



Quality Assurance Considerations in Advanced Technology Building Construction

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Quality Assurance Considerations

Introduction / Overview

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Overview

Focus on:

- So Far – Requirements, Criteria, Design
- BUT – We should focus on construction too
 - Plan/Design for Construction
 - Specify the Requirements
 - Communicate the Requirements
 - Enforce Quality Control
 - Communicate to the actual workers
- Specific Lessons Learned

Quality Assurance Considerations

Planning & Design

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■ PLAN and DESIGN for CONSTRUCTION

Typical Architect/Engineer Firms

- General Construction
- Specialized Construction
- Very few have done advanced technology designs
- Very few are accustomed to a technical owner team

Advanced Technology Architect/Engineer Firms

- Much better equipped to handle high-tech buildings
 - Through in-house Struct/Arch/Mech/Elec capabilities
 - Through association with Specialized Sub-Consultants
 - Lab Planning
 - Vibration Isolation
 - EMI/RFI
 - Fire Protection
- Prior experience is PARAMOUNT
 - An experienced A/E will add depth to the project
 - Cost savings in less design rework and construction change orders

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■ PLAN and DESIGN for CONSTRUCTION

Typical General Construction Contractors

- General Construction
- Specialized Construction
- Very few have done advanced technology construction

Advanced Technology Construction Contractors

- Much better equipped to handle high-tech construction
- Have Documented Corporate Experience
- BUT..... What will YOU get?
 - May assign a few personnel who are experienced
 - these may leave for a variety of reasons
 - Usually pull construction workers from local pools or unions
 - may have little or no experience, especially high-tech experience
- Plan and Design for ANY Contractor
 - Do NOT assume your contractor will understand your requirements.

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■ SPECIFY THE REQUIREMENTS

Translate the requirements/criteria into Plans and Specs

■ Quality Assurance in Design is PARAMOUNT

- Utilize a highly technical team to handle design contracts
 - Government/Owner Rep – generalized engineering background
 - Government/Owner Team – capable of understanding project
 - - May be Owner or Owner/Contractor teams
 - - Must maintain the Owner's interest
 - - Must maintain the Project's interest
 - - Must NOT interfere with the design
- Utilize a review process that is agreeable to all parties

■ Plans will need to be highly detailed

■ Specifications can be prescriptive or performance

- Prescriptive – do not skimp performance requirements
- Performance – do not skimp on prescriptive requirements

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■ MOCK-UPS – Setting the Standard ...Early Design-Phase Mock-Ups help debug the design

■ Laboratory Mock-Up

- Weed-out Architectural and Coordination Issues

■ Temperature Control Research Project

- Proof of Design Concept
- Qualification of Controls Manufacturers

■ Vibration Isolation Research Project

- Proof of Design Concept

■ Office Mock-Up

- Weed-out Architectural and Coordination Issues

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■ SPECIFY THE REQUIREMENTS for CONSTRUCTION QUALITY CONTROL

Translate QC Needs into Specification REQUIREMENTS

■ Quality Control in Construction is CRITICAL

- Specify a Robust Quality Control Plan for the Construction Contractor
- Specify QC Specialists for ALL key areas of Construction
 - Structural Steel & Concrete
 - Mechanical (HVAC & Plumbing)
 - Electrical
 - Building Management & Controls

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Build the Design

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■ ENFORCE QUALITY CONTROL

Get what you have paid for, nothing less, nothing more!

- Quality Control should be explicitly required per Spec
- A Contractor Quality Control Plan is critical for success
 - Serves to open a dialogue on the spec'ed QC requirements
 - Serves as an enforcement tool during construction
- A Full-time, independent QC Specialist (and staff) should be a specification requirement
 - Independence is KEY
 - Separate from production staff (reports to company, not project)
 - Not controlled by project superintendent
 - Experience is KEY
 - Prior high-tech construction experience
- Project Safety is part of Quality Control
 - Safety (or lack thereof) cannot be driven by production

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Build the Design

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■ COMMUNICATE THE REQUIREMENTS

Effective communication is necessary for success

- **Plans & Specs communicate legal requirements only**
 - Most contractors are not accustomed to specialized construction requirements and will tend to “build as usual”
- **Communicate, Communicate, COMMUNICATE!!**
 - During the Bidding/RFP phase
 - At the Pre-Construction Conference
 - Meet with Prime and EACH of the primary subcontractors
 - Re-Iterate at EACH Preparatory Phase Meeting for each new trade.

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Build the Design

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■ MOCK-UPS – Setting the Standard ...Early

Construction-Phase Mock-Ups define expected tolerances and quality at the beginning of a phase...not the end

- **Mock-Ups benefit everyone**
 - Contractors have clear direction
 - Owners and Architects develop a clear idea of expectations
 - All of the players ultimately save money
- **Each lab type should be mocked-up**
 - Unique construction requirements create unique challenges
- **Expect to negotiate**
 - Remember – the design is a design, construction is “real-life”
 - Application & Interaction of contractor-selected, architect-approved products becomes an issue to be worked out

Quality Assurance Considerations

Lessons Learned

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■ Specific Lessons Learned

1. Specify User Requirements at NTP + 1 Year
2. Communicate
3. Concrete Isolation vs. "tolerances"
4. Control of Dust and Dirt
5. Vibration Isolation
6. Coordination of ALL Trades
7. Performance Tests
8. Owner's Team