


**Managing Effective Plan Reviews**  
 Course 625  
 APPA Facilities Institute – APPA-U

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 Division Manager | General Manager  
 Swinerton Management & Consulting



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**AIA CONTINUING EDUCATION**

- Credit(s) earned on completion of this course will be reported to the American Institute of Architects (AIA) Continuing Education Session (CES) for AIA members.
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- This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or constructed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.



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**Program Outline**

- Introduction
- What is a Plan Review?
- Are Plan Reviews Important?
- Can Plan Reviews save time and money?



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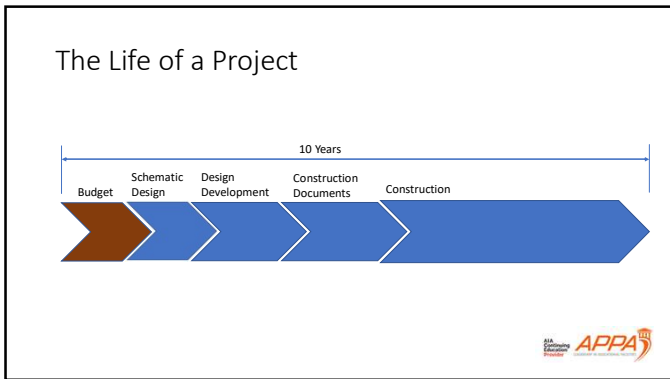
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### What could change at your campus over 10 years?

APPA

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- ### Why? Risk Management - Mitigation
- Changing academic needs
  - Project scope changes
  - Project budget creep
  - Project schedule extension
  - Quality concerns
  - Material delays
  - Safety concerns – construction / occupancy
  - Incomplete design documents
  - A/E and GC resource availability
- APPA

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# Plan Reviews

- Program
  - Program adherence
  - Conform to Campus Standards
  - Comply with funding/grant requirements
- Completeness
  - Are the construction plans and specifications complete?
- Constructability
  - Are the plans and specifications biddable?
  - Are conflicts reduced/mitigated
  - Are the construction plans coordinated



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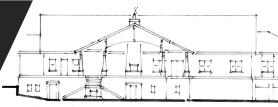
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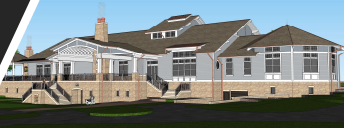
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# Case Example – Golf Club House Project

- Budget \$9,950,000
- Donor Funding
- Replace Existing Clubhouse
- Open Golf Season 2020
- Set to bid April 2018
- 1<sup>st</sup> Bid September 2018
- 2<sup>nd</sup> Bid December 2018



North Elevation



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# Program Review

- Program
  - Program adherence
  - Conform to Campus Standards
  - Comply with funding/grant requirements



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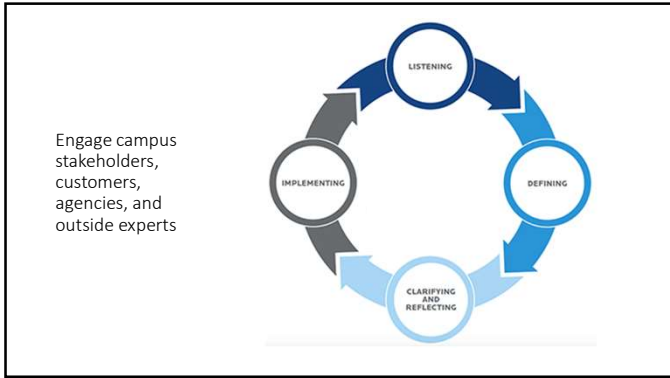
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### Hold Kick Off Meeting

- Define Roles
- Set Expectations
- Review Scope
- Discuss Schedule and Budget
- Document (Meeting Minutes)

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### Program Review

- Align to Campus Master Plan
- Develop Project Team Members
- Establish Process
- Initiate Participation
- Validate Programming (space/equipment)
- Review Submittal requirements

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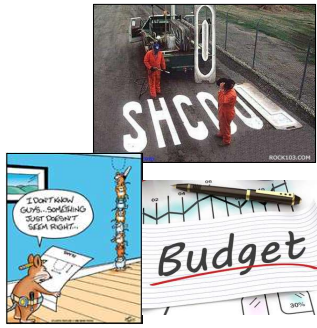
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### Program Compliance

- Capital Project Programming
- Space Requirements
- System Requirements
- Campus Design Standards
- Local / State / Federal Requirements
- Safety Review
- Life Cycle Analysis
- Sustainability/LEED
- Commissioning



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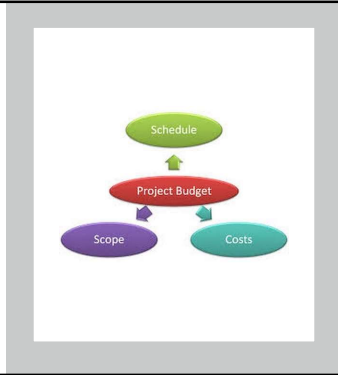
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### Schedule Review

- Review project goals
- Construction Season Impact
- Availability of Market Resources
- Material Availability
- Budget Constraints
- Design Review Time
- Contingency Built In?
- Drive project forward



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### Completeness Reviews

- Completeness
  - Are the construction plans and specifications complete?



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## Construction Documents Review

- What?
  - Drawings
  - Specifications
- Confirm
  - scope, budget, quality, schedule
- Check (Constructability Review)
- Recheck
- File Documents



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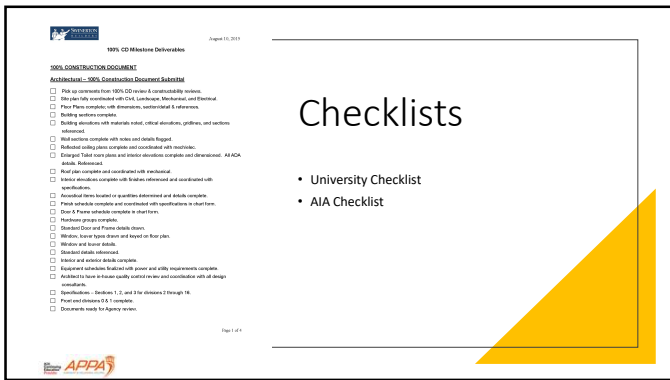
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100% CD Minimum Deliverables - August 11, 2019

### Checklists

- University Checklist
- AIA Checklist



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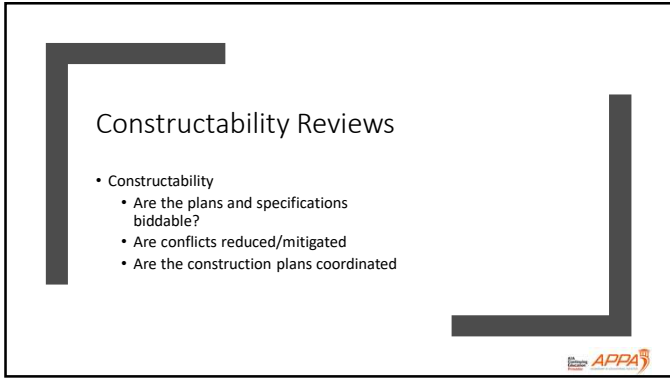
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## Constructability Reviews

- Constructability
  - Are the plans and specifications biddable?
  - Are conflicts reduced/mitigated
  - Are the construction plans coordinated



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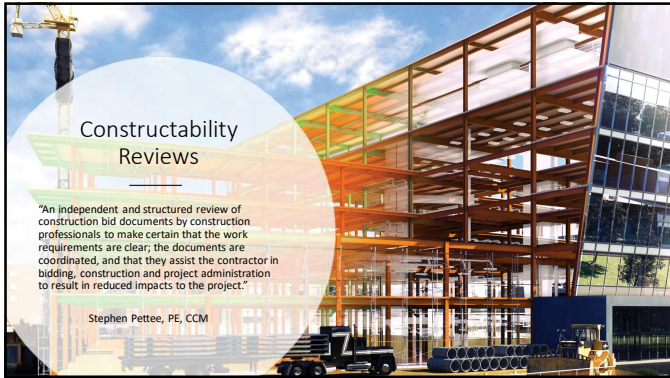
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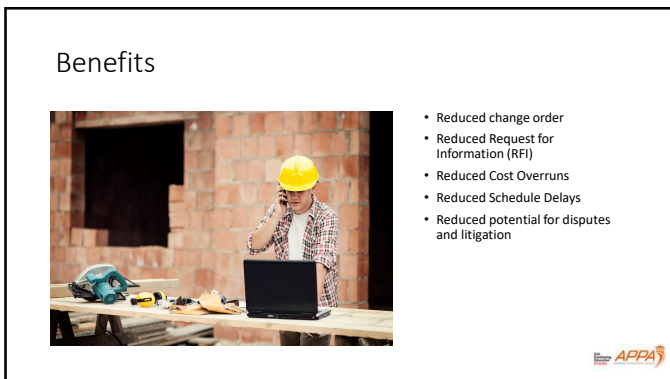
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### Cost Benefits

- Various Studies
- \$10 worth of savings for every CR Dollar spent
- 3% - 5% of the entire construction cost
- Costs are avoided with a complete constructability review, so detailed numbers are not regularly available



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### Managing Expectations

- Not all issues will be found
- Change Orders and RFI's will not be eliminated
- Design changes after reviews may likely cause issues



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### Elements of a Constructability Review



- Coordination
- Build-ability
- Bid-ability
- Building Systems Integrity



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**Constructability Review Milestones**

- 100% Design Development
- 50% Construction Documents
- 90% Construction Documents

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**Constructability Review Team**

- Architect
- MEPT
- Construction Superintendent
- Owner

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**Document and Backcheck**

- Document all issues identified
  - Clear and concise
  - Spreadsheet
  - Comments directly on plans
- Backcheck – absolutely required
- Build in time for constructability review in project schedules

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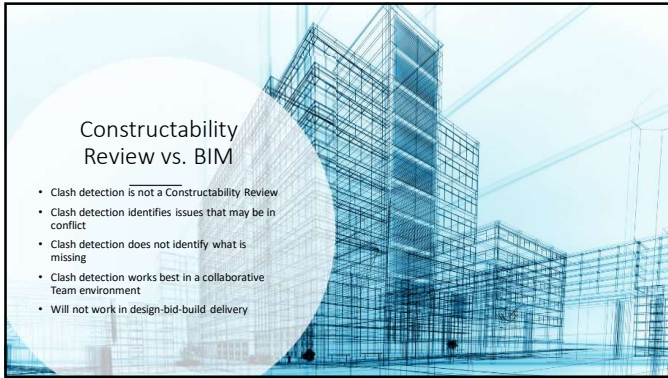
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**Constructability Review vs. BIM**

- Clash detection is not a Constructability Review
- Clash detection identifies issues that may be in conflict
- Clash detection does not identify what is missing
- Clash detection works best in a collaborative Team environment
- Will not work in design-bid-build delivery

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**Constructability Reviews**

- Reviews need to be planned for:
  - Budget
  - Schedule
- Reviews need to be managed and checked
- Reviews can save money/avoid costs
- Reviews can avoid costly time delays
- The architects and engineers retain their professional obligations



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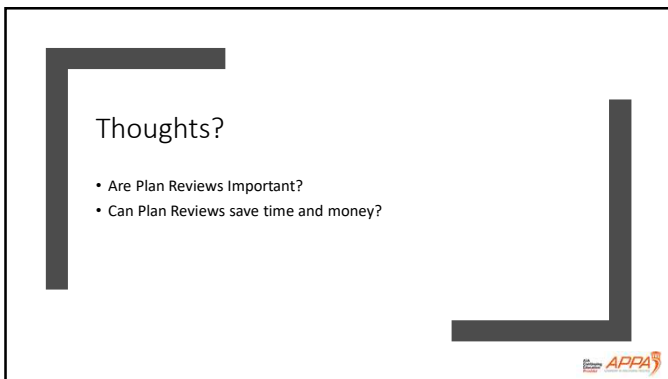
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**Thoughts?**

- Are Plan Reviews Important?
- Can Plan Reviews save time and money?



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Final Thoughts

- Improved design and construction process
- Increased contractor competition
- Increased certainty of outcomes
  - Cost
  - Schedule
- Take work away from attorneys!



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Thank You!

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# DESIGN DOCUMENT DELIVERABLE LIST

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## SCHEMATIC DESIGN PHASE

The Schematic Design Phase, representing approximately 20% of design, should clearly indicate the improvements and construction anticipated for the project or provides sufficient information and alternatives so that a clear direction for subsequent phases can be determined. The Schematic Design should incorporate all items outlined in the Scope of Work. The Schematic Design documents may be submitted in booklet form or as plans with other narrative materials; whichever best presents and conveys the necessary information. The Schematic Design should be presented with sufficient information to allow a reviewer to fully understand the main design concepts and orientation. All consultants are to produce their schematic plans following the same format, scale and drawing positioning as the architectural drawings. Designer shall insure all sub-consultant work is coordinated.

### *Schematic Design Phase Objective*

To define the general scope, scale, functional relationship, traffic flow and cost of the Project components. The conceptual design is documented in sufficient detail to convey a clear and comprehensive image of the designer's solution. The documents will identify area allocations, conceptual organization of exterior and interior spaces, conceptual image and building massing, usage of feature interior and exterior materials, selection of structural, mechanical, plumbing and electrical system concepts. Upon acceptance of the Schematic Design Package, the owner will approve the conceptual direction for further development in subsequent phases.

## DESIGN DEVELOPMENT PHASE

The Design Development Phase should provide definite design conclusions based on the approved Schematic Design framework and represent approximately 50% of design completion. Where the consultant requires a decision or recommendation to proceed to the Construction Document Phase, adequate supportive and explanatory information should be provided upon which a determination can be made. The submittal should be presented in an industry accepted format (CAD or BIM) with additional narrative materials as necessary.

Provide written response to owners schematic review comments. Resolve any outstanding issues on schematic design checklist. Designer shall insure all sub-consultant work is coordinated.

### *Design Development Phase Objective*

To develop in further detail the approved conceptual design. The design documents should clearly identify the developed civil, architectural, structural, mechanical, electrical, plumbing and fire protection design solutions. All major features and components of the design solution should be documented and included in the updated cost estimate and compound with AFC. Upon approval of the Design Development Package by the owner, the design team will begin execution the final construction design details. The approved Design Development Package constitutes a complete concept and no further changes to the plans, elevations or building systems will be allowed except to comply with construction or code requirements.

## CONSTRUCTION DOCUMENTS PHASE

The Construction Document Phase provides the completed set of plans and technical specifications necessary to build the project. Few changes should be necessary at this point. Design is to be 100% complete. Documents to have been thoroughly quality checked by the designer to include proofread for spelling, typographical and grammatical errors prior to submission. Resolve any outstanding issues on the Design Development checklist. Designer shall insure all sub-consultants' work is coordinated.

### *Construction Document Phase Objective*

To develop a complete set of design documents. The construction documents should be clear and precise for the builder to do take-offs and subcontractors to provide pricing without needing to visit the project site.

Design Document	Schematic Phase	Design Development Phase	Construction Document Phase
<p><b>1.GENERAL REQUIREMENTS THAT APPLY TO ALL SYSTEMS</b></p>	<ol style="list-style-type: none"> <li>1.Complete Design Intent Document</li> <li>2.Written statement of review of RFP and D-B proposal and list of potential non-compliance issues</li> <li>3.Pending issues Report</li> <li>4.Value Engineering suggestions</li> <li>5. Energy Code Requirements</li> <li>6. Description of construction phasing with supporting work scope</li> <li>7. List of applicable building codes and anticipated variance requests</li> </ol>	<ol style="list-style-type: none"> <li>1. Project Title – (All Sheets)</li> <li>2. Owner’s Project Number – (All Sheets)</li> <li>3. Location Map (Include North Arrow – Cover Sheet and Site Plan Sheet)</li> <li>4. Signature block for the Owner on Cover Sheet.</li> <li>5. Drawing Sheet Index on Cover Sheet or index and legend on Sheet 2.</li> <li>6. Complete Building code information on Cover Sheet including (Code Footprint)</li> <li>7. Terms and Abbreviations Index and Symbol Legend on Cover Sheet</li> <li>8. Consecutive Numbering of Sheets in accordance with AIA Drawing Numbering Standards</li> <li>9. Updated Design Intent Document</li> <li>10. Written response to Schematic Design Submittal comments</li> <li>11.List of additional information required from Owner</li> <li>12. Updated Pending Issues Report</li> <li>13. Room Data Sheets in electronic format for each unique room or space to include at a minimum: <ol style="list-style-type: none"> <li>A. Room layout</li> <li>B. Equipment</li> <li>C. Furniture</li> <li>D. Finishes</li> <li>E. Lighting layout</li> <li>F. MEP devices</li> <li>G. Telecommunication devices</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Milestone Construction Schedule</li> <li>2. Plans and Project Manual all have the same issue date</li> <li>3. An inspection for Hazardous Materials must be made for renovation projects and a copy of the report submitted.</li> <li>4. Responses to Design Development or previous phase review comments</li> <li>5. Mechanical Design Calculations (<i>ASHRAE 90.2?</i>) and Certification Letter</li> <li>6. Copies of all approvals and permits required of public authorities having jurisdiction.</li> <li>7. Identify all documents with project number and date.</li> <li>8. As documents develop, confer with and obtain further review from regulatory agencies such as: <ol style="list-style-type: none"> <li>a. Building Department</li> <li>b. Fire Marshal (state and local)</li> <li>c. Department of Health and other agencies, as appropriate</li> </ol> </li> <li>9. Check with the applicable regulatory agencies and establish schedule for submission and/or review</li> <li>10. Coordinate drawings with Project Manual</li> <li>11. Review the program and verify compliance</li> <li>12. Re-check Design Development documents for code compliance</li> <li>13. Review CADD or BIM Deliverables for format, coordination and completeness.</li> <li>14.All Sheets stamped, signed and dated by responsible design professionals</li> <li>15. All rooms named and numbered</li> </ol>
<p><b>2.CODE ANALYSIS &amp; LIFE SAFETY</b></p>	<ol style="list-style-type: none"> <li>1. List of applicable codes and land use restrictions</li> <li>2. Code footprint (include on drawings)</li> </ol>		

	<p>cover sheet)</p> <ul style="list-style-type: none"> <li>a. Identify building area limitations, construction classification, occupancy use, including multiple and special usage's, occupancy load and egress capacity</li> <li>b. Means of egress</li> <li>c. Site (ADA) accessibility</li> </ul> <p>3. Identify seismic requirements for project location.</p>		
<b>3.CIVIL DRAWINGS</b>			
<b>A. Site Plans</b>	<ol style="list-style-type: none"> <li>1. Site plan of the project showing location of all Existing conditions, demolition, new buildings, roads, parking and landscape elements.</li> <li>2. Clear delineation of the project limit lines</li> <li>3. Preliminary spot elevations</li> <li>4. Existing utilities noted</li> <li>5. Proposed utilities noted</li> <li>6. Site drainage, storm water removal or detention noted</li> <li>7. Identify number of parking spaces and code/zoning requirements</li> <li>8. Provisions for trash disposal and removal by truck dock, compactor etc.</li> <li>9. Conformance to zoning restrictions for easements and setbacks, etc.</li> <li>10. Results of preliminary soils and boring surveys.</li> <li>11. If needed environmental impact study</li> <li>12. Site disturbance permit (erosion control) for more than 1 acre.</li> <li>13. Off-site borrow and spoils permit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Building location plan – building tied down dimensionally with pertinent adjacencies, permanent bench mark, street lines, property lines, required setbacks, easements, rights of way, manholes, sewers, hydrants, light standards, interface with survey.</li> <li>2. Grading and paving plans include contours, critical spot elevations <ul style="list-style-type: none"> <li>a. Include sidewalks, ramps, stairs, driveways, parking areas including layout geometry</li> <li>b. Site drainage and retention areas</li> </ul> </li> <li>3. Utility Plans <ul style="list-style-type: none"> <li>a. Identify existing and new utilities to the building (electrical, water, gas, telephone and cable)</li> <li>b. Identify sanitary and storm laterals from the building to the mains</li> <li>c. Identify site storm sewers, inlets, manholes, etc.</li> <li>d. Indicate pipe sizes, invert elevations, connections to existing utility sources, locations of manholes and installation details.</li> </ul> </li> <li>4. Dewatering Plan.</li> <li>5. Plan to address existing hazardous/contaminated materials.</li> <li>6. Utility plans, elevations and details for</li> </ol>	<ol style="list-style-type: none"> <li>1. Area traffic plan if existing roads/walks are impacted</li> <li>2. Site development phasing and construction staging and site access.</li> <li>3. Final pipe sizes and connection details.</li> <li>4. Photometrics of proposed site lighting.</li> <li>5. Protection requirements for existing elements to remain.</li> </ol>



		local government and utility company approval.	
<b>B. Site Sections</b>		1.Include typical driveway, parking area, and sidewalk cross-sections.	
<b>C. Typical Design Details</b>		1.Railing, stairs, ramps, walkway paving types and patterns, benches, site lighting, other significant features	
<b>4.ARCHITECTURAL DRAWINGS</b>			
<b>A. Code Analysis Plan</b>		1. Code Footprint a. Include all fire rated partitions 2. Code Analysis (Show on drawings)	
<b>B. Architectural Floor and Roof Plans</b>	<ol style="list-style-type: none"> <li>1. Plans of all floors and roof showing structural grid, vertical circulation elements, core elements, vertical shafts, interior partitions, mechanical and electrical closets, door and window locations, floor elevations. Minimum 1/8" scale with legends.</li> <li>2. Key dimensions, bay sizes and overall dimensions</li> <li>3. Plan indicating major extent of materials and any special conditions or equipment</li> <li>4. Room names</li> <li>5. Preliminary finish schedule for typical areas</li> <li>6. Area summary</li> <li>7. Accessibility routes</li> <li>8. Solar orientation diagrams</li> <li>9. Sketches of alternative approaches considered.</li> <li>10 Owner occupant report explaining design rational and assumptions regarding operational and functional issues</li> </ol>	<ol style="list-style-type: none"> <li>1. Dimensioned structural bay system</li> <li>2. Internal partitions located, drawn and located and dimensioned</li> <li>3. All casework and other equipment called out on plans</li> <li>4. Major mechanical/electrical systems determined and their requirements reflected and indicated on the plans including louvers, areaways and utility entrances</li> <li>5. Locate all plumbing fixtures</li> <li>6. All rooms named and numbered</li> <li>7. Locate exterior and interior doors and windows</li> <li>8. Locate typical and fire rated partition types</li> <li>9. All keyed references: match lines, building sections, enlarged plans, etc. keyed notes</li> <li>10. Finish floor elevations noted</li> <li>11. Expansion joints indicated</li> <li>12. Building cores (stairs, elevators, toilets, shafts, etc.) drawn to a larger scale (1/4" min.), dimensioned and keyed to larger plans</li> <li>13. Plans and elevations of feature areas (lobby, special spaces) drawn to a larger scale (1/4" min.) with all surfaces shown and</li> </ol>	<ol style="list-style-type: none"> <li>1.Fully dimensioned floor plans</li> <li>2.Enlarged plans</li> <li>3. Partition details</li> <li>4.Interior details and elevations</li> <li>5. Finish Schedules</li> <li>6.Door and Hardware schedules</li> <li>7.Toilet accessory schedules</li> <li>8.Schedule of any Owner furnished items</li> <li>9.Room signage.</li> </ol>

	<ul style="list-style-type: none"> <li>11. Roof material</li> <li>12. Preliminary drains and slope</li> <li>13. For re-roof projects, indicate roof cores results.</li> <li>14. Demolition plans if needed</li> </ul>	<ul style="list-style-type: none"> <li>materials called out and keyed to larger plans</li> <li>14. Detailed demolition plan with sequence of work.</li> <li>15. Roof and drainage plan</li> <li>16. Reflected ceiling plans</li> </ul>	
<b>C. Reflected Ceiling Plans</b>		<p><i>Provide a reflected ceiling plan for all finished spaces which includes:</i></p> <ul style="list-style-type: none"> <li>1. Located lighting fixtures, speakers, cameras</li> <li>2. Soffits, bulkheads, skylights</li> <li>3. Identify major ceiling materials and their relationship with partitions</li> <li>4. Identify all areas with exposed structure</li> </ul>	
<b>D. Building Elevations</b>	<ul style="list-style-type: none"> <li>1. Major elevations with extent of glazing and mullion spacing indicated</li> <li>2. Major materials identified</li> <li>3. Floor lines, roof line and top of parapets indicated with dimensions</li> <li>4. Finished grades clearly shown</li> </ul>	<ul style="list-style-type: none"> <li>1. Building elevations including roof structures and foundations</li> <li>2. Identify and locate all exterior windows and doors</li> <li>3. Identify floor levels, vertical dimensions and overall building heights</li> <li>4. Column centerlines</li> <li>5. Locate expansion joints and major panel joints</li> <li>6. Exterior mechanical equipment</li> <li>7. All materials noted; demarcation of materials shown</li> <li>8. Detailed elevations at a larger scale (1/4" min.) as necessary to explain intent of unique features (building entrance, special brickwork or masonry, building canopy, etc.)</li> <li>9. Major keyed references: match lines, buildings sections, wall sections</li> <li>10. Expansion joint locations</li> <li>11. Description of water and vapor characteristics of roof, exterior walls, and below grade wall systems including typical waterproofing details</li> </ul>	<ul style="list-style-type: none"> <li>1. Roof mounted equipment</li> <li>2. Roof details for manufacturer approval</li> <li>3. Exterior door, window, and flashing details</li> <li>4. Control joint definition and details</li> </ul>

<b>E. Building and Wall Sections</b>	<ol style="list-style-type: none"> <li>1. Major sections through building to show relevant conditions</li> <li>2. Structural grid</li> <li>3. Building to grade relationship</li> <li>4. Floor to floor and floor to ceiling height</li> <li>5. Material designations</li> </ol>	<ol style="list-style-type: none"> <li>1. Include major building sections, identify column lines, feature openings and relationships between floors, ceilings, structure and mechanical systems</li> <li>2. Vertical dimensions including floor-to-floor and ceiling heights</li> <li>3. Finished grades around the building</li> <li>4. Typical wall sections or assembly details</li> <li>5. Parapet and coping details.</li> </ol>	
<b>F. Landscaping Plan</b>	<ol style="list-style-type: none"> <li>1. Design Concept Plan</li> <li>2. Existing Conditions</li> <li>3. Landscaping Concepts</li> <li>4. Existing Irrigation</li> </ol>	<ol style="list-style-type: none"> <li>1. Documents indicating planting and irrigation plan with complete hierarchy of plant materials identified.</li> <li>2. Show irrigation diagrammatically in terms of number of zones and type of components.</li> <li>3. Landscape lighting.</li> <li>4. Provide sufficient topographic data to confirm adequate drainage.</li> </ol>	<ol style="list-style-type: none"> <li>1. Existing tree protection</li> <li>2. Soil preparation and planting specifications</li> <li>3. Landscaping and irrigation details and legends.</li> <li>4. Piping sizes.</li> </ol>
<b>G. Details</b>	<ol style="list-style-type: none"> <li>1. Typical Wall Section</li> </ol>	<ol style="list-style-type: none"> <li>1. Large scale details of major exterior wall assemblies, (parapets to foundation)</li> <li>2. Large scale details of major foundation and perimeter treatment</li> <li>3. Typical window and door details (i.e. head jamb and sill conditions)</li> <li>4. Typical interior and exterior columns details</li> <li>5. Key areas shown including stairs, elevators, escalators, loading docks, shafts and other conditions where vertical transitions occur</li> <li>6. Major casework elevations and millwork profiles</li> <li>7. Partition types</li> </ol>	
<b>H. Interior Elevations</b>		<ol style="list-style-type: none"> <li>1. Elevations of significant interior spaces</li> </ol>	
<b>I. Schedules</b>		<ol style="list-style-type: none"> <li>1. Draft interior finish schedule</li> <li>2. Draft door and frame schedules</li> </ol>	

		3. Draft window and glazing schedule	
<b>5.STRUCTURAL DRAWINGS</b>			
<b>A. Structural Plans</b>	<ol style="list-style-type: none"> <li>1. Design criteria narrative</li> <li>2. Structural system description including alternates considered</li> <li>3. Single line floor and roof framing plans</li> <li>4. Typical bay and member sizes noted</li> <li>5. Description of foundation system, compare with geotechnical report</li> <li>6. Soil Retention work if needed</li> </ol>	<ol style="list-style-type: none"> <li>1. Foundation plan including interior and perimeter foundations, footings, piles, caissons, wall beams and grade beams as needed.</li> <li>2. Framing plans for all floors and roof including major member sizes noted or scheduled, typical and maximum column sizes</li> <li>3. Locate columns, beams, purlins, joists, etc.</li> <li>4. Approximate reinforcing quantities</li> <li>5. Indicate subsurface drainage system if required. Coordinate with civil and plumbing designs</li> <li>6. Indicate recessed areas in slabs, major openings, elevator and sump pits</li> </ol>	<ol style="list-style-type: none"> <li>1. Definition of control and seismic joints</li> <li>2. Beam, column, and slab schedules</li> <li>3. Mechanical, electrical and housekeeping pads.</li> <li>4. All slab steps, depressions, and openings coordinated with architectural and mechanical designs.</li> <li>5. Detail and dimension all slab edge conditions</li> <li>6. Plan load maps indicating live loads and dead loads that require special consideration</li> <li>7. Provide penetration guidelines where structural penetrations are allowed.</li> </ol>
<b>B. Structural Sections/Details</b>		<ol style="list-style-type: none"> <li>1. Location of in-floor electrical system</li> <li>2. Expansion and seismic joints located</li> <li>3. Typical edge of slab details for cladding attachment</li> <li>4. Special conditions noted (shoring, underpinning, etc.)</li> <li>5. Provide wind, seismic, dead and live loads design information.</li> <li>6. Footing, beam, column and connection details.</li> <li>7. Updated building elevations and locations and heights of soil retention systems.</li> <li>8. Typical structural sections</li> <li>9. Preliminary structural demolition drawings if required.</li> </ol>	<ol style="list-style-type: none"> <li>1. Foundation and structural details, notes, and calculations</li> </ol>

<b>6.CONVEYING SYSTEMS</b>	<ol style="list-style-type: none"> <li>1. Elevator study to confirm quantity, capacity, size and speed of elevators.</li> <li>2. Elevator locations</li> <li>3.Equipment room locations</li> </ol>	<ol style="list-style-type: none"> <li>1.Elevator shaft section and sizes</li> <li>2.Equipment description</li> </ol>	<ol style="list-style-type: none"> <li>1.Fully Dimensioned plans</li> <li>2.Sections and details of hydraulic cylinder</li> <li>3.Description of shaft sump pits (if needed) and full coordination with plumbing</li> <li>4.Elevator car and equipment support details</li> <li>5.Description of controls and features</li> <li>6.Door and frame details, coordinated with wall types</li> <li>7.Cab finishes with details including lighting, security, and communications</li> </ol>
<b>7.MECHANICAL DRAWINGS</b>			
<b>A. Floor Plans</b>	<ol style="list-style-type: none"> <li>1. Preliminary HVAC system description to include central plant, duct chases, single lines showing major duct runs, preliminary flow diagrams, etc.</li> <li>2. Design criteria for HVAC narrative including (“U” factors, temperature range, air changes, humidity controls, zoning, number of rooms per VAV, etc.)</li> <li>3. Energy sources identified, entrances noted on architectural drawings. Air intake and discharge locations determined</li> <li>4. Mechanical rooms sized and located on architectural drawings and locations of major interior and exterior equipment shown</li> <li>5. Vertical shafts and risers spaces sized and indicated on architectural drawings</li> <li>6. Special features noted (UPS room, Special occupancy zones, kitchen hood exhaust routing and discharge location, etc.)</li> <li>7. Location of cooling tower, mechanical rooms, shown on elevations, roof and/or site plans.</li> </ol>	<ol style="list-style-type: none"> <li>1.Material and equipment legend, symbols, and abbreviations</li> <li>2. Size and locate utility risers, shafts, chases, housekeeping pads, and equipment coordinated with architectural and structural plans</li> <li>3. Heating and cooling load criteria for each space and major duct or pipe runs sized to interface with structural and architectural building components.</li> <li>4. Duct layout and ceiling device locations for typical spaces</li> <li>5. Locate all equipment such as boilers, cooling towers, air handling units, heat pumps, exhaust fans, unit heaters, perimeter fin tubes, meter locations and types, etc.</li> <li>6. Locate intake and exhaust louvers</li> <li>7. Indication of typical locations of fire/smoke dampers</li> <li>8. Consider access and replacement requirements for all equipment types. Provide preliminary floor plans of mechanical rooms with all components and required service / clearance areas drawn to scale</li> <li>9. Coordinate ceiling plenum space with architectural, plumbing, fire protection, electrical, structural</li> <li>10. Air and water flow diagrams showing</li> </ol>	<ol style="list-style-type: none"> <li>1. Detailed piping and duct design with all sizes indicated. All HVAC systems drawn to scale including ductwork in double line format with fittings.</li> <li>2. Floor plans with all components and required service areas drawn to scale. On the plans show actual duct sizes and indicate flow quantities relative to each room.</li> <li>3. Provide detailed floor plans of mechanical rooms with all component and required service and access areas as well as clearance requirements shown to scale.</li> <li>4. Show all valves and volume controls, identify each with a unique number to be assigned by the engineer.</li> <li>5. Show connections to fire alarm and campus control systems.</li> <li>6. Show location and size of all fume hoods and other exhaust systems.</li> <li>7. Complete coordination drawings demonstrating no conflicts with architectural, structural or other systems.</li> </ol>

	8. Indication of the amount of redundancy for all major pieces of mechanical equipment (e.g. "two pumps, 100% capacity each")	CFM and GPM respectively. Main supply/return ductwork shown in double line format, show major taps, splits, and duct sizes. Ductwork downstream of terminal units shown, not sized. Single line duct riser diagrams for each HVAC system with CFM quantities, dampers, controls ect. Show flow diagrams for each piping system including all associated equipment, valves, and pipe sizes. 11. Show electrical requirements such as panel size, location, voltage and current requirements for mechanical equipment.	
<b>B. Sections</b>		1. Critical mechanical room cross sections 2. Corridor sections indicating duct clearances	
<b>C. Catalog Cuts and Details</b>		1. Grills and diffusers 2. Special equipment 3. Control Diagrams/Building Management Control Systems (concept form) for all mechanical and plumbing systems. Outline major control sequences of operation 4. Equipment Schedule (major equipment) 5. Mechanical and electrical smoke control schemes	1. Show all equipment details including structural support requirements. 2. Penetration/sleeve details 3. Duct construction schedule on the drawings indicating materials and pressure class for each duct system 4. Detailed control drawings including clear differentiation of trade responsibility for control, fire, and power wiring. 5. Detailed sequence of operation including the specific set points for all control loops as required to meet the design criteria as well as alarm set points and time delays. 6. Design calculations
<b>D. Energy Report</b>	1. Life cycle cost analysis of energy conservations measures 2. Annual energy consumption/SF of building space		

	<p>3. Energy report – Furnish an energy consumption report consisting of calculations (including any computer printouts) and a written summary of the results (clearly indicate assumptions made and used).</p> <ul style="list-style-type: none"><li>a. Identification of analysis methods, including loads and building systems analysis.<ul style="list-style-type: none"><li>1) Building energy consumption</li><li>2) Energy budget determination</li></ul></li><li>b. Methodology of life cycle costing analysis.</li><li>c. Description of the major energy conservation features selected, such as building envelope U-values (or R-values), type of fenestration and percent of gross wall area, type of air handling system, reheat systems, automatic system control features, lighting levels and controls, etc.</li><li>d. Estimates of building energy consumption is subdivided as follows:<ul style="list-style-type: none"><li>1) Energy consumption per month by energy type. Including maximum demand per month.</li><li>2) Total monthly and annual energy consumption (BTUs).</li><li>3) Annual energy consumption (BTUs) per building system, i.e., lighting, HVAC, hot water, equipment, etc.</li><li>4) Annual energy consumption per square foot of building space (BTU/GSF/year)</li></ul></li></ul>		
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<b>8.PLUMBING/FIRE PROTECTION DRAWINGS</b>			
<b>A. Floor Plans</b>	<ol style="list-style-type: none"> <li>1. Plumbing fixture count complies with code/program (Drinking fountains, lavatories, urinals, water closets, etc.)</li> <li>2. One-line diagram for every plumbing system (e.g. domestic water, sanitary, storm, gas, etc.) as required to describe the fundamental design concept for all plumbing systems.</li> <li>2. Gas, water, sewer, etc., service points</li> <li>4. Restroom locations</li> <li>4. Indication of the amount of redundancy for all major pieces of equipment (e.g. "two pumps with 100% capacity each")</li> <li>3. Fire protection codes and standards narrative</li> <li>4. General description of fire suppression system</li> <li>5. One-line diagrams for each fire protection system</li> <li>6. Fire sprinkler utility connection location and report documenting the adequacy of existing connection point.</li> <li>7. Location of fire pump and controller, jockey pump, storage tank and valve locations as needed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Size and locate utility risers, shafts, chases and equipment on architectural plans</li> <li>2. Preliminary piping plans with indication of required service access areas</li> <li>3. Meter locations</li> <li>4. Back flow prevention locations</li> <li>5. Fixture schedules (to include lab fixtures)</li> <li>6. Equipment schedules (major equipment)</li> <li>7. Preliminary floor plans of mechanical rooms with all components and required clearances, service and access areas shown to scale.</li> <li>8. Fire pump sizing and calculations</li> <li>9. Location of fire system test headers and fire department connections</li> <li>10. Preliminary fire protection piping plans equipment room plans with all components, clearance, service, and access areas shown to scale.</li> </ol>	<ol style="list-style-type: none"> <li>1. Complete design documents including detailed piping design with all pipe sizes indicated.</li> <li>2. Waste and vent riser diagrams including assumed fixture counts per floor</li> <li>3. Water riser diagram including assumed fixture counts per floor</li> <li>4. Foundation drains and sumps</li> <li>5. Complete Fire Suppression design documents and calculations</li> <li>6. Fire protection piping schematics, riser diagrams, and equipment schedules.</li> <li>7. Location of all sprinkler zone valves, drains, fire hose connections.</li> </ol>
<b>B. Detail Plans</b>		<ol style="list-style-type: none"> <li>1. Locate all toilets, urinals, lavatories, mop sinks, floor drains and drinking fountains</li> <li>2. Locate under-slab sanitary and supply lines</li> <li>3. Locate maintenance hose bibs in toilet rooms and on exterior of building</li> <li>4. Include roof drainage system (quantity and location of roof drains, internal and external downspouts)</li> </ol>	<ol style="list-style-type: none"> <li>1. Typical plumbing details, including structural support requirements</li> <li>2. Penetrations/sleeve details</li> <li>3. Design calculations</li> <li>4. Completed fixture and equipment schedules</li> </ol>



		<p>5. Coordinate fixture sizes and mounting heights (for special accessibility and age groups)</p> <p>6. Coordinate plumbing chase and shaft depths with architectural</p> <p>7. Consider access and replacement requirements with all room layouts</p> <p>8. Coordinate ceiling plenum space with architectural, fire protection, mechanical, electrical structural</p> <p>9. Coordinate piping size and flows with existing sprinklers if applicable.</p> <p>10 Fire Sprinklers: On new construction, make arrangements with the water company to have a hydrant flow test made. Include the flow test report in the Contract Documents.</p>	
<b>C. Catalog Cuts</b>		<p>1. Plumbing fixtures</p> <p>2. Sprinkler heads</p> <p>3. Special Equipment</p> <p>4. Fire suppression system</p>	
<b>10.ELECTRICAL, FIRE ALARM AND TELECOMMUNICATIONS DRAWINGS</b>			
<b>A. Floor Plans</b>	<p>1. Electrical symbols legend and general drawing notes</p> <p>1. Location of electrical equipment shown on elevations, roof and/or site plans.</p> <p>2. Power requirements stated</p> <p>3. Substation and switch gear and electrical rooms sized and located on plans</p> <p>4. Telephone and electrical room requirements shown on plans</p> <p>5. Interior and exterior lighting outlined in plan including general photometric levels, fixture, lamp and controls descriptions</p>	<p>1. Material and equipment legend, symbols and abbreviations</p> <p>2. All background sheets with scale, north arrow, column lines, and room numbers. Plans to show switchgear and primary equipment that requires power (e.g. pumps, air handlers, refrigeration units, etc.).</p> <p>1. Size and locate utility equipment on architectural plans.</p> <p>2. Major electrical interior and exterior equipment (switch gear, distribution panels, emergency generator, transfer switches, UPS system, etc.) dimensioned and drawn to scale into the space allocated, also include riser diagram or one line diagram.</p>	<p>1. Details of power service to buildings</p> <p>2. Complete power plans including primary cable raceways, feeder conduits, electrical loads, duplex and special receptacles and circuiting.</p> <p>3. Interior and exterior lighting plans including control systems and devices, lighting panels, switching and circuiting.</p> <p>4. Lighting control system schematic, wiring diagrams, and sequences of operation.</p> <p>5. Emergency power system plans, controls and details</p> <p>6. Connections to other building systems,</p>

	<p>6. Design criteria for electrical services, including voltage, number of feeders and whether feeders are overhead or underground. Provide a specific description of items to be served by emergency power and describe consideration for special areas.</p> <p>7. Exterior equipment, utility connections and building entry locations.</p> <p>8. Electrical demolition requirements</p>	<p>3. Identify service amperage and voltage requirements</p> <p>4. Locate and size conduit runs, cable trays, risers, shafts, chases, etc.</p> <p>5. Locate and size site electrical: transformers, underground service, entrance details, etc.</p> <p>6 Identify typical and feature lighting fixtures: ceiling and wall types, reflective ceiling plan</p> <p>7. Identify electric and telephone panel room locations</p> <p>8. Locate electrical devices for typical classroom, offices, and special classrooms including power receptacles, computer, telephone, TV, light switches, closed circuit TV, fire alarm, security and intercom devices</p> <p>9. Locate exit and emergency lighting and fire alarm devices (consider ADA requirements). List all equipment on emergency power</p> <p>10 Dimensioned layouts for all electrical rooms showing all electrical equipment and required access and clearances to scale</p> <p>11 Coordinate ceiling plenum space with architectural, plumbing, fire protection, mechanical, structural</p> <p>12 Update design calculations to include power consuming equipment and load characteristics</p> <p>13 Interior and exterior lighting, locate and identify all lighting fixtures and control plans.</p> <p>14. Panel schedules</p> <p>15. Typical electrical outlet locations</p> <p>16. Plan for temporary power during construction</p> <p>17. Emergency generator layout with fuel tank, exhaust, combustion and cooling air sources shown and coordinated</p>	<p>including fire alarm and HVAC systems</p>
<p><b>B. Catalog Cuts and Details</b></p>	<p>1. Panel numbering scheme</p> <p>2. Emergency generator and back-up</p>	<p>1. Light fixture types and schedules</p> <p>2. Fire alarm devices</p>	<p>1. Installation details for all fixtures and devices including structural supports</p>

	power descriptions	<ul style="list-style-type: none"> <li>3. Special equipment</li> <li>4. Factory installed lighting and voltage surge protection equipment</li> <li>5. Panel locations and schedules</li> <li>6. Lighting control system and control device description</li> </ul>	<ul style="list-style-type: none"> <li>2. Normal and emergency lighting photometric calculations (including exterior egress pathways).</li> <li>3. General notes on conduit and wire sizes for lighting branch circuits</li> <li>4. Details of all non-standard electrical installations</li> <li>5. Building electrical load analysis</li> <li>6. Panel schedules fully populated with load summary.</li> <li>7. Enlarged equipment room plans where necessary.</li> <li>8. Short circuit calculations, over current protection device coordination study if required.</li> <li>9. Roof, floor and rated wall penetration details</li> </ul>
<b>E. Security</b>			
<b>11.OTHER REQUIREMENTS</b>			
<b>A. Specialty Consultants</b>	<ul style="list-style-type: none"> <li>1.Design criteria defined</li> <li>2. One line plans as appropriate (kitchens, labs, etc.)</li> <li>3. If applicable, include any hazardous materials reports in the Construction Documents. If hazardous material abatement is not part of the project – state so in the Project Manual</li> </ul>	<p>All specialty consultants should provide the same level of information that is required for MEP disciplines.</p> <p>Typical specialty consultants may include: fire &amp; life safety, laboratory, security, acoustical, audio-visual, theater, lighting, information technology, graphics and kitchen consultants</p>	
<b>B. Specifications</b>	<ul style="list-style-type: none"> <li>1.Table of Contents for proposed specification sections</li> <li>2.Identify major building material</li> </ul>	<ul style="list-style-type: none"> <li>1. Draft specifications for all systems, materials, and equipment. Section numbering system to remain consistent from</li> </ul>	<ul style="list-style-type: none"> <li>1. Technical Specifications must be complete including the completion of the appropriate Division 1 Sections.</li> </ul>

	<p>systems and finishes</p>	<p>this point on. All changes to be tracked in electronic "red line" format  2. When a product is specified, three manufacturers must be listed as acceptable. Contact the Project Manager if circumstances require a product to be sole sourced.</p>	<ol style="list-style-type: none"> <li>2. Provide a written list of any sole source products</li> <li>3. Table of contents for all Divisions</li> <li>4. Name and phone number of contact person for Design Issues.</li> <li>5. The number of calendar days allowed for construction after Notice-to-Proceed.</li> <li>6. Major subcontractor categories</li> <li>7. Description of Alternates</li> <li>8. Description of any Unit Prices, including amount in Base Bid</li> <li>9. List of Testing and Product Submittals including shop drawings required</li> <li>10. Description of any Phasing or Special Work Conditions required</li> <li>11. The number of Bad Weather Days for the construction period including rationale used to develop the number.</li> <li>12. Expanded Description of the Base Proposal and Alternates</li> <li>13. Consultants seal and certification, as well as the seal and certification of all sub-consultants.</li> </ol>
<p><b>C. Estimates</b></p>	<ol style="list-style-type: none"> <li>1. Major component cost estimate, verify inclusion of elements by crosschecking against outline specification for omissions and compare with budget.</li> <li>2. Identify escalation factors to mid-point of construction</li> <li>3. Estimate construction period, identify any phased work and any long-lead time for special item.</li> <li>4. Sole source items identified and justified</li> <li>5. Provide life cycle cost analysis of proposed major MEP and roof systems</li> <li>6. Area tabulation: Gross SF to Net SF.</li> </ol>	<ol style="list-style-type: none"> <li>1. Major line items costs for all building components, verify inclusion of all elements by cross-checking against specification for omissions</li> <li>2. Identify escalation to mid-point of construction</li> <li>3. Update cost estimate of construction and compare it to the allowable for construction.</li> <li>4. Estimate construction period, identify any phased work and any long-lead time for special item.</li> <li>5. Sole source items identified as approved.</li> </ol>	<ol style="list-style-type: none"> <li>1. An itemized cost estimate showing base bid items equal to approximately 90% of the available construction funds and appropriate add alternates to attain 100%+ (usually 110%) of the available budget</li> <li>2. A summary cost estimate by trade section showing total for section and project with alternates per example for inclusion within the specifications.</li> </ol>
<p><b>D. Constructability</b></p>			

<b>Review</b>			



August 10, 2015

## 100% CD Milestone Deliverables

### **100% CONSTRUCTION DOCUMENT**

#### **Architectural – 100% Construction Document Submittal**

- Pick up comments from 100% DD review & constructability reviews.
- Site plan fully coordinated with Civil, Landscape, Mechanical, and Electrical.
- Floor Plans complete; with dimensions, section/detail & references.
- Building sections complete.
- Building elevations with materials noted, critical elevations, gridlines, and sections referenced.
- Wall sections complete with notes and details flagged.
- Reflected ceiling plans complete and coordinated with mech/elec.
- Enlarged Toilet room plans and interior elevations complete and dimensioned. All ADA details. Referenced.
- Roof plan complete and coordinated with mechanical.
- Interior elevations complete with finishes referenced and coordinated with specifications.
- Acoustical items located or quantities determined and details complete.
- Finish schedule complete and coordinated with specifications in chart form.
- Door & Frame schedule complete in chart form.
- Hardware groups complete.
- Standard Door and Frame details drawn.
- Window, louver types drawn and keyed on floor plan.
- Window and louver details.
- Standard details referenced.
- Interior and exterior details complete.
- Equipment schedules finalized with power and utility requirements complete.
- Architect to have in-house quality control review and coordination with all design consultants.
- Specifications – Sections 1, 2, and 3 for divisions 2 through 16.
- Front end divisions 0 & 1 complete.
- Documents ready for Agency review.



August 10, 2015

### **Civil – 100% Construction Documents Submittal**

- Pick up comments from 100% DD review & constructability reviews.
- Bench mark and horizontal controls complete and coordinated with other disciplines.
- Excavation and recompaction requirements coordinated with geotechnical report and building pad elevations established.
- Grading & drainage plans complete and coordinated
- All ADA issues resolved.
- All drain inlets, catch basins, area drains, dry wells, perc pits, and misc. drainage structures complete and coordinated with other disciplines.
- Erosion control and details complete
- Retaining walls located with wall construction type and details.
- All hardscape coordinated with Architectural & Landscape plans.
- Road and paving plans with AC sections, subgrade, and concrete curbs confirmed.
- Roof drains to site storm drainage coordinated.
- Fire service flow & pressure confirmed. Main loop, laterals, and hydrant locations indicated and approved by local Fire Marshal.
- Fire service & POC at buildings coordinated with riser locations on fire protection plans.
- All site plumbing and underground piped utilities with POC inverts shown and coordinated.
- Off-site improvement plans and details.
- Special details complete.
- Coordination with architectural site plan.
- Specifications complete and coordinated with plans.
- Plans ready for Agency review.

### **Structural – 100% Construction Document Submittal**

- Pick up comments from 100% DD review & constructability reviews.
- Foundation plan complete and coordinated with architectural dimensions and underslab plumbing plans.
- Roof framing – final coordination with architectural & mechanical/electrical.
- Wall sections complete & coordinated with architectural wall framing plans.
- Moment/Brace frame elevations and/or shear wall details complete.
- Standard & Specials Details complete and cross referenced with plans.
- Special testing defined.



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- Specifications complete.
- Structural calculations complete.
- Plans ready for Agency review.

### **Mechanical – 100% Construction Document Submittal**

- Pick up comments from 100% DD review & constructability reviews.
- General Notes & Details, Legends, Symbols, and Abbreviations.
- Plumbing fixture schedule and cut sheet binder complete.
- Plumbing and utilities connections confirmed and coordinated with design team.
- Mechanical equipment schedule complete & final cut sheets provided.
- Mechanical distribution plans complete with problem areas detailed and drawn to scale.
- HVAC fire damper coordination with architectural/electrical plans.
- Controls diagrams and schedules complete and coordinated with HVAC plans.
- Acoustical & vibration and special details complete.
- Title 24 energy calculations complete.
- Specifications complete.
- Mechanical in-house quality control review and coordination with electrical plans.
- Plans ready for Agency review.

### **Electrical – 100% Construction Document Submittal**

- Pick up comments from 100% DD review & constructability reviews.
- Title 24 calculations complete.
- Final coordination with local utility company and/or service.
- Site electrical plan complete, including power and lighting.
- Site distribution coordinated with Civil plans.
- Building lighting and power coordinated with architectural plans and interior elevations.
- Lighting plans & fixture schedule complete.
- Power and low voltage plans complete.
- Low voltage/Telecom cable tray and conduit plans complete.
- Power coordinated with equipment schedule.
- Fire alarm plans complete.
- Power coordinated with mechanical units and fire/smoke damper locations.
- Single line diagram & panel schedules complete.
- Standard & special details complete.
- Specifications complete.





August 10, 2015

- In-house quality control and coordination review with design team.
- Plans ready for Agency review.

**Landscape – 100% Construction Document Submittal**

- Pick up comments from 100% DD review & constructability reviews.
- Planting and irrigation plans complete.
- Utility POC's coordinated.
- Finish grading and drainage refined.
- Hardscape design, texture, and color complete and coordinated with Civil and Arch plans.
- Special playground areas, and site structures complete.
- Site furnishings determined and specified.
- Special details complete.
- Specifications complete.
- Documents ready for Agency review.