be available.
24. **Estimated Project Cost** – Use whole dollar amounts (do not need the detail of single dollars.)
25. **Funding Sources** – Type in the business unit and fund numbers if they apply; if they don't, type in what other funding method will be used.
26. Actual Project Cost – Use actual whole dollar amounts cost.
27. (Contractor) Name – The name of the individual person, if a contractor is involved.
28. (Contractor) Company – The name of the contractor's company, if a contractor is involved.
29. (Contractor) Phone – The contractor's phone number, if a contractor is involved.
30. (Contractor) Email – The contractor's email address, if a contractor is involved.
31. (Design Professional) Name – The name of the individual person, if a design professional is involved.
32. (Design Professional) Company – The name of the contractor's company, if a design professional is involved.
33. (Design Professional) Phone – The contractor's phone number, if a design professional is involved.
34. (Design Professional) Email – The contractor's email address, if a design professional is involved.
35. **Notes** – This is an expandable open text field where you record the project's progress (additionally, anything that does not belong in one of the other fields but is relevant to the project also goes into this field). Start each entry with the date, your initials and then Notes. Each time you add a new note, add a new blank line at the top of the Notes field, so the newest information is always on top. Example: 08/15/08 JWS – Entered Project Record.
36. Save This Project Record – This button will save the record but it is not required unless you want to save and continue. If you want to save and close, all you have to do is close the record; the database will automatically save your changes when it closes.
37. Find a Record – This button works exactly the same way as the Find button in the Work Orders database.
38. Print This Project Record – Use this button to get a printout of the individual project. As with the Work Orders database, if you just use the Print command, it will print out the entire database. (Known bug: The printouts aren't formatted to fit on one page each yet – working on it. JS)

ATTACHMENT D

Department of General Services

BOSS Design and Construction Project Close Out

Building Plans, Schematics and Drawings:

A. Final Plans	Received: _____	N/A: _____
B. Shop Drawings	Received: _____	N/A: _____
C. Sketches	Received: _____	N/A: _____
D. Samples	Received: _____	N/A: _____

System Operational Manuals:

A. Electrical	Received: _____	N/A: _____
B. HVAC	Received: _____	N/A: _____
C. Sprinkler	Received: _____	N/A: _____
D. Plumbing	Received: _____	N/A: _____

System Warranty Information:

A. Electrical	Received: _____	N/A: _____
B. HVAC	Received: _____	N/A: _____
C. Sprinkler	Received: _____	N/A: _____
D. Plumbing	Received: _____	N/A: _____

Space Analyze Documents:

A. Gross Measurement	Received: _____	N/A: _____
B. Floor Measurement	Received: _____	N/A: _____
C. Unit Measurement	Received: _____	N/A: _____

Training provided on:

_____

_____

_____

Design Construction (Project Manager) **Business Support Staff**

_____ _____