



Standard Specification for Agencies Engaged in System Analysis and Compliance Assurance for Manufactured Building¹

This standard is issued under the fixed designation E541; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification provides the criteria for the administrative agency that has regulatory authority as granted by the authority having jurisdiction AHJ to evaluate the capabilities and qualifications of building evaluation agencies, that performs system analysis or compliance assurance or both for certification of manufactured building on behalf of an authority having jurisdiction (AHJ) that meet the needs of regulatory programs. Administrative agencies and building evaluation agencies (third-party agencies) are the primary users of the standard.

1.2 To establish an appropriate degree of intra- and interstate credibility regarding building system evaluations made through governmental or private agencies, the authorities having jurisdiction should utilize an oversight and approval process for the building-evaluation agencies that provide the services of system analysis or compliance assurance on behalf of the AHJ that may include: approval by the AHJ for both oversight and or auditing of the regulatory body, or approval by the AHJ and oversight, and or auditing by an independent auditor for the regulatory body, or approval with the AHJ and oversight, and auditing by an independent accreditation agency.

1.3 Building-evaluation agencies examined under this specification may include governmental or private agencies or both.

1.4 Practice E651 may be used to support the evaluation of building-evaluation agencies. Other criteria such as independence, financial stability, and objectivity may need to be considered.

NOTE 1—Practice E651 is intended as a companion standard to Specification E541 and includes questions that should be asked of system analysis and compliance assurance agencies in order for the administrative agency to evaluate their competency.

¹ This specification is under the jurisdiction of ASTM Committee E36 on Accreditation & Certification and is the direct responsibility of Subcommittee E36.70 on Agencies Performing Construction Inspection, Testing and Special Inspection.

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1.5 These criteria set forth the minimum personnel requirements and the technical and organizational procedures required for building-evaluation agencies engaged in evaluating manufactured building.

1.6 Criteria are included for building-evaluation agencies evaluating innovative as well as conventional building systems, against applicable requirements.

1.7 Building-evaluation agencies involved in testing, quality assurance, and evaluating building components can be evaluated by using Specification E699.

1.7.1 Specification E699 is used in conjunction with Specification E541 and Practice E651. This specification defines the minimum requirements for agencies engaged in inspections and testing performance in accordance with ASTM standards for factory-built building components and assemblies. The criteria in this specification are provided for assessing the competence of an agency to properly perform designation testing, quality assurance, and inspection.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards*:²

E651/E651M Practice for Evaluating Capabilities of Agencies Involved in System Analysis and Compliance Assurance for Manufactured Building

E699 Specification for Agencies Involved in Testing, Quality

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

Assurance, and Evaluating of Manufactured Building Components

3. Terminology

3.1 Definitions:

3.1.1 *administrative agency, n*—an authority having jurisdiction (AHJ) granted with regulatory authority to evaluate the capabilities and qualifications of building-evaluation agencies.

3.1.2 *agency, n*—a building-evaluation agency acting on behalf of the authority having jurisdiction (AHJ) in structural analysis, compliance assurance, and certification of manufactured building.

3.1.3 *applicable requirements, n*—the specific material and performance specifications included in designated codes, standards, and approved documents. They may include special requirements adopted by the administrative agency or other jurisdictions.

3.1.4 *authority having jurisdiction (AHJ), n*—an organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving a building, a building component, equipment, materials, an installation, or a procedure.

3.1.4.1 *Discussion*—The authority having jurisdiction AHJ may be a federal, state, commonwealth, province, region, local, territory, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having regulatory authority charged with administering the legislation, act, or oversight.

3.1.5 *building component, n*—a subsystem, subassembly, or other system designed for use in or as part of a structure which may include structural, electrical, mechanical, plumbing, and fire protection systems, or any other system affecting health and safety.

3.1.6 *building-evaluation agency, n*—a third-party agency that performs one or more of the building evaluation services of systems analysis or compliance assurance or both.

3.1.7 *closed construction, n*—any building, building assembly, or system manufactured in such a manner that concealed parts or processes of manufacture cannot be inspected at the building site without disassembly, damage, or destruction.

3.1.8 *compliance assurance, adj*—the process of appraising the manufacturer’s compliance control program in conjunction with monitoring or auditing and inspection of production, implemented to provide objective evidence that the manufactured building conforms to the approved documents.

3.1.8.1 *Discussion*—In conventional construction, the compliance assurance function roughly corresponds to field inspection of construction to ensure that the building is constructed in accordance with the approved plans.

3.1.8.2 *Discussion*—Remote video inspections at the discretion of the AHJ. The administrative agency may allow building evaluation agencies to use remote video inspections (RVI) procedures as long as the RVI procedures are comparable to traditional in-plant inspection procedures. The RVI procedures shall be reviewed and approved by the AHJ prior to imple-

menting the RVI process within the production facility based on the complexity and type of inspection.

3.1.9 *compliance assurance manuals, n*—a document employed as part of the manufacturer’s compliance control program for the purpose of periodic monitoring, surveillance, or audit by the manufacturer and the compliance assurance agency of the manufacturer’s production and product compliance programs.

3.1.10 *compliance control manual, n*—a document prepared by the manufacturer detailing the methods, procedures, and systems employed in the compliance control program.

3.1.11 *compliance control program, n*—the manufacturer’s system, including directly related quality and process controls, for assuring compliance with applicable codes and standards and approved documents.

3.1.12 *criteria, n*—the minimum standards or limits on which judgments may be based.

3.1.13 *innovative building systems, n*—new concepts or alternative materials, design, or method of construction.

3.1.14 *manufactured building, n*—any unit, components, module, building, or manufactured home that are factory-built off-site, using closed construction methods, for design, fabrication, assembly, and installation on the building site.

3.1.15 *manufactured home, n*—prior to 1976, a manufactured home was referred to as a mobile home.

3.1.15.1 *Discussion*—A manufactured home means a structure designed and constructed on or after July 15, 1976, to be used as a dwelling that is factory-built off-site to meet the Federal Manufactured Home and Construction Safety Standards, otherwise known as the “HUD Code.” The HUD Code is nationally recognized and preempts all state and local building codes and is regulated by the US Department of Housing and Urban Development. /astm-e541-22

3.1.15.2 *Discussion*—A manufactured home can be transported in one or more sections, which, in the traveling mode, is eight body feet or more in width, or 40 body feet or more in length, or when erected on site, is 320 or more square feet and built on a permanent chassis.

3.1.16 *open construction, n*—any building, building assembly, or system manufactured in such a manner that all portions can be readily inspected at the building site without disassembly, damage, or destruction.

3.1.17 *service equivalent, n*—the experience that an individual has accumulated in the engineering or architectural discipline(s) involved that serves as a substitute for academic requirements. In general, eight years of experience in engineering or architectural practice indicative of growth in engineering or architectural competency and responsibility are considered an alternative to the engineering or architectural education requirements.

3.1.18 *system analysis, adj*—the process employed to determine whether a proposed manufactured building conforms to applicable requirements.

3.1.18.1 *Discussion*—In conventional construction, the system analysis function roughly corresponds to plan review.

3.1.19 *third-party agency, n*—a building-evaluation agency that is independent of the manufacturer, the retailer, the installer, or any other person that has a monetary interest other than the collection of the inspection fee that performs one or more of the building-evaluation services of systems analysis and compliance assurance on behalf of an authority having jurisdiction.

3.1.19.1 *Discussion*—Third-party agencies are also referred to as a design approval agency (DAA) and or a quality assurance agency (QAA). Third-party agencies are also referred to as DAPIA or IPIA. DAPIA stands for design approval primary inspection agency. The DAPIA performs plan reviews of manufactured home construction & installation designs that meet the HUD code. Similarly to DAPIA, IPIA stands for production inspection primary inspection. IPIA performs inspections in the manufacturing plants and on certain homes at the site. Both DAPIA and IPIA perform the tasks of a building code official for homes designated as a manufactured home.

4. Requirements and Criteria for System Analysis Agencies

4.1 The system analysis agency is responsible for determining whether a building system, including the design, materials, and fabrication process, is in conformance with applicable requirements. The agency shall be capable of performing the following steps, where applicable, in the system analysis function:

- 4.1.1 Project management,
- 4.1.2 Preliminary meeting,
- 4.1.3 Submission of documents,
- 4.1.4 Staffing,
- 4.1.5 Evaluation of prescribed systems,
- 4.1.6 Evaluation of performance specifications,
- 4.1.7 Evaluation of innovative systems,
- 4.1.8 Evaluation of compliance assurance manuals,
- 4.1.9 Evaluation of installation documents, and
- 4.1.10 Factory visit (this may be included in compliance assurance function).

5. Documents of the System Analysis Function

5.1 The criteria herein are based on the following basic documents:

- 5.1.1 Product description document.
- 5.1.2 Compliance assurance manual.
- 5.1.3 Installation document.

5.2 The first and third documents are prepared by the manufacturer and submitted for processing through the system analysis agency.

5.3 The manufacturer's compliance control program is submitted for review by the compliance assurance agency. This program forms the basis for preparation of, and is incorporated into, a compliance assurance manual containing a description of the building, required production tests, compliance procedures, and any other information that is needed to guide and assist the compliance assurance agency in determining that production units continue to comply with requirements.

6. General Procedure for System Analysis

6.1 *Task*—To provide a description of the general procedures for system analysis, which includes as a minimum the activities described in 6.2.

6.2 *Requirements:*

6.2.1 Drawings, calculations, test reports and specifications of manufactured building shall be reviewed by the agency's engineering staff and details compared with provisions of applicable requirements. The construction of assemblies or components, or both, including material identification, shall be compared with published descriptions of listed, approved, or recognized designs where applicable.

6.2.2 Where production has been instituted, and subsequent to the review of drawings and specifications, qualified personnel from the system analysis agency (or compliance assurance agency) shall visit the factory of the producer of manufactured building to:

6.2.2.1 Compare the actual construction with the drawings and specifications.

6.2.2.2 Examine and record all features required by the codes and standards if not included in the drawings and specifications.

6.2.2.3 Evaluate all required production test methods to ascertain that the correct equipment, instruments, and procedures are followed and to determine that the building, assembly, or subassembly is capable of meeting the test requirements.

6.2.2.4 Discuss items of noncompliance with the manufacturer's representative, identify the source of the requirement, and explain the requirement.

6.2.3 The system analysis agency shall issue a written report to the manufacturer confirming all items of noncompliance from the applicable requirements and summarizing the steps needed to proceed with the system analysis.

6.2.4 The system analysis agency shall verify that all items of noncompliance are corrected by the manufacturer.

6.2.5 The system analysis agency shall prepare a final report describing the manufactured building, confirming the tests performed, stating the basis for judgment of acceptability of assemblies and components, and itemizing the edition of the codes or standards against which the building was evaluated.

6.3 *Criteria*—The system analysis agency shall be prepared to provide sample documentation to establish that its procedures accomplish the intent of the requirements of 6.2. Such documentation shall include examples of data sheets or other forms used to analyze construction and equipment, preliminary reports, final reports, and compliance assurance manuals prepared for producers of manufactured building.

7. System Analysis Project Manager

7.1 *Task*—To provide the services of a project manager in the system analysis function, including the following:

7.1.1 *Convening and Conducting the Preliminary Meeting*—For the purpose of familiarizing the manufacturer with the system analysis function, and with the submittal.

7.1.2 *Assisting in Preparation of a Plan for Submittal*—To establish the scope of the submission and evaluation effort.

7.1.3 *Determining the Need for Submission of Performance Data*—Assessing the extent of innovation involved in the submission in terms of identifying any part of the proposed product that is beyond the scope of ordinary systems.

7.1.4 *Staffing the System Analysis Function*—Selecting the appropriate team to undertake the system analysis, consisting of in-house staff and consultants.

7.1.5 *Monitoring Progress of System Analysis Activities*—To keep it on schedule and performing effectively.

7.2 Requirements:

7.2.1 *General Expertise in Building Systems*—Experience and familiarity with the state-of-the-art of new developments in building products and in the building process.

7.2.2 *Knowledge of the System Analysis Function*—Thorough understanding of the system analysis agency (of which he is a part) as well as all details of the system analysis function procedure.

7.2.3 *Knowledge of Performance Specifications*—Familiarity with performance-based evaluation of building systems.

7.2.4 *Analytical Ability*—The ability to analyze a problem and determine all the resources necessary for its solution.

7.2.5 *Practical Knowledge of Building*—An understanding of the practical aspects of the manufactured building process from several points of view (that is, owner, builder, design professional, etc.).

7.2.6 *Management Ability*—The capability of managing an interdisciplinary team of professionals, including work assignment and scheduling.

7.3 Criteria:

7.3.1 *Education*—Bachelor's degree in engineering or architecture, or service equivalent.

7.3.2 *Experience*—Four years of plan examination, design, construction, manufacturing building component evaluation, or manufacturing experience in the building industry. A master's degree in a related field of study may be substituted for one year of the required four years' experience. It is not a substitute for any of the types of experience listed above.

7.3.3 *Professional Competence*—Registration as a professional engineer or architect.

8. Technical Staff Evaluating Building Systems

8.1 *General*—8.1.1 – 8.1.2.6 apply to all disciplines listed in Section 8. Technical staff members may qualify for more than one discipline. The agency need not have individual technical staff members for each discipline.

8.1.1 *Task*—To assess the submission against the applicable requirements for compliance using the following:

8.1.1.1 Drawings and building specifications, including plans, elevation, sections, and details;

8.1.1.2 Engineering calculations;

8.1.1.3 Test reports, which may relate to particular subsystem or subassembly within the structure;

8.1.1.4 Materials and product specifications; and

8.1.1.5 Site and climate-related load data.

8.1.2 *Requirements:*

8.1.2.1 *Knowledge of Codes and Standards*—Knowledge of the applicable codes and standards, including geographic requirements for various load conditions.

8.1.2.2 *Knowledge of Engineering*—Understanding of conventional engineering principles and practices.

8.1.2.3 *Ability to Interpret Drawings*—Ability to read and interpret drawings for code compliance, completeness, and coordination with calculations.

8.1.2.4 *Analytical Ability*—Ability to evaluate calculations for compliance with applicable codes and standards.

8.1.2.5 *Ability to Evaluate Reports*—Ability to evaluate test reports for validity and compliance with applicable requirements.

8.1.2.6 *Knowledge of the System Analysis Process*—Understanding and appreciation of the system analysis function.

8.2 Structural:

8.2.1 *Task*—To assess the structural aspects of the submission against the applicable requirements for compliance.

8.2.2 Criteria:

8.2.2.1 *Education*—A bachelor's degree in engineering or architecture with specialized course work in structures, or service equivalent.

8.2.2.2 *Experience*—One year of structural engineering experience related to buildings.

8.3 Mechanical:

8.3.1 *Task*—To assess the mechanical aspects of the submission against the applicable requirements for sufficiency.

8.3.2 Criteria:

8.3.2.1 *Education*—A bachelor's degree in engineering or architecture with specialized course work in HVAC systems, or service equivalent.

8.3.2.2 *Experience*—One year of mechanical engineering experience related to buildings.

8.4 Electrical:

8.4.1 *Task*—To assess the electrical aspects of the submission against the applicable requirements for compliance.

8.4.2 Criteria:

8.4.2.1 *Education*—A bachelor's degree in engineering or architecture with specialized course work in electrical engineering, or service equivalent.

8.4.2.2 *Experience*—One year of electrical engineering experience related to buildings.

8.5 Plumbing:

8.5.1 *Task*—To assess the plumbing aspects of the submission against the applicable requirements for compliance.

8.5.2 Criteria:

8.5.2.1 *Education*—A bachelor's degree in engineering or architecture with specialized course work in hydraulics, or service equivalent.

8.5.2.2 *Experience*—One year of plumbing experience related to buildings.

8.6 Building Planning:

8.6.1 *Task*—To assess the building planning aspects of the submission against the applicable requirements for compliance.

8.6.2 Criteria:

8.6.2.1 *Education*—A bachelor’s degree in engineering or architecture, or service equivalent.

8.6.2.2 *Experience*—One year of experience related to building planning.

8.7 *Fire Safety:*

8.7.1 *Task*—To assess the fire safety aspects of the submission against the applicable requirements for compliance.

8.7.2 *Criteria:*

8.7.2.1 *Education*—A bachelor’s degree in engineering or architecture, or service equivalent.

8.7.2.2 *Experience*—One year of experience in fire protection engineering related to buildings.

9. Project Manager Evaluating Innovative Building Systems

9.1 *Task (All Disciplines)*—To assess the adequacy of the innovative design specifications to carry out the intent of the applicable requirements.

9.1.1 *Subtask 1*—To assess the applicable requirements for adequacy, using the following:

9.1.1.1 *Code Intent Statement*—An explicit statement of the intent of the applicable requirements with regard to safety and serviceability.

9.1.1.2 *Performance Specifications*—Comparison with existing performance specifications.

9.1.1.3 *Reference Materials*—Applicable reference materials such as other codes and standards, similar specifications, technical books, and journals.

9.1.1.4 *Interface with Conventional Materials*—A review of conventional materials and their environment.

9.1.2 *Subtask 2*—To assess the proposed tests for adequacy in demonstrating compliance with the proposed criteria, using the following:

9.1.2.1 Detailed test method write-ups of each proposed test.

9.1.2.2 Proposed theoretical method of calculation.

9.1.2.3 Texts on the rationale and history of simulation methods.

9.2 *Requirements:*

9.2.1 *Subtask 1:*

9.2.1.1 *Knowledge of Codes*—Knowledge of the intent of the applicable codes. Thorough understanding of the intent of the particular provisions of the applicable codes, as well as an understanding of the general concepts of health and safety requirements.

9.2.1.2 *Knowledge of Research Methods*—Access to related reference material and understanding of reference research methods.

9.2.1.3 *Advanced Concepts*—Knowledge of state-of-the-art advanced concepts in the particular discipline(s) involved. Awareness of current research relative to the material and process.

9.2.1.4 *Design Perception*—Sufficient design perception to anticipate potential areas of incompatibility and areas of potential failure relative to the structure, other systems, and the occupants.

9.2.1.5 *Building Process*—Understanding of how various constraints of sequential assembly operations influence the design selection of components and their interface connections.

9.2.2 *Subtask 2:*

9.2.2.1 *Proposals for Performance Testing*—Knowledge of testing, equipment, and methods, and evaluation of testing to performance specifications. An understanding of test methods and their applicability to different materials is essential.

9.2.2.2 *Accepted Engineering Procedures*—Knowledge of accepted engineering procedures and their applicability to innovative materials. The appropriateness of analysis by calculations versus physical testing for these materials is a critical determination.

9.3 *Criteria:*

9.3.1 *Education*—A bachelor’s degree in engineering with specialization in the particular discipline(s) involved.

9.3.2 *Experience*—Three years of building plan evaluation or building design experience with an additional one year in evaluating or designing innovative materials and systems. A master’s degree may be substituted for one year of the required experience.

9.4 In addition to the above, the requirements and criteria for the technical staff evaluating innovative building systems shall be identical to those detailed in Section 8.

10. Technical Staff Evaluating Compliance Assurance Manuals

10.1 *Task*—To assess the following aspects of the compliance assurance manual relative to the applicable requirements for the product being produced and to assess the manufacturer’s capabilities to implement and to manage the proposed processes:

10.1.1 *Integrity of Raw Material Supply*—Procedures for acceptance or rejection of incoming materials for damage and compliance with purchase documents.

10.1.2 *Integrity of Raw Materials Storage and Handling*—Availability of equipment and facilities for storage and handling of raw materials, including weatherproof space for materials susceptible to damage by weather or whose moisture content must be controlled.

10.1.3 *Assembly/Fabrication*—Appropriateness of inspection locations for monitoring fabrication or assembly sequence and availability of systems for tests and inspections.

10.1.4 *Replacement and Repair*—Ability to replace or repair unacceptable materials to limit damage of previously accepted portions.

10.1.5 *Unit Storage and Handling*—Adequacy of storage and handling of accepted units prior to shipment, including weatherproofing of units to be stored outside, the means of transporting the units from the assembly area to the storage area, and the means of rechecking the units’ integrity during storage.

10.2 *Requirements:*

10.2.1 *Understanding of Materials in Proposed System*—Experience with the specific materials proposed, including understanding of their characteristics and attributes.