Alternative Solutions for the Building Official

Determining Compliance

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Topics

• Roles/Responsibility
• Elements of an Alternative Solution
• Evaluation Techniques
• Acceptance Criteria
• Peer Review
• Documentation
• Liability Issues
• Site Work

Roles - Proponent:

• Sound Code Knowledge

• FPE Tools/Resources – access to expertise
  • Research Papers (NFPA, others)
  • Texts, Online Material
  • Models (CFAST, CFD)
Responsibilities - Proponent

• Demonstrate Compliance
  • Objectives
  • Functional Statements

• Compare Code Compliant vs. Proposed

• "As good as or better"

• Reasonable Mitigation Strategies

Roles – AHJ

• Sound code knowledge

• Permit Issuer

Responsibility - AHJ

• Independent, unbiased reviewer

• Is the Alternative Solution "as good as or better"?

• Do not necessarily have to "like" the solution, just assess compliance with O+FS
Elements of an Alternative Solution

• Review basis of Alternative Solution
  • Division A 1.2.1.1.(1) Compliance with this Code
    1) Compliance with this Code shall be achieved by
    a) Complying with the applicable acceptable solutions in
       Division B (see Appendix A), or
    b) Using alternative solutions, accepted by the authority having
       jurisdiction under section 2.3 of Division C, that will achieve
       at least the minimum level of performance required by
       Division B in the areas defined by the objectives and
       functional statements attributed to the applicable acceptable
       solutions (see Appendix A).

Elements of an Alternative Solution

• Appendix Notes to Division A.1.2.1.1.: 
  • Division B solution satisfies Objectives and Functiona
    Statements (O+FS)
  • "...Division B establishes the quantitative performance
    targets that Alternative Solutions must meet"
  • Acceptable vs Unacceptable risk:
    • Division B defines what society is willing to accept

Elements of an Alternative Solution

• Clear statement of code reference(s)
  • Clear statement of O+FS
  • Clear statement of mitigating features including
    design criteria (e.g. sprinklers, glazing, fans)
Elements of an Alternative Solution

- Justification/Discussion can take many forms
  - Research Papers (CWS)
  - Models (CFAST, FDS)
  - Calculations

- Should compare Compliant Case vs Proposed Solution

- Not a comparison of risk, but of performance

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Elements of an Alternative Solution

- Complete report with:
  - Maintenance Requirements
  - Short Term
  - Long Term
  - Testing
  - Proponent Qualifications
  - Supporting Documentation

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Evaluation Techniques

- Broad Categories
  - Justified by technical reports
  - Justified by modeling/calculations
  - Justified by words
Evaluation Techniques

- Technical Report based:
  - Compare proposed design to criteria in report
    - Examples:
      - Water Curtain Sprinklers
      - Glazing Wetted - Look for no horizontal mullions
      - Pony Walls - Look for methods to keep fire away from base of glazing

Evaluation Criteria

- Reports:
  - Heat Attenuation
    - Does water spray at glazing stop at least as much heat as wired glass?
    - Show by heat transfer calculation or by test data
Evaluation Criteria

- Models
  - Review input parameters carefully
    - Fire size and location adequately justified
    - Multiple runs done for location sensitivity
    - Geometry correct (will be simplified to reduce run time)
    - Is geometry representative of what space really looks like?

Evaluation Criteria

Simplified Geometry Example

Evaluation Criteria

- Models – need sensitivity analysis:
  - Bigger fire size
  - Different (faster) growth rate
  - Multiple occupancies (e.g. Hockey vs Trade Show)
  - Different (credible) fire location
  - Requires multiple runs
  - Different ventilation rates
  - Sprinkler failures
Evaluation Criteria

- Base (Compliant Case) vs Proposed
  - Often difficult to set up a code compliant case, especially for travel distance
  - For smoke studies, can do a run with 4ACH vs other proposed design, but make sure geometry is the same
  - Beware of changing more than one design parameter at a time (e.g. 4ACH, ft³/m³ combustibles)

Evaluation Criteria

- Word Based
  - Beware of "RISK" comparison
  - Not what Division A says about performance
  - Code (Division B) gives us the tolerable risk, not up to Proponent to say otherwise

Acceptance Criteria

- O+F/S
  - Demonstrated as performing as good as or better
  - Should have sound basis for comparison

- Are all elements included?

- Is the solution viable and maintainable in the long term?
Acceptance Criteria

• ASET vs RSET
  • Valid comparison of available vs required time to clear an area, floor or building
  • Must include decision making time delay (1-3 minutes)
  • Based on height of smoke layer (2100-2400mm aft)
  • Requires a timed egress study

Acceptance Criteria

• Make sure other O+FS are drawn into the discussion, and are justified if they are

  Example
  • Atrium smoke only:
    • O: OS 1.2, OS 1.6, OP 1.2
    • FS: F03, F12
    • But if travel distance as well, add in:
      • D: OS 3.7
      • FS: F10

Notes on Models

• Use commercially available models only
  • Validated
  • Provide accurate representation of equations, balances
  • Reliable, repeatable
  • No "In-House" models unless validated against real world and repeatable
  • NIST CFD, CFAST etc. ok
• Commercially published reports good
  • NFPA
  • SFPE
  • NIST
  • etc.
FDS Simulation

Peer Review
- For complex models, or complex Alternative Solutions
- Viable alternative to AHI review
- Get sealed recommendation for acceptance from peer reviewer
- Applicant pays

Documentation
- Sealed reports
- Commitment for:
  - Field Reviews
  - Shop Drawing reviews
- Review stamp on sprinkler shop drawings
- Schedule S-B, S-C
- Never Schedule B, C-B
Liability Issues

- AHJ issues the permit
- Alternative Solution is a viable and permitted method of code compliance (Division A)
- Means that as long as the Alternative Solution demonstrates compliance with Division A 1.2.1.1.(1), then no different than Division B
- Then the Alternative solution becomes part of the compliant building permit
- No additional liability

Liability Issues

- Proponent has liability for the Alternative Solution
- Signs Schedule 5-B, 5-C
- Applicant has obligation to comply
- AHJ Bylaws and permit wording confirm this
- Occupant has obligation to maintain systems under Fire Code

Site Works

- Proponent obliged to do field reviews during construction (if applicable)
- Should form part of coordinated fire and life safety system testing if appropriate (e.g. fans)
- Caution regarding long term operability and knowledge of systems by building operators
- Do not rely too much on putting information in Fire Safety Plan